REPORT

# Assessing opportunity and implementation cost of forest certification for ecosystem services in Viet Nam

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Bangkok, Thailand

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This report is an output of the Forest Certification for Ecosystem Services (ForCES) project. The ForCES project is implemented by the SNV Netherlands Development Organisation in Vinh Tu commune, Quang Tri province and the Huong Son Forest State Company, Ha Tinh province. Funding for the ForCES project has been provided by the Global Environment Facility and the Embassy of Finland through the Forest Stewardship Council (FSC) and RECOFTC – The Center for People and Forests.

The ForCES project aims to pilot and enhance global and national environmental standards as an initial step in upgrading the successful models of FSC certification and establish these models as a market tool for a wide range of Ecosystem Services (ES) that are, presently, inadequately covered for sustainable forest management. This report provides a basis for selecting ForCES benefit and certification models that are suitable for implementation in pilot sites across Viet Nam.

This report was written by Do Anh Tuan, Vu Thi Que Anh, Ngo Thi Minh Duyen and Tran Viet Ha. The authors are grateful to the following individuals and organizations who provided invaluable feedback and inputs: Bernhard Mohns and Fabian Noeske of RECOFTC, Chris Henschel and Alison von Ketteler of FSC, Le Thuy Anh of the Worldwide Fund for Nature (WWF) Vietnam, Vietnam Forest Administration (VNFOREST), Sub-DoF Quang Tri, Vinh Tu Forest Certification Groups and the Huong Son State Forest Company.

# Table of contents

# Tables



# Figures

# Acronyms

| | |
|---|---|
| ACC | Area cut allowable |
| BCA | Benefit-cost analysis |
| ES | Ecosystem services |
| FMU | Forest management unit |
| ForCES | Forest Certification for Ecosystem Services |
| FSC | Forest Stewardship Council |
| LEV | Land expectation value |
| MA | Millennium Ecosystem Assessment |
| NPV | Net present value |
| NTFP | Non-timber forest product |
| OCA | Opportunity cost analysis |
| PES | Payment for ecosystem services |
| RIL | Reduced impact logging |
| SFE | State forest enterprise |
| SFM | Sustainable forest management |
| TEV | Total economic value |

# Introduction

## Background

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. The Forest Certification for Ecosystem Services (ForCES) project is testing the idea of expanding FSC certification to include additional ecosystem services (ES), such as carbon, water, biodiversity and more, across four pilot countries: Viet Nam, Chile, Indonesia and Nepal. SNV Vietnam has implemented activities under the ForCES project in Quang Tri province and Ha Tinh province

Essential to the expansion in the ES coverage of FSC certification is the development of suitable measurable compliance indicators. These indicators will be incorporated in the respective national FSC standards of the pilot countries and included in international FSC standards.

To generate a basis for proposing and setting up the payment mechanism for selected ES, it was necessary to conduct an opportunity cost analysis (OCA) through which the FSC sustainable forest management approach was compared to other land use options. This report is the result of consultations on assessing opportunity and implementation costs of forest certification for ecosystem services. The consultation was conducted in two ForCES project sites: the Huong Son Forestry State Forest Enterprise (Huong Son SFE) in Ha Tinh province and the Vinh Tu commune in Quang Tri province.

## 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 that are crucial to human survival and wellbeing (Pearce & Pearce, 2001). Forest ecosystem services are the outcomes of forests ecosystem functions that benefit human wellbeing. 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 depending on the nature of the services and benefits derived by society: provisioning, supporting, regulating and cultural.

**Provisioning services** are goods and services obtained from the production function of the ecosystem, such as timber, non-timber forest products (NTFPs) and fresh water, among others. **Regulating services** are environmental benefits obtained from the regulation of ecosystem processes, such as climate regulation, flood regulation, soil erosion prevention, water purification and so forth. **Cultural services** are non-material benefits obtained from the ecosystem, such as spiritual, religious, recreational, etc. **Supporting services** are services necessary for the production of other forms of ES, such as soil information, nutrient cycling and primary production, to name a few.

Although forest ES are diverse and play important roles in human wellbeing, their worth has been mainly based on the value of marketable forest products such as timber. Many important ES have been systematically undervalued or even not considered at all because existing price determinants did not cover them. Due to the presence of attributes of externalities and difficulty in estimating their worth and importance, these undervalued and unconsidered ES have not been factored into the decision-making processes relating to land use and management.

### *Certification for ES*

Forest certification is a system for identifying well-managed forests. It requires 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 the responsible management of the world's forests. Its primary focus is the management of natural and planted forests for the production of timber and fiber. FSC Principles and Criteria (P&C) are also relevant in ES certification.

FSC has pioneered the concept of "protection through certification" (Principle #9 - High Conservation Value Forest and Principle #6 - Environment Impact). In addition to timber production, FSC sees a pressing need to expand its certification system to a well-managed forest ecosystem service. Through the ForCES project, FSC and its partner organizations are researching, analyzing and field-testing innovative ways of evaluating and rewarding the delivery of critical ES such as watershed protection, carbon sequestration and biodiversity conservation. As mentioned above, due to the presence of externality attributes that create difficulties in estimating the true worth of an ecosystem service, two major challenges emerge in certification: quantifying the value and setting-up payment mechanisms for ES (CIFOR, 2011).

### *Opportunity cost*

The deforestation or conversion of forestland into agricultural land, despite its negative environmental and social impacts, also generates economic benefits from the selling of timber, cultivation of crops and the raising of animals. Reducing deforestation and preventing changes in land use means losing economic benefits derived from the sale of timber and agricultural activities. The costs of these forgone benefits (the net benefits that a conserved forest ecosystem versus a converted forest ecosystem generates) are known as the "opportunity cost," probably the most important incentive influencing policymakers, forestland managers and landowners in decision-making regarding land use and management.

Sustainable forest management practices employed for ES certification generate costs that can be grouped into three categories:

1. **Opportunity costs:** the differences in profits between conserving forests and converting forests into other land uses and the profits generated from the maintenance of forest ES or the development of both on-site and off-site ES locations for carbon storage; NTFPs; acquisition of positive influences in the form of economic, social and cultural values; and the enhancement of livelihoods of surrounding and downstream communities.
2. **Implementation costs:** the costs involved in the sustainable implementation of FSC forest management practices. These include costs for sustainable forest management planning, forest protection and improvement, the practice of low-impact logging, job training and so forth.
3. **Transaction costs:** the costs incurred through each stage of the forest certification process until completion, such as FSC certification, measuring, reporting, verification and so forth.

In terms of rational human behavior, forest certification only makes sense for decision makers, forest managers and landowners if the benefits of forest certification are greater than the aggregate of costs incurred from FSC certification and implementation. In this study, the consultation group focused on assessing the opportunity and implementation costs of forest certification for ecosystem services that will lead to an FSC forest management certification. In a broader sense, there may be other costs involved (e.g. auditing costs), but these may not be part of transaction costs.

## Objectives

The objectives of this report are to:

i. Identify potential ecosystem services in major forest ecosystems within project sites;
ii. Conduct a) an OCA using financial analyses for different land-use options and the land expectation values (LEV) of bare land versus land in perpetual forest production, then b) integrate the OCA into expanded FSC forest management certification models;
iii. Identify the best land-use option that will deliver the highest net benefit and use this as scientific evidence that will aid provincial policymakers in decision-making for land use and land management; and
iv. Identify opportunities that will emerge from ES and set up an ES payment scheme.

# Settings of the study areas

## General overview

Huong Son SFE in Ha Tinh province and Vinh Tu commune in Quang Tri province were the two pilot sites selected for the ForCES project in Viet Nam. Each site was characterized by its typical forest ecosystems and forest functions.

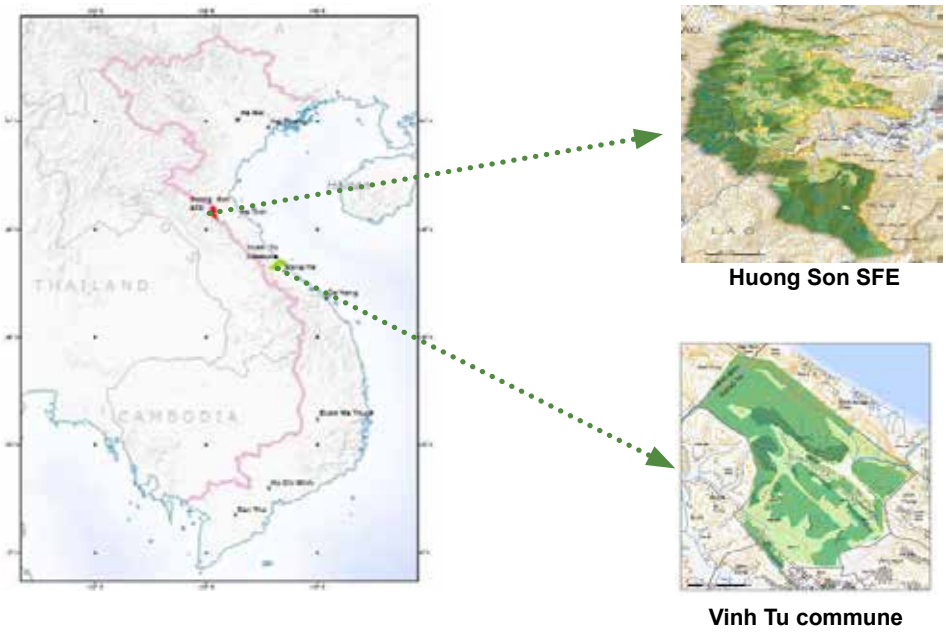



**Figure 1: Map of study sites**

The forest management unit (FMU) of *Huong Son SFE* covers low to medium-high elevations in a mountainous region that contains 38 500 hectares (ha) of production evergreen tropical forest. It has high biodiversity that includes 400 flora and 87 fauna species, many of which are high conservation value species listed in the International Union for Conservation of Nature (IUCN) Red List. The FMU is bordered by the Ngan Pho river watershed forest protection area to the north, by a large area of primary forest in Lao PDR to west and Vu Quang National Park (where the Sao La species was first identified) to the south. Due to their geographical location, 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 hot spot in the Indochinese Peninsula.

The lowland adjoining Huong Son SFE is home to approximately 6 000 local people and staff of the SFE of four communes and one district town. Understanding the importance of forests and in response to threats posed by deforestation, degradation and illegal wildlife poaching, Huong Son SFE initiated sustainable forest management activities with the objective of gaining FSC-FM certification. Huong Son SFE's sustainable forest management plan was approved in 2011. The project team has also undertaken GFA certification scoping and FSC FM and FSC CW/CoC audits in November 2013, and the SFE has since been issued an FSC CW certificate.

*Vinh Tu commune* is located on the coastal area of Vinh Linh district, Quang Tri province, adjacent to National Highway 1. The commune has 10 villages of approximately 3 450 persons comprising 990 households (2013 estimates). The total area of the commune is 3 454 ha, including 450 ha of natural forest that prevent soil erosion (the area being sandy) and serves as a water table for settlements and agriculture production and 1 527 ha of forest plantations delegated for timber production. The natural forests, together with the plantations, form patches or shelterbelts that protect the settlements and agriculture lands of the commune.

Some initial studies have shown that Vinh Tu's sand forests are typical ecosystems for Viet Nam's coastal zone. These zones are very rich in flora and fauna species. All the natural forests in the commune have been claimed as communal property forests and are under the management of the Vinh Tu Commune People Committee (CPC) through protective activities conducted by village forest protection teams. Private households have ownership over all plantations, which are mainly planted with acacia. These households have also formed small groups to apply for smallholder forest certification. By 2013, there were already 298.8 ha of hybrid acacia and 145 FSC small groups formed with the support of WWF Vietnam.

## Forests and land-use systems of the study sites

The forestlands in the project sites grow on different land types and are used for different purposes. In Huong Son SFE, the total area of natural forest accounts for 95.4 percent or 38 448 ha of the FMU. The total plantation area is only 275 ha, equivalent to around 0.7 percent; non-forested area is 1 012.3 ha or 2.6 percent; and the remaining 1.2 percent is classified as other lands (see Table 1). Huong Son SFE has four major land-use types:

1. Management of rich and medium forests for timber production using selective cutting methods – with a rotation designed for 35-year periods – as the major activities employed for the protection of forestlands and sustainable harvesting of timber;
2. Management of mixed forests for the production of bamboo and timber through the application of selective cutting (designed as a potential land-use option);
3. Protection of poor and regenerated forests for protection and conservation purposes; and,
4. Establishment of timber plantations (mainly hybrid acacia species) on bare lands for timber production with rotation designed for seven-year periods.

In short, Huong Son SFE is a production-oriented company that has applied for FSC-FM on production natural forests with the primary purpose of sustainably harvesting valuable timber, creating plantations on bare land and protecting and enriching poor forests.

In comparison, Vinh Tu commune's total land area of 3 454 ha is equivalent to only 10 percent of the Huong Son FMU's total land area. However, its local inhabitants are utilizing six different land-use systems:

1. The largest area – 1 527 ha or 44.2 percent of the FMU – is devoted to hybrid acacia plantations with production rotation periods ranging from seven to 10 years, though mainly seven. All these plantations are managed by households that have organized into smallholder certification groups applying for FSC CW/CoC certification for their timber products.
2. Natural forests growing on sandy soil account for 12.9 percent of the commune's total land area. Sandy soil forests are typical in the region. These forest ecosystems are considered important in protecting the environment as well as agricultural productivity and other forms of the local people's livelihoods. The local people are organized into small groups that conduct patrols to protect their forests. The harvesting of timber is not allowed and only a few types of NTFPs can be extracted.
3. The total area devoted to crop production (e.g. corn, cassava, peanuts) is about 990 ha or nearly 29 percent of the total commune land area. Private households cultivate croplands. Crops are raised either for subsistence or for generating cash.
4. The area suitable for paddy rice production is around 105.5 ha or 3 percent of the land area, but it plays a vital role in the food security of the local population. The protection of forests has made two growing seasons possible in these rice lands per year.
5. Rubber plantations make up only 40.5 ha. The high cost entailed by this enterprise is the reason for the low proliferation of this type of land use in the commune: the first harvest of rubber resin can be made only after an initial investment of seven years within a 30-year rotation period.
6. Other local households cultivate home gardens mostly for the commercial production of pepper.

The land-use systems of Huong Son SFE are mostly naturally based systems while the land-use systems of Vinh Tu commune are diverse. The diversity of the commune's land-use systems range from environmental protection-oriented forest-use systems to agriculture production systems that often require high initial investment.

**Table 1: Land-use types of the study sites**

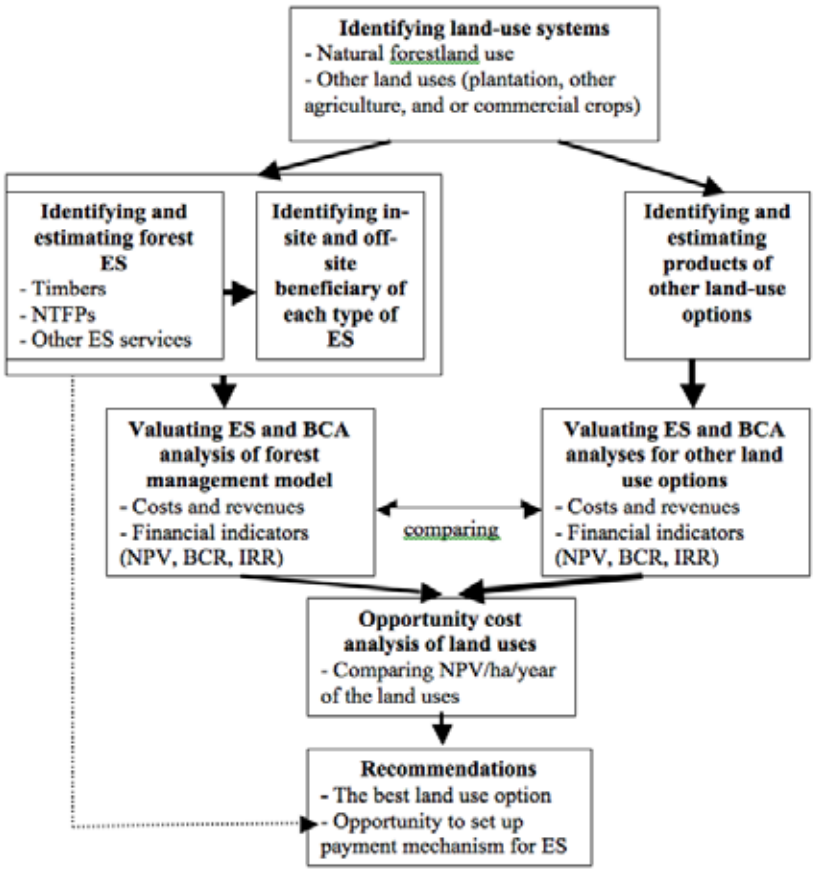
| Site | Current land-use types | Brief description | Area (ha) | Percentage (%) | Major-use purpose | Management model |
|---|---|---|---|---|---|---|
| Huong Son SFE | **1. Forestland** | | **36 961.90** | **96.1** | | |
| | 1.1. Natural forest | | **36 686.90** | 95.4 | | Being applied towards FSC forest management (35-year rotation period), received FSC CW/CoC |
| | - Rich forest | - Ever-green broad-leaf forest | 18 258.40 | 47.5 | Production | |
| | - Medium forest | | 11 038.20 | 28.7 | | |
| | - Poor forest | | 5 542.70 | 14.4 | Protection and enrichment | |
| | - Regenerated forest | Shrubs and saplings | 1 227.00 | 3.2 | | |
| | - Mixed forest | Mixed bamboo | 620.6 | 1.6 | Production | |
| | 1.2. Plantation | Acacia species, seven-year rotation periods | 275 | 0.7 | production | |
| | **2. Non-forestland** | | **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 and climbers | 654.6 | 1.7 | | |
| | **3. Other lands** | Water bodies, roads and homestead areas | **473.8** | **1.2** | | |
| | **Total** | | **38 448.0** | **100** | | |
| Vinh Tu commune | **1. Forestland** | | **1 973.0** | **57.1** | | |
| | 1.1. Natural forest | Forests on sandy soils | 446.0 | 12.9 | Environmental protection | Sustainable forest management towards FSC |
| | 1.2. Plantation | Hybrid Acacia, seven-year rotation periods | 1 527.0 | 44.2 | production | FSC CW/CoC |
| | **2. Rubber plantation** | 30-year rotation periods | **40.5** | **1.2** | production | |
| | **3. Agriculture lands** | | **1 097.2** | **31.8** | | |
| | 3.1. Paddy rice | 02 season cultivation | 105.3 | 3.0 | production | |
| | 3.2. Other agricultural crops | Corn, cassava, peanut, yearly rotation | 991.9 | 28.7 | | |
| | **4. Home garden and 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 for the period 2012-2040 and Vinh Tu CPC report 2013

# Methodology and assumptions

Estimating the opportunity and implementing cost of forest certification for ES requires the identification and evaluation of products and services of forest ecosystems, calculation of associated costs and benefits of the forest ecosystem management models and estimation of opportunity costs by comparing net profits of the forest management schemes to other land-use options using the same time frame and interest rate. In theory, estimating opportunity cost is simple, but in practice, generating reliable estimates can be difficult especially for natural forest ecosystems. Difficulties in quantifying and evaluating forest products and services (e.g. most environmental services) arise from many forest environment services having externality attributes and non-market prices available (Bishop, 1999). To meet the requirements of the study's objectives, the project team applied the following approach with multiple estimation methods to collect and analyze data (see Figure 2).

**Figure 2: Research flow chart**




***i) Limitations and assumptions***

Two major forest ecosystems were found in the respective study sites: the tropical evergreen broad-leave rainforest of Huong Son SFE and the natural forest on the sandy soil of Vinh Tu commune. The other land uses were plantations (mainly acacia, found in both Huong Son SFE and Vinh Tu commune), rubber plantation and agricultural crops in Vinh Tu. In this study, OCA and land expectation value (LEV) studies were conducted with the following assumptions:

- Only major plantations and croplands with significant cultivated areas (e.g. acacia, rubber, rice, corn, cassava, and peanuts) were included in this study. Very small areas (e.g. pepper in home gardens) were not considered.

- The production rotations of acacia plantation and rubber plantations were fixed at seven and 30 years respectively.
- Timber stock per ha of both FSC acacia plantations and Non-FSC acacia plantations were considered to be the same. It was also assumed that there was no reduction in the timber stock of acacia plantations in the next rotation.
- In estimating LEV, bare land was characterized as grassland without trees, crops or values of biodiversity. The NTFPs on such land were assumed to be zero.

For forest ES estimation, which was the most difficult task in this research, a consultation report was available on mapping several ecosystem services in the project sites of SNV Vietnam. These include estimates for carbon storage and soil loss potential (estimated in range value) and descriptions of biodiversity. This research used some data of that report as secondary data (such as carbon storage), but many other important ES (e.g. NTFPs, water reservation and sand-moving prevention) were drawn directly from the field by conducting interviews and collecting data by other research means (see Table 2 for details). It was, however, impossible for this research study to estimate all possible forest ES. Some ES, such as disease regulation and cultural services, were not included in the estimation because the local people at the study sites did not give them significant value.

***ii) Identifying, estimating and valuing forest ecosystem services***

To identify and classify forest ecosystem services, forest managers (in their role as services providers) and local people (as beneficiaries) were interviewed about the types of forest products and services present in the different forest ecosystems. Open-ended questionnaires were used. The key question for this was: *what are the environmental services of the forest ecosystem and for whom.* Secondary data was also used, derived from the training workshop on monitoring ES conducted by Sini Savilaako.[1] Estimation of forest ES was one of the most difficult missions for the research team because many services (e.g. biodiversity, water purity) have not been assigned quantifiable values. To overcome this difficulty, a combined method of reviewing secondary data and interviewing in the field were applied (see Table 2).

For timber products that have available inventory data and market prices, the estimation and valuation are mainly based on secondary data, which were cross-checked or validated using interviews. For NTFPs that have existing market prices (e.g. bamboo, rattan, medicinal herbs) or substitute goods (e.g. fuel wood, green manure), the data and prices of products were collected from interviews conducted with key informants (see Appendix 2).

For the forest ES, the project team examined the two sites' capacities of carbon storage, soil loss protection and water preservation, as well as the levels of biodiversity, in addition to other less prevalent services.

For the estimated carbon storage capacities in Huong Son SFE and Vinh Tu commune were derived from the SNV report used in this study, in which the price for the total carbon dioxide (tCO2) is fixed at US$ 5 per ton.

For the soil erosion protection service, the SNV report only estimated ranges of potential soil loss based on the universal soil loss equation (USLE) to estimate areas in different potential soil loss levels. For Huong Son SFE, the SNV Report provided secondary data on potential soil loss of forested areas. In addition, the values of soil loss prevention for hydropower plants derived from Vuong Van Quynh's study were also used for this study. Unlike the mountainous Huong Son SFE site, the Vinh Tu commune occupies flat land and therefore has no problem experiencing soil erosion due to water. However, the area does have a high potential for erosion due to sand movement, though there is no available secondary data on this. The avoided cost method was applied to estimate the soil erosion protection service at Vinh Tu commune to identify the role and determine the value of the benefits of the forest shelterbelt on preventing loss of agricultural and crop land from moving sand by applying the following equation:

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

Esp = Aagri. * P* NPV

Where:

Esp is total value of the soil loss prevention service per year in the commune;
Aagri. is the estimated total area of potential agriculture and crop land loss due to sand movement (for scenarios where shelter belts are not present);
P is productivity per area unit (in ha); and
NPV is profit per area unit (in ha) of cultivated agricultural crops.

Due to a lack of available data on the water preservation service in Huong Son SFE, the project team use data from Quynh's study for this research. For Vinh Tu commune, the project team applied the avoided cost method to determine the value of this service for understanding the forest's impacts on water for rice productivity and the local people's daily needs.

The amenity service was estimated using the hedonic method, which measures the local population's willingness to pay (WTP) for better environmental conditions and improvement in their quality of life.

**Table 2: Selected methods to estimate and determine the value of forest ES**

| FMU | Forest ES | Estimation | | Valuation | |
|---|---|---|---|---|---|
| | | Methods | Data sources | Methods | Data sources |
| **Huong Son SFE** | 1. Timber | Forest inventory | SFE reports, interviews | Market price (MP) | SFE reports, interviews |
| | 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. Ecosystem services | | | | |
| | 4.1. Carbon storage | UN IPCC 2003 | SNV Report[2] | MP (US$ 5/t$CO_2$) | Matthew[3] |
| | 4.2. Soil loss protection | Soil loss (USLE) | SNV Report[2], Quynh[4] | Avoided cost | Quynh (2009)[4] |
| | 4.3. Water preservation | N/A | Quynh (2009)[4] | Avoided cost | Quynh (2009)[4] |
| | 4.5. Biodiversity | Qualitative only | - | - | - |
| | 4.6. Other ES | | | | |
| **Vinh Tu commune** | 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. Ecosystem services | | | | |
| | 4.1. Carbon storage | IPCC 2003 | SNV Report[2] | MP (US$ 5/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. Amenity 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,” SNV Vietnam.
[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) Benefit and cost analysis (BCA) of key land-use options***

In the study sites, forestlands are utilized for different land-use options (Table 1). Costs and revenues of key land-use options were collected from available data (e.g. the financial statements of Huong Son SFE) and field interviews (Appendix 2) and were calculated using 2013 prices as the benchmark prices. The fluctuation of input and output prices during lengthy production rotation periods (e.g. seven years for plantations) was crossed out, a common practice in benefit-cost analysis (BCA). The FSC Natural Forest Management Scheme (FSC forest management) was used as the baseline model and was compared with other land-use alternatives including:

- Conventional natural forest management (conventional forest management) with the assumption that production is limited to timber;
- Acacia Plantation Certification Group with FSC (FSC plantation) for the production rotation period of seven years;
- Acacia plantation in the same seven-year rotation period but without FSC (non-FSC plantation);
- Rubber plantation with a 30-year rotation period (rubber plantation).
- Other crop cultivations were named by crop species (such as cassava, rice, etc.); and
- Bare land.

Net Present Value (NPV), Benefit and Cost Ratio (BCR), and Internal Rate of Return (IRR) were the key financial indicators selected for analyzing and comparing the financial feasibility of the different land use options. The interest rate used was 10 percent per annum and was applied using the following formula:

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

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

IRR is the interest rate that makes the NPV equal to zero
Where: r = discount rate (10 percent); Bi = benefit at year i;
Ci = cost at year i; and n = period of time (in years).

***iv) Opportunity cost analysis of the different land options***

The calculated NPVs of the different land uses were used to analyze opportunity costs by comparing the FSC forest management's NPV/ha/year with the NPV of other land-use options.

***v) Land expectation value (LEV)*** 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 was used in estimating the value of bare land with the assumption of being used as a non-FSC acacia plantation with a seven-year production rotation period. A simple three-step process was used for this calculation:

1. 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 forth, as well as all subsequent costs and revenues;
2. Place the costs and revenues on a timeline and compound all of them to the end of the rotation. Calculate Future Value ($FV_R$) of the first rotation of the land use by applying the following equation:

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

ii. Where: R = the length of the rotation (here R = 7 years)
    1. r = interest rate expressed as a decimal (here r = 0.1, equal to 10 percent)
    2. E = plantation establishment cost per unit area (here = 01 ha)

3. $I_t$ = an intermediate cost or revenue per unit area at a time *t* larger 0 but less than R
4. A = the net cost or revenue per unit area from all annual cost and benefits
5. $P_p$ = price of product *p*
6. $Y_{p,R}$ = expected yield per unit area of product p at age R
7. $C_h$ = cost of harvesting the timber

3. Apply the infinitive periodic payment formula to get the LEV:

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

# Results

## Estimation of goods and services of different land-use options

### Types of goods and ES of different land-use options

Different land-use options provide different goods and services for different beneficiaries. Table 3 summarizes the purpose for each land-use option found in the two pilot sites. Also included in the table are the types of goods and services these options deliver to 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 using one of the following schemes: conventional forest management for timber production or the alternative management schemes, which include FSC forest management for the sustainable production of timber, NTFPs and other ES. The conventional management scheme, common in almost all SFEs in Viet Nam, is planned for five-year periods with the main objective of benefiting from timber logging. In terms of sustainable forest management, the plan period of five years is too short in comparison to a normal rotation for tropical natural management of at least 30 years. Since timber and NTFPs that possess direct-use values form only part of the total value of a forest ecosystem, this management scheme focuses on acquiring short-term benefits from the forest.

On the other hand, sustainable natural forest management towards obtaining FSC certification has long-term and multi-use objectives. It provides a broader array of forest goods and environmental services for the SFE, local people and downstream communities. In this management scheme, the SFE could preserve and provide long-term benefits from both direct-use values (such as timber and NTFPs) and indirect-use values (through the provision of ES such as carbon storage, soil erosion and water preservation). In addition, off-site beneficiaries such as local and downstream communities and companies could benefit from NTFPs and forest ES. Many ES (with the exception of carbon storage) possess positive externalities that, although not allocated to the SFEs, benefit off-site beneficiaries. This means that Huong Son SFE, the ES provider, has a low incentive to provide the services unless all stakeholders in the ES provision agree upon a sound payment for ecosystem services (PES) mechanism.

In Vinh Tu commune, there are four categories of land use: 1) management of natural forest on sandy soil; 2) timber plantations; 3) commercial rubber plantation; and 4) cash crop cultivation. The key use of the natural forest is environmental protection against the negative effects of sand movement in the coastal region with the end result being the protection of settlements, and livelihood and agricultural production improvement of the local communities. Aside from the direct benefits derived from the forest (e.g. fuelwood and NTFPs), the local communities also gains significant benefits from the indirect effects of forest ES. These indirectly beneficial ES include land loss prevention, improvement of cash crop productivity, air purification and the conservation of the typical coastal forest ecosystem. The natural forest in Vinh Tu plays a vital role in the protection of the environment, which translates to positive benefits for the livelihoods of the local communities.

Acacia and rubber plantations have been established Vinh Tu for production on a commercial scale. Small household groups, with the aim of acquiring FSC certification so that they can demand premium prices for timber and environment protection, are managing some of the acacia plantations. Other areas are devoted to annual cash crop cultivation. Among the cash crops cultivated in Vinh Tu are peanuts, cassava and corn. These crops are either farmed for subsistence or for the generation of cash revenue.

### Estimation of goods and services of land-use options

Table 4 presents estimates on the respective quantity of goods and services of the various land-use options based on the combined results of the field studies and secondary data reviews. In Huong Son SFE, the total area of the FMU is 38 448 ha. The estimated average timber productivity per ha is 160.7 cubic meters ($m^3$). Applying the FSC management scheme, Huong Son SFE benefits from a number of forest values. The benefit from timber logging alone under the FSC management scheme is estimated at 6 372.3 $m^3$, not to mention benefits from fuelwood, bamboo, at least 11 other species of NTFPs, as well as additional ecosystem services. Among the NTFP species, bamboo, rattan and Mau Cho (a local medicinal species) are the most abundant. In terms of environmental services, the forest could store around 6.9 million tons

of carbon dioxide (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 two hydroelectric power plants with total electric generation capacity of 360 megawatts (MW) per year and provide from its protected aquifer 200 000 $m^3$ of water for the consumption of the local people of Huong Son town. In short, the tropical forest in Huong Son FMU provides a wide range of goods and services, including high value NTFPs and a high carbon storage capacity by the FSC management scheme.

In comparison, under the conventional management scheme, the major benefits come from timber logging conducted in an unsustainable manner. In the long term, the forest would be reduced to a poor forest due to unsustainable use. Therefore, carbon storage capacity and the ability to prevent soil loss would also be reduced. In the same context, the quantity of NTFPs (except for bamboo) would also be reduced.

In Vinh Tu commune, NTFPs and ES are the major benefits that local people can derive from the natural forest. It is estimated that every year local people collect approximately 3 000 $m^3$ of fuel wood, 1 000 tons of tree leaves for producing 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. Interviews of local inhabitants on the role of the forest convey that the interviewees agreed that compared to past years (estimated at about 20 years ago) when there was little natural forest, today's natural forest plays an important role as a shelterbelt that prevents large portions of soil from being lost, as well as contributing significant improvements to crop productivity. It is estimated that with the present shelterbelt, local inhabitants have more tillable space for agriculture production (estimated at 40 ha for paddy rice, 70 ha for peanuts and 50 ha for cassava). Crop productivity also increased 20-30 percent and the natural forest absorbs 35 520 tons of carbon per year (Ty, 2012).

The estimated productivity of other land uses in Vinh Tu are: three tons per ha for peanut, 30 tons per ha for cassava, five tons per hectare for corn and 32.2 tons per ha for rubber resin (30-year production rotation period). The estimated timber productivity of acacia plantations with seven-year production rotation periods is around 75 $m^3$ per ha, which is smaller than the 119.2 $m^3$ per ha productivity of acacia plantations in Huong Son.

**Table 3: Key land-use options, associated products & services, and beneficiaries**

| Site | Key land-use option | Management models | Major purposes | Identified goods and services and beneficiaries | |
|---|---|---|---|---|---|
| | | | | On-site | Off-site |
| Huong Son SFE | Natural forest management | conventional mgt (five-year plan) | Production | Timber for the SFE | Some NTFPs for surrounding villages |
| | | FSC mgt (35-year plan) | Sustainable timber production and provision of NTFPs and ES | Timber, carbon storage and partly NTFPs for the SFE | Some timber and NTFPs for surrounding villages |
| | | | | Biodiversity conservation (for region and national) | Soil erosion and sedimentation prevention and water preservation and flood prevention for surrounding and downstream villages (on agricultural production and living) and for hydropower and water plans |
| | | | | Potential ecotourism | |
| | Plantation (Acacia) | Non-FSC plantation | Timber production | Timber for HS SFE | Soil erosion, sedimentation prevention and water preservation for surrounding and downstream villages and hydropower plans (but much less significant than natural forest) |
| Vinh Tu commune | Natural forest on sandy soil | Sustainable mgt | Environment protection | Fuelwood and NTFPs (foods, medicinal herbs, green manure) for local people | |
| | | | | Land loss prevention (from soil protection from sand moving and water conservation for living and agriculture cultivation) | Preventing sand moving to National Highway 1 |
| | | | | Agriculture protection (as improvement of productivity) | |
| | | | | air purification/ temperature regulation for health of local people | |
| | | | | Biodiversity conservation of representative sandy forest (for region) | |
| | Plantation (Acacia) | Non-FSC plantation | Production | timber and fuelwwood for local households | |
| | | | | jointly with natural forest to set up shelterbelt | |
| | | FSC plantation | Production with care of environment protection | timber and fuelwood for households with environmental friendly operations | |
| | | | | jointly with natural forest to set up shelterbelt | |
| | Rubber plantation (35-year rotation) | pure plantation | commercial production | resin and timber for households | |
| | Paddy rice cultivation | annual | food security | rice | |
| | Crop cultivation (peanut, cassava, corn) | annual | food provision and cash earning | crop products for households | |

**Table 4: Estimated products and environmental services of major land-use options**

| Indicators | Land uses in Huong Son SFE | | | Land use in Vinh Tu commune | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | FSC natural forest mgt option | Conventional natural forest Mgt option | Acacia plantation | Natural forest on sandy soil | Non-FSC_Acacia plantation | FSC_ Acacia plantation | Peanut | Cassava | Corn | Rubber |
| Rotation (year) | 35 | 5 | 7 | L. term | 7 | 7 | annual | annual | annual | 30 |
| Total area (ha) | 38 448 | 38 448 | 275 | 446 | 1 228.22 | 298.78 | 300.0 | 500.0 | 380.0 | 40.5 |
| Average productivity per ha for rotation ($m^3$ or ton) | 160.70 $m^3$ | 160.70 $m^3$ | 119.18 $m^3$ | | 75.0 $m^3$ | 75.0 $m^3$ | 3.0 t | 30.0 t | 5.0 t | 32.15 t resin |
| Total productivity for rotation | 61 78602 $m^3$ | 61 78602 $m^3$ | 32 774.5 $m^3$ | | 92 116.5 $m^3$ | 22 408.5 $m^3$ | 900 t | 15 000 t | 19 00 t | 1 302.08 t resin |
| Average harvested area/year (ha) | 233.26 | 233.26 | | | | | 105.3 | 300.0 | 500.0 | |
| Average harvested amount/ha/ year | 26.73 $m^3$ | 25.46 $m^3$ | | | | | 3.0 t | 30.0 t | 5.0 t | 1.01 t resin |
| Average harvested products/year | 63 72.29 $m^3$ | 60 68.85 $m^3$ | | | | | 900 t | 15 000 t | 1 900 t | 43.4 t resin |
| Total harvested amount for rotation | 223 030.15 $m^3$ | 212 409.94 $m^3$ | 32 774.5 $m^3$ | | 92 116.5 $m^3$ | 22 408.5 $m^3$ | 900t | 15 000 t | 1 900 t | 1 302.08 t resin |
| Harvested amount of NTFPs/year | | | | | | | | | | |
| Fuel wood (1 000 $m^3$) | 10-15 | | | 3.0 | | | | | | |
| Green manure (tons/year) | | | | 1 000 | | | | | | |
| Bamboo (1 000 stems) | 15 520 | 15 520 | | | | | | | | |
| Medicinal herbs | | | | | | | | | | |
| Chrysobaphus roxburghii (mau cho) (1000 kg) | 250-300 | 100-150 | | | | | | | | |
| Knema globularia (lan Kim tuyen) (1 000 kg) | 3-5 | 1.5-2.5 | | | | | | | | |
| Drynaria sp (bo cot toai) (1 000 kg) | 1-2 | 0.5-1.0 | | | | | | | | |
| Ganoderma lucidum (linh chi) (kg) | 50-70 | 25-35 | | | | | | | | |
| Lindera strychnifolia (ô dước) (1 000 kg) | | | | 2-3 | | | | | | |
| Tongkat ali (sâm đắng) (1 000 kg) | | | | 1-2 | | | | | | |
| Sp (lầu âu) (1 000 kg) | | | | 1-1.2 | | | | | | |
| Rattan (1 000 kg) | 200-250 | 100-125 | | | | | | | | |
| Orchidacea (VND 1 000) | 350.000 | 150 | | | | | | | | |
| Honey (1 000 li) | 2.5-3.5 | 1.3-1.8 | | 0.2-0.3 | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Phrynium placentarium (la Dong) (1 000 leaves) | 500-1000 | 5000-1000 | | | | | | | | |
| Licuala Fatoua Becc (la Nón) (1 000 leaves) | 500-800 | 500-800 | | | | | | | | |
| Canarium (quả Trám) (kg) | 2000-3000 | 1000-1500 | | | | | | | | |
| Quescus nut (1 000 kg) | | | | 4-5 | | | | | | |
| Others (mil. VND) | 500-700 | 250-350 | | 40-50 | | | | | | |
| Benefit from ES per year | | | | | | | | | | |
| Carbon storage in tons of C (tC) | 6 870 281 | 419 0871* | | 35 520 | 155 188.5 | 456 237.1 | | | | |
| Soil loss prevention compared to bare land (ton/ha/year)** | 44.1 | 43.6 | | | | | | | | |
| Total soil loss prevention (ton/ year) | 1 615 691.1 | 1 601 016.3 | | | | | | | | |
| Prevention of losable area of paddy cultivation (ha) due to sand follow | | | | 40 ha | | | | | | |
| Prevention of losable area of peanut cultivation (ha) due to sand follow | | | | 70 ha | | | | | | |
| Prevention of losable area of cassava cultivation (ha) due to sand follow | | | | 50 ha | | | | | | |
| Increasing productivity of crops due to the ES of improving land condition | | | | added productivity 20-30 percent | | | | | | |
| Price premium of homestead land with forest shelterbelts | | | | about 10 percent of price | | | | | | |
| Water reservation power generation for hydroelectric power plan | 360 MW/year | 360 MW/year | | | | | | | | |
| Water for living consumption from water plan ($m^3$/year) | 190 000 | 190 000 | | | | | | | | |
| Biodiversity conservation | High | High, reducing | | Typical | | | | | | |

* referenced to rate of forest cover loss average 13 percent per 10 years, Mathew (2012);
** referenced to Phuong 2009 and 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 natural forest of Huong Son)

# BCA of the key land-use options

### BCA for the options of land-use options of Huong Son SFE

***BCA for conventional natural forest management for timber products***

The unit cost and revenue of conventional forest management for timber production is presented in Table 5. On average, the total cost per harvested cubic meter is estimated at 2 576 864.2 VND, accounting for up to 91.1 percent of the revenue per cubic meter (2 827 886.2 VND). The total operation costs (for harvesting design and approval, harvesting operations, road maintenance and post-harvesting activities) account for 73.4 percent of the total cost. On average, the net income (after income tax) is rather small at just 188 266.5 VND per harvested cubic meter, equal to 4 722 052.3 VND per harvested ha, or 3 409.4 VND per managed hectare.

**Table 5: Unit cost and revenue structure of conventional forest management**

| | | Per harvested $m^3$ | Per harvested ha (for 233.26 ha) | Per mgt ha (for 38 448 ha) |
|---|---|---|---|---|
| **I** | **Costs** | **2 576 864.2** | **64 632 250.1** | **416 223.1** |
| 1.1 | Harvesting design | 63 308.8 | 1 587 895.2 | 10 225.8 |
| 1.2 | Approval of the design | 7 577.7 | 19 0061.9 | 1 224.0 |
| 1.3 | Harvesting operations | 1 001 461.7 | 25 118 406.7 | 161 759.2 |
| 1.3.1 | Preparations before harvesting | 89 285.4 | 2 239 433.6 | 14 421.7 |
| 1.3.2 | Skidding trails | 248 493.9 | 6 232 660.6 | 40 137.5 |
| 1.3.3 | Felling and logging | 1 171.4 | 29 380.8 | 189.2 |
| 1.3.4 | Transportation to landing area | 240 636.0 | 6 035 570.7 | 38 868.3 |
| 1.3.5 | Transportation log yard | 407 777.3 | 10 227 766.2 | 65 865.5 |
| 1.3.6 | Grading, protection and others | 14 097.7 | 353 594.9 | 2 277.1 |
| 1.4 | Road maintenance | 189 078.3 | 4 742 413.7 | 30 540.5 |
| 1.5 | Post harvesting operations | 629 647.1 | 15 792 647.8 | 101 702.5 |
| 1.6 | Management expenses | 206 495.0 | 5 179 254.9 | 33 353.7 |
| 1.7 | Taxes | 332 828.7 | 8 347 924.5 | 53 759.5 |
| 1.7.1 | Natural resource tax | 310 814.4 | 7 795 767.4 | 50 203.7 |
| 1.7.2 | Land use tax | 21 394.8 | 536 618.9 | 3 455.8 |
| 1.7.3 | Business tax | 619.5 | 15 538.1 | 100.1 |
| 1.8 | Depreciation | 146 466.9 | 3 673 645.4 | 23 657.8 |
| **II** | **Revenue per $m^3$ of logs** | **2 827 886.2** | **70 928 319.8** | **456 768.9** |
| **III** | Income before tax (= II-I) | 251 022.0 | 6296 069.7 | 40 545.9 |
| **IV** | Income tax (25% of III) | 62 755.5 | 1574 017.4 | 10 136.5 |
| **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 lesser from the government fund for forest protection activities, mainly used for natural forest loggings and protection of the forest. With the given interest rate of 10 percent a year, the total NPV for a five-year plan was estimated of 6 302 717 607.4 VND, and BCR is equal to 1.2 times. On average, the NPV per year is just 1 260 543 521.5 VND (Table 6).

**Table 6: BCA for conventional forest management of Huong Son SFE (five-year plan)**

| No | Costs and revenues | Year | | | | | Total |
|---|---|---|---|---|---|---|---|
| **I** | **Key forest management activities** | **2011** | **2012** | **2013** | **2014** | **2015** | |
| 1 | Harvesting natural forest | | | | | | |
| | Harvesting area (ha) | 247.6 | 231.7 | 223 | 234 | 230 | 1 166.3 |
| | Harvesting volume of logs ($m^3$) | 6 210.2 | 6 252.2 | 6 000.1 | 6 072.7 | 6 164.4 | 30 699.6 |
| 2 | Protection of forest (ha) | 38 448 | 38 448 | 38 448 | 38 448 | 38 448 | 38 448 |
| **II** | **Total cost (VND) (C)** | **16 002 945 129.4** | **16 111 018 814.0** | **1 546 1494 423.7** | **15 648 420 152.8** | **15 884 821 674.5** | **79 108 700 194.3** |
| **III** | **Total revenues (VND) (B)** | **17 681 851 994.7** | **17 800 453 541.9** | **17 087 656 546.3** | **17 292 791 411.3** | **17 552 221 691.3** | **87 414 975 185.5** |
| 1 | Revenue from timber harvesting | 17 561 851 995 | 17 680 453 542 | 16 967 656 546 | 1 7172791411 | 17 432 221 691 | 86 814 975 185.5 |
| 2 | Total government fund for forest protection and regeneration | 120 000 000.0 | 120 000 000.0 | 120 000 000.0 | 120 000 000.0 | 120 000 000.0 | 600 000 000 |
| **IV** | **B - C** | 1 678 906 865.3 | 1 689 434 728 | 1 626 162 122.6 | 1 644 371 258.5 | 166 740 0016.8 | 8 306 274 991.2 |

Interest rate (r) = 10 percent per year

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

**NPV/harvested ha/year** = 5 404 027.8 VND; NPV/managed hectares/year = 32 785.7 VND

**BCR** = 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 a 35-year period is significant at the FMU level (Table 7). It consists of the direct costs coming from the process of FSC certification and indirect costs (compliance with FSC standard requirements). **Direct costs** associated with the certification process include internal and external elements. **Direct internal costs** relate to expenditures preparatory to certification are due to various internally developed activities including sustainable forest management (SFM) planning, staff training on FSC, hired consultants for guiding and training, conducting stakeholder consultations and other logistical costs. Indirect internal costs are one-time allocations invested in the first years of rotation and were estimated at 129 500 000 VND, accounting for 0.2 percent of the total costs of FSC certification and implementation.

The **direct external costs** are the payments made by the contracts with the auditing body with an estimated total of 5 189 100 000 VND (7.5 percent). About US$ 7 600 of this amount is related to the scoping audit, US$ 12 000 to the main audit, and about US$ 6 600 every year to the annual surveillance audits.

**Indirect (compliance) costs** consist of two cost categories: *costs of compliance with management system criteria* (or costs of management system) and *cost of compliance with performance criteria* (or forest management costs). The total indirect costs were estimated at 64 084 677 023 VND for the whole rotation (over 92 percent of the total FSC cost), including 14.6 percent allocated to costs of management system and 77.8 percent allocated to forest management costs. The **costs of management system** are necessary costs of adjusting the forest management system in accordance with FSC standards, covering costs of resource assessment and inventory, HCVF survey and mapping, and SFM re-planning for every five-year period, cost of Reduced Impact Logging (RIL) design and annual recording. Forest management costs can be further classified into two sub-types: **costs for forestry operations and ecological aspects** and **costs related to social aspects.** Costs for forest operations and ecological aspects are the expenditures for the adjustment of the SFE's technical procedures to make them compliant with the legal requirements and other requirements related to standards used for certification, including investment for required equipment and practicing RIL operations, road maintenance, waste management, biodiversity measures, etc. This type of cost takes up nearly 74 percent of the total FSC cost due to the high cost of equipment and high cost requirements of yearly forestry operations. The costs related to social aspects are the expenditures made 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 communities. In Huong Son SFE, this cost is significant, accounting for nearly 4 percent of the total cost.

Compared with the conventional management scheme, which mainly focuses on the economic aspect of timber logging without – or insufficiently – investing in 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 close to 2 000 000 000 VND per year (VND/year), or nearly 327 000 VND/harvested cubic meter, equal to nearly 13 percent higher than the total cost per cubic meter in the conventional management approach.

**Table 7: 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 years of cost allocation *(3)* | Total cost (VND) *4 = 2*3* | (%) | Source of reference |
|---|---|---|---|---|---|---|---|---|
| ***A*** | ***Direct costs of FSC certification process*** | | | | | ***5 318 600 000*** | ***7.7%*** | |
| *A.1* | *Internal costs* | | | | | *129 500 000* | *0.2%* | |
| 1 | SFM planning | | 1st year | 50 000 000 | 1 | 50 000 000 | | Interviewed |
| 2 | Internal training of staff on the certification | 1000 USD/year*2 years | 2n year | 21 000 000 | 2 | 42 000 000 | | Dak To SFE |
| 3 | Hired of consultants | 1 month expert * US$ 1 500 | 1st year | 31 500 000 | 1 | 31 500 000 | | Interviewed |
| 4 | Consulting stakeholders | | 1st year | | 1 | 5 000 000 | | Interviewed |
| 5 | Other costs | | 1st year | 1 000 000 | 1 | 1 000 000 | | Interviewed |
| *A.2* | *External costs* | | | | | *5 189 100 000* | *7.5%* | |
| 6 | Scoping and FM CW/CoC | | 1st year | 159 600 000 | 1 | 159 600 000 | | GFA audit free |
| 7 | Mail audit | | 2nd year | 252 000 000 | 1 | 252 000 000 | | Dak To SFE |
| 8 | Annual surveillance audit | | yearly | 140 514 706 | 34 | 4 777 500 000 | | |
| ***B*** | ***Indirect costs (compliance with FSC standard requirements)*** | | | | | ***64084677023*** | ***92.3%*** | |
| ***B.1*** | ***Costs of compliance with management system criteria*** | | | | | ***1010148908*** | ***14.6%*** | |
| 9 | Resources assessment and forest inventory, HCVF, re-planning | VND 432 540 000 for 5 years | 1 times for every 5 years | 432 540 000 | 7 | 3 027 780 000 | | Cost-norm # 690/2013/QD-BNN-TCCB |
| 10 | Additional cost for RIL designs (compared to conventional) | About 50% higher than conventional | yearly | 192 105 974 | 35 | 6 723 709 078 | | Malaysia, Dak To SFE |
| 13 | Recording | documentation | yearly | 10000000 | 35 | 350 000 000 | | Interviewed |
| ***B.2*** | ***Costs of compliance with performance criteria*** | | | | | ***5 398 318 7945*** | ***77.8%*** | |
| | *Forestry operations and ecological aspects)* | | | | | *51315089280* | *73.9%* | |
| 14 | Reduced impact logging equipments | Safety equipment for worker | every 5 years | 120 000 000 | 7 | 840 000 000 | | 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 | 1 442 145 408 | 35 | 5 0475 089 280 | | Malaysia, Dak To SFE. |
| | *Social aspects* | | | | | *2 668 098 665* | *3.8%* | |
| 16 | Measures to improve safety and health of workers | Training staff and monitoring on RIL | yearly | 9 103 283 | 35 | 318 614 904 | | |
| 17 | Provision of social services for local communities | 5% of total income after tax | yearly | 57 128 108 | 35 | 1 999 483 761 | | Referenced to Dak To SFE |
| 18 | Measures and actions to resolve potential conflicts | | yearly | 10 000 000 | 35 | 350 000 000 | | Interviewed |
| | **Total cost for 35-year rotation** | **Total cost for 35-year rotation** | | | **69 403 277 022.8** | **69 403 277 022.8** | **100** | |
| | **Average cost per year** | **Average cost per year** | | | **1 982 950 772.1** | **1 982 950 772.1** | | |
| | **Average cost per ha/year** | **Average cost per ha/ year** | | | **51 574.9** | **51 574.9** | | |
| | **Average cost per harvested c.m** | **Average cost per harvested c.m** | | | **326 742.1** | **326 742.1** | | |

* Exchange rate: US$ 1 = 21 000 VND

***Benefits from FSC implementation***

The benefits derived from the FSC certification are more difficult to estimate than the costs. First, they come with a time lag. Second, many of the benefits cannot be quantified directly in monetary terms. Because Huong Son SFE has only just begun 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 Viet Nam (e.g. Dak To SFE). This indicates that implementation of forest certification could bring both direct and indirect benefits for Huong Son SFE and other stakeholders on economical, environmental and social aspects.

*i.* *Economic benefits:* there are two main sources of additional revenue that can result from certification. First, the certified timber can be sold at a *premium price*, which is 15 percent higher than the *normal price* (Dak To SFE, 2013). Second, practicing RIL with good monitoring can avoid the loss of usable timber (from lower height of stumps and reduce percentage of damaged timber). It was estimated in Dak To that RIL practice could increase total usable timber amount by five percent without cutting more trees. Table 8 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 $m^3$ and the total annual timber output is estimated at of 6 372.3 $m^3$, which can be sold at a premium price of 3 252 069.1 VND per cubic meter (VND/$m^3$) or an added revenue of 424 182.9 VND/$m^3$. Therefore, the total direct economic benefit for Huong Son SFE is estimated at VND 3 561 121 680.1 per year, equal to 179.6 percent of the total FSC cost per year (1 982 950 772.1 VND). This means that the forest certification could bring significant economic profit for Huong Son SFE.

**Table 8: 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) | 6 068.9 | 2 827 886.2 | 17 162 032 193.1 |
| FSC scheme (2) | 6 372.3** | 3 252 069.1*** | 20 723 153 873.1 |
| Additional revenue from FSC (=(2)-(1)) | 303.4 | 424 182.9 | 3 561 121 680.1 |
| Average additional revenue per managed ha | | | 92 621.8 |
| Average additional revenue per harvested ha | | | 15 266 748.2 |

** Only accounts for timber production*
*** Added amount of timber saving by applying RIL (about 5 percent higher than conventional logging), referenced source from Dak To SFE*
**** Price premium about 15 percent higher than normal price of a cubic meter ($m^3$) in case of conventional scheme, referenced from Dak To SFE*

In addition, several possible indirect economic benefits from the certification can also be gained. Reduction of damage on remaining trees and saplings during logging would be one of these significant indirect benefits. The study results on the impact of RIL in Dak To SFE and Truong Son SFE indicates that good practices of RIL reduced logging damage from 13 percent in conventional logging to as low as 4.5 percent in RIL practice. Practice of RIL can shorten the rotation from 35 years (as normally fixed in Viet Nam) to 25 years (Tuan and Hung, 2013). This means that the FMU can save costs for post-harvesting silvicultural treatments. More profit is also gained from shortened rotations. In the near future, Viet Nam will sign two important timber trade agreements: FLECT and LACEY. The Vietnamese government has also proposed to end natural forest logging (except for FSC certified FMUs). Therefore, forest certification would create competitive advantages on timber market access and premium prices for any FSC-certified FMU. These are very important indirect economic benefits.

*ii.* *Environmental benefits* are derived from the improved mitigation of environmental impacts on forest operations and enhanced measures taken to address biodiversity conservation and biological functions of the forest. Most of the benefits generated by the forest certification rebound to civil 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 cannot 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, conflict resolution and the direct or indirect employment of local people as FMU workers paid in cash or in natural capital (e.g. seedlings). This 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 the FSC forest management scheme***

Table 9 presents the cost and revenue structures for both the conventional and FSC management schemes for a harvested cubic of timber in Huong Son SFE. The table indicates that the total cost of a cubic meter harvested using the FSC scheme is 2 917 998.9 VND, about 341 134.7 VND (or 13.2 percent) higher than the cost of a cubic meter harvested using the conventional scheme. As explained above, the additional cost is caused by additional investments required to meet FSC principles and criteria.

**Table 9: Structure of cost and revenue per cubic meter ($m^3$) for two forest management schemes**

Unit: VND

| | Costs and revenues | Conventional logging scheme (1) | FSC compliance scheme (2) | Difference (= 2-1) |
|---|---|---|---|---|
| **3** | **Costs per $m^3$ 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 | 817 217.2 | 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 | |
| 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 (silvi-cultural 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 |
| | Hired consultants | | 148.3 | 148.3 |
| | Stakeholders consultation | | 23.5 | 23.5 |
| | Other costs of preparation | | 4.7 | 4.7 |
| | Scoping and 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 and 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 $m^3$ of logs** | **2 827 886.2** | **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 $m^3$ 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 for natural forest management.

***i) TEV***

Table 10 indicates that the natural forest is a high value ecosystem producing a wide range of products and environmental services. On average, the SFE can derive up to 71 000 000 000 VND each year, of which 29.2 percent comes from timber logging, 13 percent from NTFP harvesting and 57.5 percent from environmental services. Fuelwood, bamboo, rattan and medicinal herbs are abundant NTFPs in the FMUs while carbon storage and soil loss prevention are highly valued services of the forest ecosystems. However, the value of the other environmental services like water conservation for hydroelectric power plants and human consumption are rather low (less than 1 percent). This estimate is likely undervalued because it is difficult to determine other potential downstream beneficiaries receiving these services (e.g. flood prevention value). Nearby and direct beneficiaries are limited in number and small in scale (only two small hydroelectric power plants and a small water plant in a small town).

The estimated TEV of Huong Son forest clearly shows that the revenue from conventional natural forest logging accounts for only one third of the TEV. In other words, conventional forest management has not optimized the use and management of forest resources because many valuable products (e.g. NTFPs) and all the ES have not been given adequate consideration.

**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** | $m^3$ | 6 372.3 | 3 252 069.1 | **20 723 153 873.1** | **29.2** |
| **2** | **NTFPs value** | | | | **9 251 000 000.0** | **13.0** |
| | Fuel wood | $m^3$ | 15 000 | 200 000 | 3 000 000 000 | 4.2 |
| | Bamboo | stem | 152 000 | 6 000 | 912 000 000 | 1.3 |
| | Chrysobaphus roxburghii (mau cho) | kg | 300 000 | 3 200 | 960 000 000 | 1.4 |
| | Knema globularia species (lan Kim tuyen) | kg | 5 000 | 250 000 | 1 250 000 000 | 1.8 |
| | Drynaria sp (bo cot toai) | kg | 2 000 | 30 000 | 60 000 000 | 0.1 |
| | Ganoderma lucidum (nam linh chi) | kg | 70 | 1 200 000 | 84 000 000 | 0.1 |
| | Rattan | kg | 250 000 | 2 500 | 625 000 000 | 0.9 |
| | Orchidacea (VND) | | | | 350 000 000 | 0.5 |
| | Honey | liter | 3 500 | 200 000 | 700 000 000 | 1.0 |
| | Phrynium placentarium (la Dong) | leaves | 1 000 000 | 500 | 500 000 000 | 0.7 |
| | Licuala Fatoua Becc (la Nón) | leaves | 800 000 | 25 | 20 000 000 | 0.03 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Canarium (quả Trám) | kg | 3 000 | 30 000 | 90 000 000 | 0.1 |
| | Others (VND) | | | | 700 000 000 | 1.0 |
| **3** | **Potential environment services values** | | | | **41 059 272 802** | **57.8** |
| 3.1 | Carbon storage per year (= 6870281/35) | ton of C (tC) | 196 293.7 | 105 000 | 20 610 843 000 | 29.0 |
| 3.2 | Soil loss prevention compared to bare land | ton/year | 1 100 607.0 | 18 500 | 20 361 229 802 | 28.7 |
| 3.3 | Water reservation for hydro power plan | kWh/year | 360 000 | 20 | 7 200 000 | 0.01 |
| 3.4 | Water for living consumption from water plan | $m^3$ | 2 000 000 | 40 | 80 000 000 | 0.1 |
| 3.5 | Biodiversity | | NA | NA | NA | |
| | **Total estimated economic value** | | | | **71 033 426 675.6** | 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 estimates on financial indicators for the different scenarios of FSC natural forest management with a five-year phased approach:

- Scenario 1: FSC management for timber production only;
- Scenario 2: FSC management for timber and NTFPs; and,
- Scenario 3: FSC management for timber, NTFPs and ES.

Table 12 shows the result of the BCA for FSC forest management for timber, NTFPs and ES with a 35-year plan.

For Scenario 1, the total NPV for five years is estimated at 11 570 540 350.2 VND for the entire FMU using the given interest rate (R) of 10 percent per year. Therefore, NPV per hectare per year (NPV/ha/year) is quite low at 60 188 VND. The BCR is 1.17. Meanwhile, for the other scenarios, the figures of NPV are much higher. Scenario 2 produces 15 950 225 181.3 VND; Scenario 3: 131 834 670 601.1 VND. On average, Huong Son SFE can earn a monetary return of 82 970.4 VND per hectare per year (VND/ha/year) if Scenario 2 is practiced, or 685 781.7 VND/ha/year if using Scenario 3. The BCR values of Scenario 2 and Scenario 3 are estimated at 1.23 and 2.09 respectively. For the 35-year FSC plan, the estimated NPV is 450 324 482 830 VND (or an NPV of 334 645 VND/ha/year). The BCR is 2.92 (see Table 12). The above BCA results clearly show that the volume of profit that the SFE can derive from the forest depends on the management strategy it adopts, whether it is solely managed for timber production or a wider range of forest products and environmental services are also being provided.

**Table 11: BCA for different scenarios of FSC forest management of Huong Son SFE in a five-year phased approach**

| Scenario | B&C | 2011 | 2012 | 2013 | 2014 | 2015 | Total |
|---|---|---|---|---|---|---|---|
| **Scenario 1: Only for FSC timber production** | Cost of timber production | 18 121 473 196.2 | 18 243 854 068.1 | 17 508 343 277.2 | 17 720 014 914.0 | 17 987 712 128.8 | 89 581 397 584.2 |
| | Revenue from timber production | 21 205 936 283.6 | 21 349 147 651.9 | 20 488 445 279.7 | 2 073 6145 629.1 | 210 49 407 692.2 | 104 829 082 536.5 |
| | B-C | 3 084 463 087.4 | 3 105 293 583.8 | 2 980 102 002.5 | 3 016 130 715.1 | 3 061 695 563.5 | 15 247 684 952.3 |
| | NPV | 2 804 057 352.2 | 2 566 358 333.7 | 2 238 994 742.7 | 2 060 057 861.6 | 1 901 072 060.1 | 11 570 540 350.2 |
| | *Total NPV=11570540350.2* | | *NPV/year =2 314 108 070.04* | | | *NPV/ha/year = 60 188.0* | *BCR = 1.17* |
| **Scenario 2 FSC FM (timber and NTFPs)** | Total cost | 227 279 46 856.0 | 22 856 446 771.5 | 22 084 160 441.1 | 22 306 415 659.7 | 2 258 749 7735.2 | 122 827 285 664.0 |
| | Costs of timber production | 19 027 546 856.0 | 1 9156 046 771.5 | 18 383 760 441.1 | 18 606 015 659.7 | 1 888 709 7735.2 | 94 060 467 463.4 |
| | Cost of NTFPs production (of 40% of the NTFPs revenues) | 3 700 400 000.0 | 3 700 400 000.0 | 3 700 400 000.0 | 3 700 400 000.0 | 3 700 400 000.0 | 18 502 000 000.0 |
| | Total revenue | 30 456 936 283.6 | 30 600 147 651.9 | 29 739 445 279.7 | 29 987 145 629.1 | 30 300 407 692.2 | 151 084 082 536.5 |
| | Revenue from timber production | 21 205 936 283.6 | 21349147651.9 | 20488445279.7 | 20736145629.1 | 21049407692.2 | 104 829 082 536.5 |
| | Revenue from NTFPs | 9 251 000 000.0 | 9 251 000 000.0 | 9 251 000 000.0 | 9 251 000 000.0 | 9 251 000 000.0 | 46 255 000 000.0 |
| | B-C | 7 728 989 427.6 | 7743 700 880.4 | 7 655 284 838.6 | 7680 729 969.4 | 7 712 909 957.0 | 28 256 796 872.5 |
| | NPV | 7 026 354 025.1 | 6 399 752 793.7 | 5 751 528 804.4 | 5 246 041 916.2 | 4 789 110 255.1 | 1 5950 225 181.3 |
| | *Total NPV = 15950225181.3* | | *NPV/year = 319 004 5036.3* | | | *NPV/ha/year = 8 2970.4* | *BCR = 1.23* |
| **Scenario 3 FSC FM (timber, NTFPs and ES)** | **Total cost** | **24 780 910 496.1** | **24 909 410 411.6** | **24 137 124 081.2** | **24 359 379 299.8** | **24 640 461 375.3** | **122 827 285 664.0** |
| | Costs of timber production | 1 9027 546 856.0 | 19 156 046 771.5 | 1 838 376 0441.1 | 18 606 015 659.7 | 18 887 097 735.2 | 94 060 467 463.4 |
| | Cost of NTFPs production | 3 700 400 000.0 | 3 700 400 000.0 | 3 700 400 000.0 | 3 700 400 000.0 | 3 700 400 000.0 | 18 502 000 000.0 |
| | Transaction cost for ES (estimated of 5% of the ES) | 2 052 963 640.1 | 2 052 963 640.1 | 2 052 963 640.1 | 2 052 963 640.1 | 2 052 963 640.1 | 10 264 818 200.6 |
| | **Total revenue** | **7 151 6209 086.0** | **71 659 420 454.3** | **70 798 718 082.2** | **71 046 418 431.6** | **71 359 680 494.7** | **356 380 446 548.8** |
| | Revenue from timber production | 21 205 936 283.6 | 2 1349 147 651.9 | 204 884 452 79.7 | 20 736 145 629.1 | 21 049 407 692.2 | 104 829 082 536.5 |
| | Revenue from NTFPs | 9 251 000 000.0 | 92 51 000 000.0 | 9 251 000 000.0 | 9 251 000 000.0 | 9 251 000 000.0 | 46 255 000 000.0 |
| | Revenue from ES | 41 059 272 802.5 | 41 059 272 802.5 | 41 059 272 802.5 | 41 059 272 802.5 | 41 059 272 802.5 | 205 296 364 012.3 |
| | **B-C** | **46 735 298 589.9** | **46 750 010 042.7** | **46 661 594 001.0** | **46 687 039 131.8** | **46 719 219 119.3** | **233 553 160 884.7** |
| | NPV | 42 486 635 081.8 | 38 636 371 936.1 | 35 057 546 206.6 | 31 887 875 918.2 | 29 008 959 347.9 | 131 834 670 601.1 |
| | *Total NPV = 131834670601.1* | | *NPV/year = 26 366 934 120* | | | *NPV/ha/year = 685 781.7* | *BCR = 2.90* |

*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 | 24 780 910 496 | 71 516 209 086 | 46 735 298 590 | 1.10 | 42 486 635 082 |
| 2012 | 24 909 410 412 | 71 659 420 454 | 46 750 010 043 | 1.21 | 38 636 371 936 |
| 2013 | 24 137 124 081 | 70 798 718 082 | 46 661 594 001 | 1.33 | 35 057 546 207 |
| 2014 | 243 59 379 300 | 71 046 418 432 | 46 687 039 132 | 1.46 | 31 887 875 918 |
| 2015 | 24 640 461 375 | 71 35 968 0495 | 467 19 219 119 | 1.61 | 29 008 959 348 |
| 2016 | 241 56 353 110 | 70 820 148 567 | 46 663 795 457 | 1.77 | 26 340 496 013 |
| 2017 | 24 380 005 467 | 71 069 406 007 | 46 689 400 541 | 1.95 | 23 959 044 923 |
| 2018 | 24 290 220 976 | 70 969 342 442 | 46 679 121 466 | 2.14 | 21 776 154 665 |
| 2019 | 24 357 357 127 | 71 044 164 748 | 466 86 807 621 | 2.36 | 19 799 763 922 |
| 2020 | 24 369 857 834 | 71 058 096 612 | 46 688 238 778 | 2.59 | 18 000 337 156 |
| 2021 | 24 276 470 198 | 70 954 017 391 | 46 677 547 193 | 2.85 | 16 360 195 534 |
| 2022 | 24 434 199 708 | 71 129 804 736 | 46 695 605 028 | 3.14 | 14 878 658 813 |
| 2023 | 24 405 337 782 | 71 097 638 520 | 46 692 300 739 | 3.45 | 13 525 096 332 |
| 2024 | 24 357 357 127 | 71 044 164 748 | 46 686 807 621 | 3.80 | 1 229 4095 610 |
| 2025 | 24 195 583 270 | 70 863 870 035 | 46 668 286 765 | 4.18 | 11 172 016 809 |
| 2026 | 24 438 244 055 | 71 134 312 104 | 46 696 068 049 | 4.59 | 10 162 424 934 |
| 2027 | 243 16 913 663 | 70 999 091 070 | 46 682 177 407 | 5.05 | 9 235 819 933 |
| 2028 | 24 187 494 577 | 70 854 855 299 | 46 667 360 722 | 5.56 | 8 393 535 028 |
| 2029 | 24 458 465 787 | 71 156 848 943 | 46 698 383 156 | 6.12 | 7 635 558 805 |
| 2030 | 24 175 361 538 | 70 841 333 196 | 46 665 971 658 | 6.73 | 6 936 599 332 |
| 2031 | 24 195 583 270 | 70 863 870 035 | 46 668 286 765 | 7.40 | 6 306 312 235 |
| 2032 | 244 22 066 669 | 71 116 282 633 | 46 694 215 964 | 8.14 | 5 736 196 420 |
| 2033 | 24 296 691 930 | 70 976 554 230 | 46 679 862 300 | 8.95 | 5 213 121 028 |
| 2034 | 24 147 051 113 | 70 809 781 621 | 46 662 730 508 | 9.85 | 4 737 461 619 |
| 2035 | 24 377 578 859 | 71 066 701 587 | 46 689 122 728 | 10.83 | 4 309 219 186 |
| 2036 | 24 579 796 179 | 71 292 069 977 | 46 712 273 798 | 11.92 | 3 919 414 488 |
| 2037 | 24 385 667 551 | 71 075 716 322 | 46 690 048 771 | 13.11 | 3 561 408 807 |
| 2038 | 24 179 405 885 | 70 845 840 564 | 46 666 434 679 | 14.42 | 3 236 006 890 |
| 2039 | 24 316 913 663 | 70 999 091 070 | 46 682 177 407 | 15.86 | 2 942 816 857 |
| 2040 | 24 195 583 270 | 70 863 870 035 | 46 668 286 765 | 17.45 | 2 674 492 000 |
| 2041 | 24 394 123 912 | 71 085 140 819 | 46 691 016 907 | 19.19 | 2 432 540 574 |
| 2042 | 24 173 523 199 | 70 839 284 392 | 46 665 761 194 | 21.11 | 2 210 204 349 |
| 2043 | 24 359 195 466 | 71 046 213 551 | 46 687 018 085 | 23.23 | 2 010 191 934 |
| 2044 | 24 244 115 427 | 70 917 958 449 | 46 673 843 022 | 25.55 | 1 826 931 508 |
| 2045 | 24 276 470 198 | 70 954 017 391 | 46 6775 47 193 | 28.10 | 1 660 978 635 |
| **Total** | **852 170 274 474.6** | **2486169933645.3** | **1 633 999 659 170.7** | | **450 324 482 830.2** |

NPV= 450 324 482 830 NPV/year = 12 866 413 795
NPV/year/ha = 334645 BCR = 2.92
** given r = 10%/year*

***BCA for Acacia plantation and LEV in Huong Son SFE***

***i) BCA for Acacia plantation***

The establishment of acacia plantations in some low land areas of the SFE is one of the designed tasks of Huong Son SFE. Over the next five years, Huong Son SFE plans to set up about 500 ha of acacia plantations on shrub and bare land areas. Table 13 shows the result of the BCA for one ha of acacia plantation with a rotation period of seven years. This analysis is based on the assumption that the plantation is only for timber production. Other products and services derived from the plantation are assumed as insignificant.

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

*Unit: 1000 VND; given R = 10% per year*

| No | Items | Year | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | 1st | 2nd | 3rd | 4th | 5th | 6th | 7th | |
| **I** | **Costs (C)** | **6416.0** | **2960.0** | **840.0** | **840.0** | **480.0** | **480.0** | **28194.1** | **40210.1** |
| A | Production costs | 6 416.0 | 2 960.0 | 840.0 | 840.0 | 480.0 | 480.0 | 24 238.8 | 36 254.8 |
| 1.1 | Design | 240.0 | | | | | | | |
| 1.2 | Vegetation removal | 480.0 | | | | | | | |
| 1.3 | Hole digging (manual) | 960.0 | | | | | | | |
| 1.4 | Seedlings | 1 056.0 | | | | | | | |
| 1.5 | Fertilizers (NPK) | 1 760.0 | 1 760.0 | | | | | | |
| 1.5 | Planting | 720.0 | | | | | | | |
| 1.6 | Tending | 720.0 | 720.0 | 360.0 | | | | | |
| 1.7 | Protection and fire prevention | 480.0 | 480.0 | 480.0 | 480.0 | 480.0 | 480.0 | 480.0 | |
| 1.8 | Brunching | | | | 360.0 | | | | |
| 1.9 | Harvesting | | | | | | | 23 758.8 | |
| ***B*** | ***Other costs*** | | | | | | | ***3 955.3*** | ***3 955.3*** |
| 1.10 | Road maintenance | | | | | | | 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)*** | | | | | | | ***109 111.5*** | ***109 111.5*** |
| 2.1 | Timber | | | | | | | 71 533.0 | |
| 2.2 | Chip wood | | | | | | | 37 578.5 | |

NPV/ha = 31 470 572 VND NPV/ha/year = 4 495 796 VND

BCR = 2.71 IRR = 43.2%

Table 13 shows that the total estimated cost of one ha of acacia plantation with a seven-year rotation is 40 210 100 VND and the total estimated revenue from selling timber and chip wood is 109 111 500 VND per ha. The NPV is 31 470 572 VND/ha over seven years. The forest owner can earn a yearly average profit of 4.5 million VND/ha from an acacia plantation. The BCR is high (2.71) and the value IRR (43.2 percent) is much higher than the interest rate (10 percent). This means that management of an acacia plantation can be highly profitable for the landowner.

***ii) LEV in Huong Son SFE***

Using the future value (FV) method, the expected value of bare land in Huong Son SFE in this study is estimated for even-aged acacia plantations with a single rotation of seven years for timber production. The result indicates that the LEV using an acacia plantation age of seven years at a 10 percent interest rate is 63 444 200 VND/ha (or 9 063 457.1 VND/ha/year). This LEV provides the maximum amount that could be paid for a tract of land and while still earning the required interest rate. In this case, a potential buyer could invest a maximum amount of 63 444 200 VND/ha for the tract and earn 10 percent 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 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 | -6 416.0 | -6 416.0 | -12 503.0 |
| 2 | -2 960.0 | -2 446.3 | -4 767.1 |
| 3 | -840.0 | -631.1 | -1 229.8 |
| 4 | -840.0 | -573.7 | -1 118.0 |
| 5 | -480.0 | -298.0 | -580.8 |
| 6 | -480.0 | -270.9 | -528.0 |
| 7 | 80 917.4 | 41 523.4 | 80 917.4 |
| **Total** | **68 901.4** | **30 887.3** | **60 190.6** |

*Given r = 10%*

*PV = 30 887 300 VND*

*FV = PV* (1+r)^7 = 60 190 600 VND* for 7 years of land use

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

*LEV per ha per year* is equal to *9 063 457.1 VND*

***Comparison of key financial indicators of different forest management options for Huong Son SFE***

Table 15 presents the financial indicators (NPV, BCR, IRR) of six different land-use options in Huong Son SFE, including five natural forest management schemes and a land-use scheme for an acacia plantation.

Of the natural forest management schemes, it is clear that the conventional timber production scheme has the lowest NPV value, earning a small profit at only 163 928.4 VND/ha, equivalent to 32 786 VND/ha/year. The BCR of this scheme is just above 1.1. This implies that although the conventional scheme is still profitable, management mainly based on conventional timber logging could only generate a very small profit per unit of forested area. Meanwhile, each of the four other forest management schemes in accordance with FSC standards are more profitable. The indicators NPV/ha, NPV/ha/year, and the BCRs of these management schemes are significantly higher than those of the conventional logging scheme. However, there is a significant difference between these indicators and the FSC management schemes, depending on the management strategy of producing a single type of product (e.g. timber) or multiple forest products and services. It is clear that the more types of forest products and services the SFE provides, the higher profit the SFE can earn, which increases from the FSC timber production scheme to FSC timber, to the NTFPs and ES production schemes.

For the FSC timber production scheme, gaining the advantages of the timber premium price and timber saving by applying RIL, the value of NPV/ha/year is estimated at 60 188 VND with a BCR of 1.17. This value is almost double the figure of the conventional logging scheme, although it still remains a low figure. In comparison, 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 because the SFE can acquire significant revenues from extracting NTFPs, which are abundant on the site.

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

The man-made forest-acacia plantation, on the other hand, is the most profitable land-use option. A single ha of the plantation can provide an NPV of 4 495 796 VND/year on average. In economic terms, such a land-use management is likely the most financially attractive land-use option. Clearly, compared to the acacia plantation land-use option, the profits from the natural forest options are too small and less attractive. The main explanation for the relatively low values of NPV/ha/year of the natural forest management scheme is due to the very small area cut allowable (ACC). On average, the annual ACC of Huong Son FMU is just 233.26 ha out of a total 38 448 ha (less than 1 percent). Meanwhile the SFE has to bare all costs for managing the 38 448 hectares. This situation reduces the per ha profit of the management scheme.

However, if estimation is limited to the logged area, the profit of the scheme of FSC timber, NTFPs and ES production (five-year phased approach) is valued at 6 029 621.50 VND/ha/year, of which 5 404 027.80 VND account for profits from timber logging and 625 593.7 VND are profits from NTFPs and ES. This figure is the highest among all land-use options in Huong Son FMU, even when compared to the acacia plantation.

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

*Unit: VND*

| Indicators | Conventional timber production (five-year plan) | FSC natural forest management schemes | | | | Acacia plantation (seven-year rotation) |
|---|---|---|---|---|---|---|
| | | FSC timber production (five-year plan) | FSC timber and NTFP production (five-year plan) | FSC timber, NTFP & ES Production (five-year plan)* | FSC timber, NTFP & ES Production (35-year plan ) | |
| 1. Total management area (ha) | 38 448 | 38 448 | 38 448 | 38 448 | 38 448 | |
| 2. Annual average logging area (ha) | 233.26 | 233.26 | 233.26 | 233.26 | 233.26 | |
| 3. Total NPV | 6 302 717 607 | 11 570 540 350 | 15 950 225 181 | 131 834 670 601 | 450 324 482 830 | |
| 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) | 126 054 3521 | 2 314 108 070 | 3 190 045 036 | 26 366 934 120 | 12 866 413 795 | |
| 6.NPV/ha/year | 32 786 | 60 188 | 82 970 | 685 782 | 334 645 | 4,495 796.0 |
| BCR | 1.12 | 1.17 | 1.23 | 2.90 | 2.92 | 2.71 |
| IRR | | | | | | 43.2% |

Given r = 10%

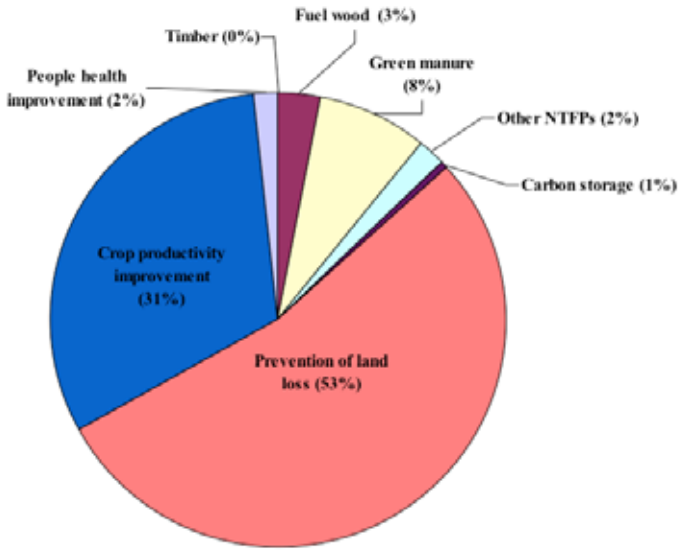
## BCA analysis of land-use options in Vinh Tu commune

### *BCA of natural forest on sandy soil*

#### *a) 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. Currently, several village forest protection teams are managing the entire 446 ha area of the forest. Their objective is to protect the forest's environment. Patrolling the forest is their key management activity. Therefore, the labor force for patrolling is their main cost. It is estimated that every year the local community spends around 900 man-days to protect the forests, which is equal to about 420 000 VND/ha/year. In addition, the local community has other small management costs (listed as "other costs" in table 16) such as team meetings and similar activities. In the event the local community receives revenue from selling the forest's carbon credits, about five percent of the revenue would be spent as transaction cost. On average, the estimated total cost per ha per year for forest management is low at less than 280 000 VND.

Compared to the natural forest in Huong Son SFE that is being managed for timber production, the natural forest on sandy soil at Vinh Tu commune is being managed to protect the environment and local communities. However, the local people can derive a great and diverse range of benefits from the forest, mainly from ES and NTPFs. It is estimated that local inhabitants can benefit close to 45 000 000 VND from a single ha of the forest each year. Total forest environmental benefits account for nearly 87.4 percent of the total TEV of the forest. Among the main benefits are the prevention of agriculture soil loss (53 percent) and improvement of crop productivity (31 percent). Green manure and fuelwood are the two major annual NTFPs from which local people benefit (see Figure 3).




*Total benefit of 44 555 089.7 VND/ha/year*

**Figure 3: 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 and benefits | Unit | Amount | Price (VND) | Total (for 446 ha) (VND) | Average per ha (VND) |
|---|---|---|---|---|---|---|
| **I** | **Costs** | | | | **123 090 000** | **275 986.5** |
| 1.1 | Protection cost (labor) (2 man-day/ha/year*446 ha) | man-day | 902 | 120 000 | 108 240 000 | 242 690.6 |
| 1.2 | Transaction cost for C (estimated of 5% of the C storage average revenue per year) | | | | 12 432 000 | 27 874.4 |
| 1.3 | Other costs | | | | 14 850 000 | 33 296.0 |
| **II** | **Benefits** | | | | **19 871 570 000.0** | **44 555 089.7** |
| **2.1** | **Timber** | **No harvesting** | | | **0.0** | **0.0** |
| **2.2** | **NTFPs** | | | | **2 513 000 000.0** | **5 634 529.1** |
| 2.2.1 | Fuelwood | $m^3$ | 3 000 | 210 000 | 630 000 000 | 1 412 556.1 |
| 2.2.2 | Green manure | ton | 1 000 | 1 500 000 | 1 500 000 000 | 3 363 228.7 |
| 2.2.3 | Other NTFPs | | | | | 858 744.3 |
| | Lindera strychnifolia (ô dước) | kg | 2 000 | 12 000 | 24 000 000 | 53 811.7 |
| | Tongkat ali (sâm đắng) | kg | 2 000 | 60 000 | 120 000 000 | 269 058.3 |
| | Sp (lầu âu) | kg | 1200 | 70 000 | 84000000 | 188340.8 |
| | Honey | liter | 300 | 150 000 | 45 000 000 | 100 896.9 |
| | Queues nut | kg | 5 000 | 12 000 | 60 000 000 | 134 529.1 |
| | others | | | | 500 00 000 | 112 107.6 |
| **2.3** | **Environmental services** | | | | **17 358 570 000.0** | **38 920 560.5** |
| 2.3.1 | Carbon storage (tC) ton of C for about 30 years | tC | 35 520 | 105 000 | 3 729 600 000 | 8 362 331.8 |
| | Carbon storage (tC) ton of C per year | tC | 1 184 | 105 000 | 124 320 000 | 278 744.4 |
| 2.3.2 | Prevention of agriculture land loss | | | | | 23 878 923.7 |
| | Prevention of losable area of paddy cultivation (ha) due to sand moving | ha of paddy | 40 | 60 000 000 | 2 400 000 000 | 5 381 165.9 |
| | Prevention of losable area of peanut cultivation (ha) due to sand moving | ha of peanut | 70 | 75 000 000 | 5 250 000 000 | 11 771 300.4 |
| | Prevention of losable area of cassava cultivation (ha) due to sand moving | ha of cassava | 50 | 60 000 000 | 3 000 000 000 | 6 726 457.4 |
| 2.3.3 | Increasing productivity of crops from improving land condition (10% of the productivities, account for remaining area, about 830 ha of paddy, corn, peanut and cassava with assumption as 10% of peanut productivity = 7 500 000 VND/ha) | ha | 831.9 | 7 500 000 | 6 239 250 000 | 13 989 349.8 |
| 2.3.4 | People's health improvement (reduce risk of eye ache and respiration disease caused by sand follows), reduce medicine needed | people | 3 450 | 100 000 | 345 000 000 | 773 542.6 |

From the estimates above, it can be said that the natural forest in Vinh Tu commune has very high value, especially the ES values concerning livelihoods of and agricultural production for local communities. The value of TEV that local people can derive from one ha of the forest per year is quite high (close to 45 000 000 VND). In Vinh Tu, the major income sources of the local community come from agricultural production. The natural forest plays a vital role as a very effective shelterbelt for the protection of Vinh Tu's agricultural lands. The main impacts on agriculture are the prevention of soil loss and the improvement of crop productivity. The forest is very highly valued and the local community has a strong incentive to protect the forest.

***b) BCA of the natural forest management in different scenarios***

Table 17 shows the NPV and BCR for three different natural forest management options in Vinh Tu commune: 1) management for providing NTFPs only; 2) management for providing NTFPs and ES (except for carbon storage); and 3) management for NTFPs and ES (including carbon storage). For option 1, the NPV/ha/year is estimated at nearly 536 000 VND. This indicator increases to 44 000 000 VND/ha/year when option 2 is used. There is another slight increase to 44 600 000 VND/ha/year when option 3 is used.
Similarly, the BCR increases from 20.4 for the first option to 160.4 for the second option. These figures clearly indicate that the management of the natural forest on sandy soil in Vinh Tu can generate high profits for the local people. All of the financial indicators for natural forest management in Vinh Tu, moreover, are much better than those of Huong Son SFE.

**Table 17: Financial analysis of different options of natural forest management for 1 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 and ES (include C storage) (option iii) |
|---|---|---|---|
| **1. Total cost** | **275 986.5** | **275 986.5** | **30 3861.0** |
| Protection cost | 242 690.6 | 242 690.6 | 242 690.6 |
| Transaction cost for C (estimated 5% of average revenue from C storage) | | | 27 874.4 |
| Other costs | 33 296.0 | 33 295.96413 | 33 296.0 |
| **2. Total revenues** | **5 634 529.1** | **4 427 6345.3** | **44 555 089.7** |
| Timber | 0.0 | 0 | 0 |
| NTFPs | 5 634 529.1 | 5 634 529.1 | 5 634 529.1 |
| ES (without C storage) | | 38 641 816.1 | |
| ES (with C storage) | | | 38 920 560.5 |
| **3. NPV (= (2)-(1))** | **5 358 542.6** | **44 000 358.7** | **44 251 228.7** |
| **4. BCR** | **20.4** | **160.4** | **146.6** |

***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***

The establishment of acacia plantations is one of the major land-use types in Vinh Tu. In this commune, the local people practice two different land-use schemes of acacia plantation management: for normal timber production without FSC and with FSC by small groups of households. The financial analysis in Table 18 indicates that both land-use schemes are profitable. All indicators, such as NPV, BCA and IRR are positive and rather high. However, the establishment of FSC acacia plantation brings in a greater profit for the landowners. All the indicators such as 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 to 6 244 371.1 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 lower (3 502 965.1 VND/ha/year in Vinh Tu versus 4 495 796 VND/ha/year in Huong Son SFE). Local people explain that the timber productivity of acacia plantations

in Vinh Tu is rather low because the soil quality in the sandy project site is poor due to semi-dry climatic conditions.

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

| Year | FSC acacia plantation (seven-year rotation) | | | | Non-FSC acacia plantation (seven-year rotation) | | |
|---|---|---|---|---|---|---|---|
| | Operational costs (1 000 VND) | FSC costs (1 000 VND) | Total cost (1 000 VND) | B-C (1 000 VND) | Operational costs (1 000 VND) | Revenue (1 000 VND) | B-C (1 000 VND) |
| 1 | 5 512 | 50 | 5 562 | 0 | 5 512 | 0 | -5 512 |
| 2 | 2 720 | 50 | 2 770 | 0 | 2 720 | 0 | -2 720 |
| 3 | 600 | 50 | 650 | 0 | 600 | 0 | -600 |
| 4 | 960 | 50 | 1 010 | 0 | 960 | 0 | -960 |
| 5 | 240 | 260 | 500 | 0 | 240 | 0 | -240 |
| 6 | 240 | 327.5 | 567.5 | 0 | 240 | 0 | -240 |
| 7 | 14 129.4 | 327.5 | 14 456.9 | 117 476.3 | 14 860 | 79 500 | 64 640 |
| Total | 24 401.4 | 1115 | 25 516.4 | 117 476.3 | 25 132 | 79 500 | 54 368 |
| | NPV= | VND 43 710 598.00 | | | NPV= | VND 24 520 721.00 | |
| | NPV/year | VND 6 244 371.10 | | | NPV/year | VND 3 502 965.10 | |
| | 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 subsistence and the profits gained from cultivating these crops are not high, ranging from 21 000 000 to 29 000 000 VND/ha. Of these crops, cultivating cassava is likely the most profitable land-use scheme with its NPV at 28 670 000 VND/ha and a BCR of 1.92. However, many local people said that this calculation only applies to the first rotation of cassava. After continuously cultivating on the same site, local inhabitants experienced a dramatic decrease in productivity for cassava cultivation. This is attributed to loss of soil quality and erosion. Therefore, after the first crop rotation, revenue from cassava may decrease sharply in the following years. If cassava cultivation can only create a high profit in the first rotation, the substantial reduction in profit during subsequent years will reflect unsustainable land use during succeeding rotations.

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

*Unit: 1 000 VND*

| Year | Peanut (one-year rotation) | | Cassava (one-year rotation) | | Corn (one-year rotation) | | Rubber (30-year rotation) | |
|---|---|---|---|---|---|---|---|---|
| | cost | revenue | cost | revenue | cost | revenue | cost | revenue |
| 1 | 54 300 | 75 000 | 31 300 | 60 000 | 28 050 | 50 000 | 20 380.0 | 0.0 |
| 2 | | | | | | | 5 208.4 | 0.0 |
| 3 | | | | | | | 5 208.4 | 0.0 |
| 4 | | | | | | | 5 208.4 | 0.0 |
| 5 | | | | | | | 5 208.4 | 0.0 |
| 6 | | | | | | | 5 208.4 | 0.0 |
| 7 | | | | | | | 5 908.4 | 17 600.0 |
| 8 | | | | | | | 6 108.4 | 24 200.0 |
| 9 | | | | | | | 6 808.4 | 30 800.0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 10 | | | | | | | 6 808.4 | 31 900.0 |
| 11 | | | | | | | 6 808.4 | 33 000.0 |
| 12 | | | | | | | 6 808.4 | 33 000.0 |
| 13 | | | | | | | 6 808.4 | 33 000.0 |
| 14 | | | | | | | 6 808.4 | 35 200.0 |
| 15 | | | | | | | 6 808.4 | 35 200.0 |
| 16 | | | | | | | 6 808.4 | 36 300.0 |
| 17 | | | | | | | 6 808.4 | 36 300.0 |
| 18 | | | | | | | 6 808.4 | 36 300.0 |
| 19 | | | | | | | 6 808.4 | 36 300.0 |
| 20 | | | | | | | 6 808.4 | 34 100.0 |
| 21 | | | | | | | 6 808.4 | 34 100.0 |
| 22 | | | | | | | 6 808.4 | 31 900.0 |
| 23 | | | | | | | 6 680.0 | 31 900.0 |
| 24 | | | | | | | 6 680.0 | 30 800.0 |
| 25 | | | | | | | 6 390.0 | 29 700.0 |
| 26 | | | | | | | 6 390.0 | 29 700.0 |
| 27 | | | | | | | 6 390.0 | 29 700.0 |
| 28 | | | | | | | 5 640.0 | 28 600.0 |
| 29 | | | | | | | 5 640.0 | 26 400.0 |
| 30 | | | | | | | 2 200.0 | 76 400.0 |
| **Total** | **54 300** | **75 000** | **31 300** | **60 000** | **28 050** | **50 000** | **199 766.4** | **802 400.0** |
| NPV | | 20 700 | | 28 670 | | 21 950 | | 88 707.4 |
| BCR | | 1.38 | | 1.92 | | 1.78 | | 4.0 |
| IRR | | | | | | | | 22.74 |

(Interest rate of 10%)

Rubber is among the key industrial trees planted in the commune. Rubber plantation rotation is rather long, normally around 30 years. Furthermore, the establishment and management of this kind of plantation usually requires a big investment and takes at least six years of initial investments before the first resin harvest. Table 19 is the summary of the costs and revenues from one ha of a rubber plantation with a rotation period of 30 years, derived from household interviews conducted in 2013. In Table 19, the total cost for one ha is estimated at 200 000 000 VND, mainly expenditures in plantation establishment activities such as site preparation, fertilizers and cost of labor during harvesting. Expenditures in the first six years (the period of investment without any income) account for appropriately 25 percent of the total cost. The expenditure for the first year is notably large: 20 300 000 VND/ha.

Local farmers receive their first income from selling the first rubber resin product during the seventh year (around 18 000 000 VND/ha), and from then on, the income gradually increases until the 11th year (85 000 000 VND/ha). From the 11th year until the 27th year, this annual income remains stable. In the final three years of rotation, the income plunges and all rubber trees will be clear-cut at the end of the rotation. The total revenue in 30 years from one ha of plantation rubber is approximately 802 400 000 VND. Although the total gross income is quite high, the NPV from one ha of planted to plantation rubber is just 88 700 000 VND, which is accounted for by the high costs of both establishment and management and the high discounted rate associated with long rotations. The BCA value in this case is calculated at 2.45 and IRR is 22.7 percent.

***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 an even-aged acacia plantation with a single rotation of 7 years for timber production. Using an interest rate of 10 percent, the estimated LEV of the bare land in Vinh Tu for one ha of plantation acacia is 54 403 600 VND (equivalent to 7 771 942.9 VND/ha/year). With the assumption that production is limited to timber, this LEV presents the maximum amount that could be paid for a tract of land and still earn the required interest

rate of 10 percent on the investment. This LEV is higher than the profit made from the rubber plantation land use but smaller than other profit from agricultural land use and it is too small to compare to the profits made from the natural forest management scheme.

**Table 20: LEV of bare land in Vinh Tu commune**

*Unit:*

| Year | Cash follow | Present value (PV) | Future value (FV) |
|---|---|---|---|
| 1 | -5 512.0 | -5 512.0 | -10 741.3 |
| 2 | -2 720.0 | -2 472.7 | -4 818.6 |
| 3 | -600.0 | -495.9 | -966.3 |
| 4 | -960.0 | -721.3 | -1 405.5 |
| 5 | -240.0 | -163.9 | -319.4 |
| 6 | -240.0 | -149.0 | -290.4 |
| 7 | 64 640.0 | 36 487.6 | 71 104.0 |
| **Total** | | **26 972.8** | **52 562.3** |

***Comparing financial indicators of land-use options in Vinh Tu commune***

Table 21 summarizes the financial indicators of the various land uses employed 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 the cash crop land-use option, FSC acacia plantation, non-FSC acacia plantation, rubber plantation and finally, the natural forest management scheme for NTFPs only.

$$PV = VND26\ 972\ 800$$

$$FV = PV^{*}\ (1+r)^{\wedge 7} = 52\ 562\ 300\ VND\ for\ 7\ years$$

$$LEV = \frac{52562300}{(1+0.1)^{7}-1} = 54\ 403\ 600\ VND\ for\ 7\ years$$

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

*Unit: 1000 VND*

| 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) | | 44 000.36 | 160.40 | |
| Natural forest for NTFPs & ES (with C) | | 44 251.23 | 146.60 | |
| Non-FSC acacia plantation | 24 520.7 | 3 502.90 | 3.16 | 41.0 |
| FSC acacia plantation | 43 710.6 | 6 244.40 | 4.60 | 53.0 |
| Peanut | 20 700.0 | 20 700.00 | 1.38 | |
| Cassava | 28 670.0 | 28 670.00 | 1.92 | |
| Corn | 21 950.0 | 21 950.00 | 1.78 | |
| Rubber | 88 707.4 | 2 956.90 | 4.0 | 22.74 |

*Given r = 10%*

Although the total NPV of the rubber plantation is quite high, the NPV/ha/year is rather low due to its long production rotation. Furthermore, establishment of a rubber plantation requires a high level of investment in the first years of operation. In addition, local inhabitants have to bear the risk of potential damages caused by tropical cyclones that are common in the region.[5]

[5] In 2013, many rubber plantations in the region were destroyed by a very strong tropical cyclone.

Cassava cultivation can deliver high profits for farmers (compared to other cash crop land uses) in the short-term, but this type of land use faces risks and uncertainty in the long-term due to price fluctuations and significantly sharp reductions in productivity. Therefore, rubber plantation and cassava have been not considered as priority land uses in the Vinh Tu commune. In reality, management of natural forest for NTFPs and ES and establishment of FSC acacia plantations are the best land-use options for Vinh Tu. The first land use is mainly for livelihood protection and improving agricultural production; the second is mainly for earning cash. In short, the sustainable management scheme of natural forest on sandy soil can be considered the most valuable land use mechanism in Vinh Tu commune.

## OCA for land uses

**Opportunity cost for land uses in Huong Son SFE**

***Opportunity cost of FSC forest certification and implementation***

Figure 4 presents the trade-off between the net costs and benefits of FSC certification and implementation per ha per year of natural forest management in Huong Son SFE. From the figure, it can be seen that changing the management scheme from conventional logging to FSC forest management requires a significant investment for FSC certification and costs for implementation to ensure compliance with FSC standards. On average, the total FSC cost incurred by one ha within a year is estimated at 51 574.9 VND. The estimated profit derived from the conventional logging is 32 785.7 per ha per year while the profit of the FSC forest management scheme reaches 685 781.7 per ha per year.

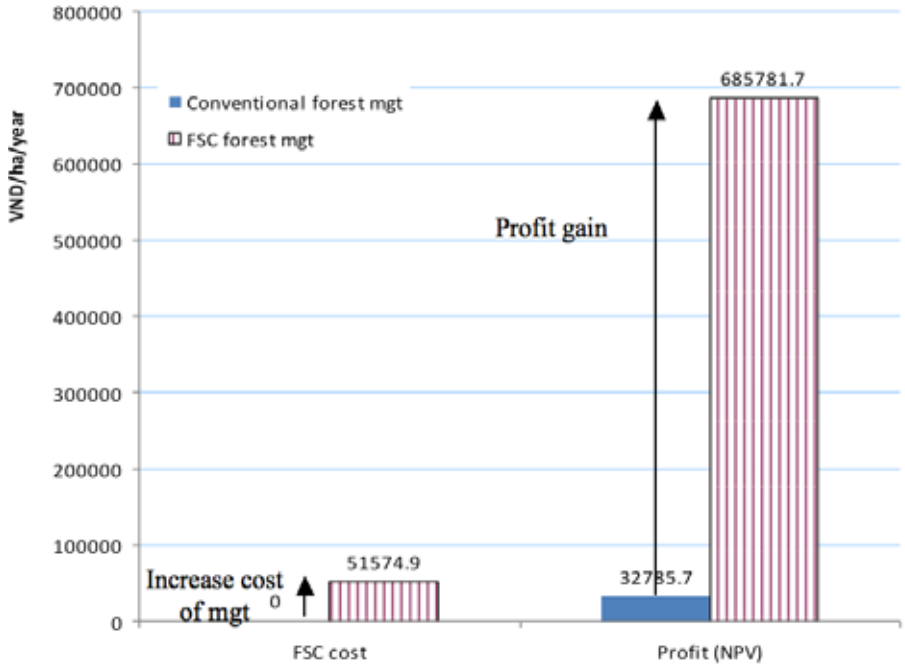



**Figure 4: FSC cost and profit gain from changing conventional logging to FSC natural forest management in Huong Son SFE**
*(estimated for whole managed forest area of 38 448 ha)*

This means that FSC forest management requires more investment in FSC certification and implementation but also delivers much more profit. Shifting from conventional logging to FSC forest management increases the profit by 652 996 VND/ha/year while costs reach 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 (652 996 VND/ha/year – 51 574.9 VND/ha/year = 601 421.1 VND/ha/year). In other words, the per unit land area estimated opportunity cost is 601 421.1 VND/ha/year, or Huong Son SFE will forgo 601 421.1 VND/ha/year if it does not shift from conventional logging to the FSC management scheme.

***Opportunity cost of land-use change***

This subsection analyzes per ha profit of a timber-ES trade-off when converting natural forest to plantation using two different application conditions: 1) for a management ha (applied for whole the management area of 38 448 ha per year (see Figure 5) and 2) for a harvesting ha (applied to a harvested forest area of 233.26 ha per year (see Figure 6).

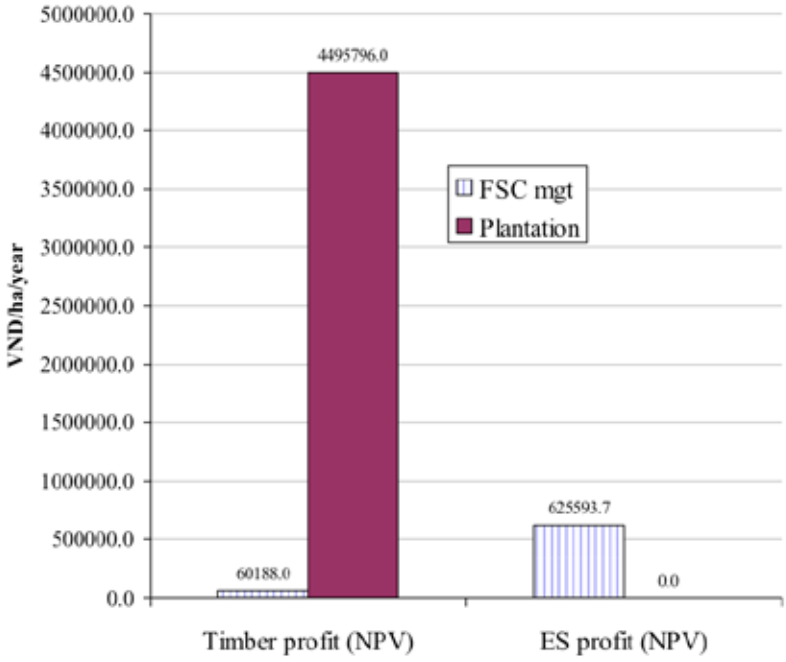



**Figure 5: Per ha timber profit gain and ES profit loss from conversion FSC forest management to acacia plantation (scenario for a management ha)**

To calculate for a management ha in the Huong Son SFE, compare a ha of managed natural forest to a ha of acacia plantation. FSC forest management has a NPV profit of 685 781.7 VND/ha/year (of which, 625 593.7 VND was derived from ES and 60 188 VND from timber), while the total NPV profit of a ha of acacia plantation is of 4 495 796 VND/ha/year produced by the production of timber alone. Therefore, the opportunity cost of not changing the natural forest to an acacia plantation is equal to 3 810 014.3 VND/ha/year. This is a high opportunity cost and is much higher than the NPV for natural forest management. This may be the key reason why many SFEs would like to convert their natural forests into plantations. In theory, it is likely that the SFE would gain more profit by converting natural forests into plantations. However, in reality most of the forest areas in the FMU are steep and located at high elevations – conditions not suitable for the establishment of an acacia plantation. Furthermore, the Vietnamese government does not allow any conversion of natural forest into plantations except for some special cases such as very poor and degraded forest. Therefore, in Huong Son SFE, the areas that can be used or are suitable for plantations are rather limited, estimated at only 1 000 ha.

Computations based on the harvesting area (233.26 ha per year) show that each ha of logged forest under the FSC forest management produces a profit of VND 5 404 027.8 per ha per 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 FSC forest management is 6 029 621.5 VND/year. This means that in converting one ha of natural forest to plantation, the SFE will lose 1 533 825.5 VND/year in NPV profits (4 495 796 VND – 6 029 621.5 VND = - 1 533 825.5 VND).

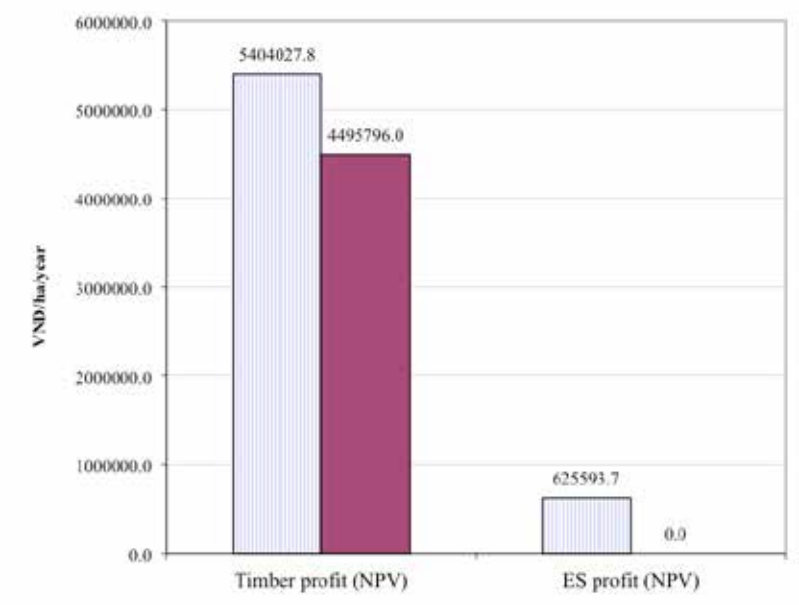



**Figure 06: Timber profit and ES profit loss from conversion FSC forest management to plantation (for a natural forest ha)**

**Opportunity cost for land uses of Vinh Tu commune**

Figures 7 and 8 present the profits derived from different land uses and the opportunity costs of six different types of land-use changes (from natural forest to six other land uses). From Figure 7, it can be seen that natural forest management for ES and NTFPs is the most profitable land-use option with an NPV/ha/year of over 44 000 000 VND, followed by three cash crop land uses (cassava, corn, and peanut), then by acacia plantation land use and the final being rubber plantation.

If the natural forest is converted to the other land uses, each conversion has a different opportunity cost, with all opportunity costs being negative. These denote that the local people will lose significant profit when converting the natural forest on sandy soil into other types of land uses. The highest profit loss will occur if the natural forest is converted into a rubber plantation, followed by non-FSC acacia plantations. In terms of maintaining profitability, the local people should avoid conversion of the natural forest to any other land uses.

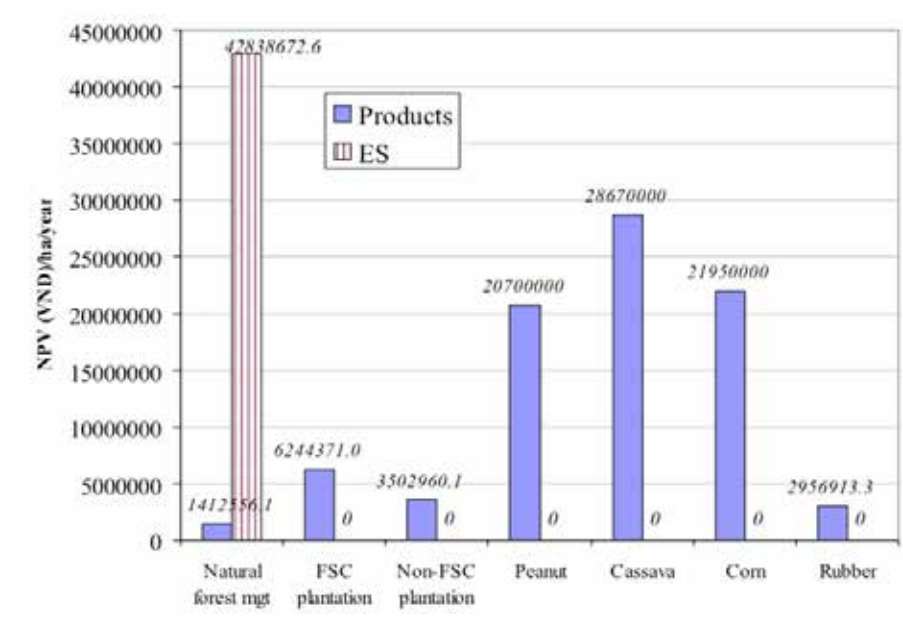



**Figure 7: Product profits and ES profits of different land-use options in Vinh Tu**

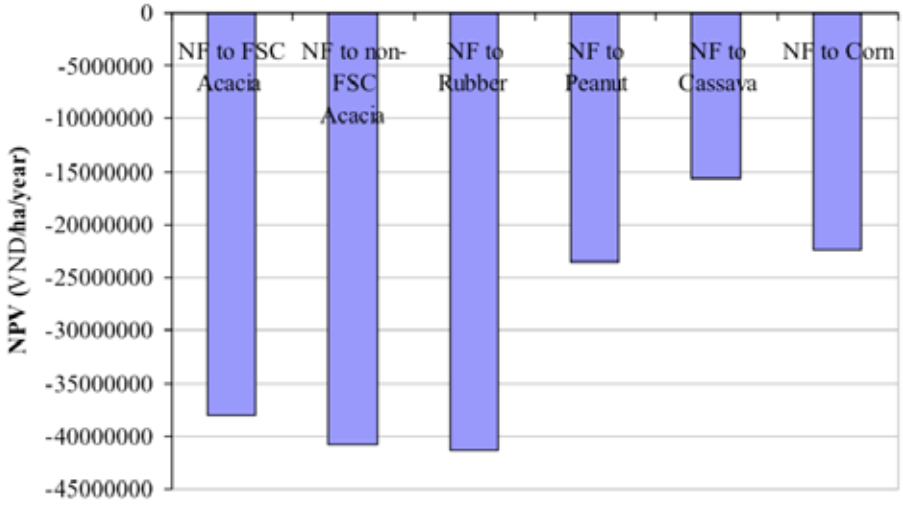



**Figure 8: Opportunity costs of six different land use changes in Vinh Tu**

# Best land use options and opportunity to set up a payment scheme for ES

## Best land use-options in the project sites

Based on the BCA and OCA of the different land use options, the following land uses are the best land-use options offer high net benefits in the study sites:

***i) For Huong Son SFE***

Huong Son SFE is managing a total area of 38 448 ha, of which 96.1 percent is forested area and the remaining 2.6 percent 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 due to the following reasons:

- FSC natural forest management can generate significantly higher profits from timber production than conventional logging schemes (by taking advantage of high price premiums and added volume of timber derived from RIL practice); and,
- Potential benefits from the provision of forest NTFPs and ES that have been significantly valuated could produce added value to the SFE.

For bare land and very poor and degraded forest areas (about 1 000 ha) on the hills and low mountain areas, establishment of plantations (e.g. acacia species) would be the best choice for timber commercial timber production because this land-use option produces the highest NPV given such conditions. However, landowners should seriously consider that although the plantation land use is likely the best option in terms of generating profit, the area for plantations should not exceed the more than 1 000 ha of barren and very poor or degraded forests suitable for the plantation due to the following reasons:

- It is illegal to convert natural forests to plantation;
- Productivity of plantations cannot reach the desired LEV and maintain their productivity if site conditions are not suitable, i.e. if the plantations are located at high elevations and on steep terrain; and
- High risk of negative environmental impacts (e.g. soil erosion) 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 in terms of environmental services (e.g. soil loss prevention and crop productivity improvement), which are vital for the livelihood and daily existence of the commune. Therefore, protection and promoting regeneration of the remaining natural forest are key elements in their management.

For bare land (except areas devoted to cash crop cultivation), the establishment of FSC certified smallholder groups on acacia plantations is a good land-use option; this land-use option produces relatively higher profit than other plantation land uses (e.g. non-FSC acacia plantations and rubber plantations).

## 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 scheme relies on incentives to induce behavioral changes through one of two types of ES markets: voluntary or regulatory (public payment scheme). PES can be considered part of a broader class of incentives or can be a market-based mechanism initiated by environmental policy. The ecosystem services

that are most commonly delivered through PES schemes on a global scale are carbon sequestration and storage, biodiversity conservation, watersheds and landscape beauty. In Viet Nam, there is a key legal framework (Decree 99/2010) regulating levels and mechanisms on payment schemes for three types of forest environmental services: water provision for daily consumption, water for hydroelectric power plants and landscapes for ecotourism. ES providers can receive revenues through a government fund, namely the Forest Protection and Development Fund (FPDF). In addition, the Vietnamese government is implementing the pilot REDD+ program for the carbon storage services of the country's forests. These options could be considered important institutional bases for setting up local PES schemes in the study sites. Table 22 presents a summary of a recommended payment scheme for different kinds of ES found in the study sites. These results were drawn from the existing relevant literature and field surveys.

Two key points can derived from Table 22: the difference between the types of forest ES in Huong Son SFE and Vinh Tu commune and the beneficiaries and providers of the forest ES in Huong Son SFE and Vinh Tu commune. In Huong Son SFE, the forest ecosystem is rich in biodiversity and its major ES relate to carbon storage, water reservation and soil erosion prevention for off-site beneficiaries (e.g. local and/or downstream communities, hydropower plans, etc.). In Vinh Tu commune, on other hand, the most important ES of the natural forest on sandy soil are agricultural soil loss prevention and improvement of crop productivity, which directly benefit the local communities. In other words, ES users in Huong Son SFE are different from the providers, while in Vinh Tu commune the local people are both the ES providers and users. Therefore, having a different set of providers and a different set of users in Huong Son SFE may translate to higher transaction costs for PES implementation in the SFE compared to those of Vinh Tu commune.

Most existing PES schemes in Viet Nam are public payment based on the regulations of Decree 99/2010. However, this legal document mentions a very limited range of ES and its provisions have not been widely implemented. Moreover, the REDD+ mechanism is still in the pilot stage and the voluntary market for ES payment is still lacking in Viet Nam due to many constraints, such as a lack of reliable measuring and monitoring systems. Expanding certification to include forest ES in the FSC forest management standard would be one way of opening ES to voluntary markets in general, and to Viet Nam in particular.

Three payment schemes are recommended for ES in the study sites:

1. For some services (e.g. water for water and hydropower plans) that are subject to Decree 99/2010, the service provider(s) can apply for funding through the Viet Nam FPDF.
2. For the carbon storage service, the piloting REDD+ scheme can be adopted.
3. For the other services, a voluntary market is an option. For timber, NTFPs and some ES (e.g. water for rice paddies, daily life and soil loss prevention), local communities can benefit from the forests of Huong Son. Payment for the labor of local people in sustainable forest management is possible by setting up a co-management mechanism. However, the inhabitants are too poor to pay cash for the SFE to be rewarded by this benefit.

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

| Site | Natural forest products and 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 | Any wood processing com. | Free timber market | |
| | Fuelwood & NTFPs | | Huong Son SFE itself and the local communities | Local people | Local people pay fees of NTFP collection or contribute 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 FPDF | Decree 99/2010 |
| | Water for hydropower plan | | Two small hydropower plans | Two small hydropower plans | Public payment through provincial FPDF | Decree 99/2010 |
| | Carbon storage | | Regional, national and global | Government, businesses, industries required to reduce emissions or purchase carbon offset voluntarily | 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 FPDF | Decree 99/2010 |
| | Other ES (e.g. soil conservation) | | | Potential inter. buyers | Voluntary | Access to voluntary market via FSC +ES |
| Vinh Tu | Fuelwood | Local community though their protection teams | Being used as common property resources (CPR) by local people | 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 local people's health | | | | | |
| | Carbon storage | | Regional, national and global | Government, businesses, industries required to reduce emissions or purchase carbon offsets voluntarily | REDD+ program | Piloting policy |
| | Biodiversity or typical ecosystem | | | Conservation agencies, potential inter. Buyers, government forest protection program | ii) Voluntary<br>ii) Regulations | i) Access to voluntary market via FSC +ES<br>ii) Government fund on forest protection & management |

# Conclusions and recommendations

This report aims to identify the best land-use options through BCA and OCA and identify payment mechanisms for ES in two SNV ForCES project sites in Ha Tinh and Quang Tri province. The following key findings can be drawn from the study:

a. Land-use options and estimates of products and services found in 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 conditions and the purpose of their forestland use. Huong Son SFE has about 38 500 ha in the medium and high mountain region along the Viet Nam and Lao PDR border, which is mostly covered by evergreen tropical forests. The natural forest in Huong Son is classified as production forest and is primarily used for timber production. Vinh Tu commune is located on a coastal area of 3 450 ha with five major land uses: natural forest on sandy soil; acacia plantations; cash crops, such as corn, peanut and cassava; rice paddies; and rubber plantations. The natural forest in Vinh Tu commune is about 450 ha. It is claimed as a communal property resource and is mainly used as a natural shelterbelt, providing environmental protection for the livelihoods of the communities.
- The forests of Huong Son SFE and Vinh Tu commune are both high value ecosystems, providing a wide range of products and environment services. The TEVs of the forests – mainly from environmental service and NTFPs, especially the natural forest on sandy soil in Vinh Tu commune – are far greater than the direct-use value of timber. On average, the total TEV, which can be derived from one ha of forested land in Huong Son per year. is estimated at almost 1 950 000 VND, of which about 29 percent comes from timber, 13 percent from NTFPs and the rest (nearly 58 percent) from ES: high carbon storage capacity and high soil erosion prevention. In Vinh Tu commune, although the natural forest has been not been managed for timber production, the forest ecosystem is very highly valued by the local people because of the forest's vital role in providing environmental protection services. The estimated TEV per ha per year of the natural forest in Vinh Tu is very high (approximately 44 600 000 VND), of which 87.4 percent is derived from ES (mainly agriculture land loss prevention against sand movement and agricultural cash crop productivity improvement) and NTFPs (mainly green manure and fuelwood).

b. BCA and opportunity cost of land uses

- In Huong Son SFE, the financial efficiency of natural forest management is significantly affected by the management scheme. Conventional management with a focus on timber logging only produces a very low NPV at 60 118 VND/ha/year. In contrast, the implementation of an FSC management scheme for sustainable provision of timber, NTFPs and ES is the most profitable option with significant gains in revenue estimated at 685 781.7 VND/ha/year.
- The SFM scheme in Huong Son requires high additional investments for FSC certification and implementation: about 327 000 per harvested cubic meter or 51574.9 VND/ha/year (nearly 13 percent higher than the unit cost in a conventional scheme). However, the total benefit from the FSC implementation is significantly higher than the FSC costs due to increased profits derived from timber premium price (about 15 percent higher), increased timber usable percentage (five percent) and other social and environmental benefits. On average, the possible profit gained from the FSC scheme is estimated at 652 996 VND/ha/year. This means that the per unit land area estimated opportunity cost is 601 421.1 VND/ha/year. In other words, Huong Son SFE may forgo 601 421.1 VND/ha/year by not applying for the FSC management scheme.
- Establishing acacia plantations on bare land is likely the most profitable land use in Huong Son with an NPV of 4 495 796.0 VND/ha/year. Based on the financial analysis, it is considered to be the most attractive land-use option. However, bare land and degraded forest areas suitable for acacia plantation establishment are few, estimated at less than 1 000 ha. Furthermore, the Vietnamese government would not allow the conversion of forestland on steep terrain and high elevations to acacia plantations.
- The expected value of bare land (LEV) in both Huong Son SFE and Vinh Tu commune was estimated

for an even-aged acacia plantation with a single rotation of seven years for timber production. Using the future value (FV) method with an interest rate of 10 percent, results indicate that the LEV is 63 444 200 VND/ha for Huong Son and 54 403 600 VND/ha for Vinh Tu respectively. These LEVs present the maximum amounts that could be paid for one ha of land and still pay the 10 percent interest on their 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 the cash crop land-uses options, FSC acacia plantations, non-FSC acacia plantations, rubber plantations and the natural forest management scheme for NTFPs only. Therefore, changing the natural forest in Vinh Tu into any other land use would result in negative opportunity cost. In other words, local people would lose significant profits if converting the natural forest on sandy soil into other types of land uses. The highest loss would happen if the forest is converted into a rubber plantation.

c. Identifying the best land-use options

- In Huong Son SFE, in terms of financial efficiency, implementation of FSC forest management for sustainable provision of timber, NTFPs and ES is the best land-use option for the sustainable management of its natural forests. The scheme yields the opportunity to enter the PES market from a long-term production perspective. For bare land, very degraded and poor lowland forests, the establishment of acacia plantations is a reasonable land-use option in terms of profit maximization. However, suitable lowland areas for this option are limited (not more than 1 000 ha).
- In Vinh Tu, the protection and regeneration of the remaining natural forest on sandy soil is the best land-use option for the commune because the forest ecosystem is vital to the livelihood of the local people and provides a high NPV profit.
- For bare land, except for areas for cash crops cultivation), establishment of an FSC certified acacia plantation is the best land use option for cash earning.

d. Opportunity to set up a payment scheme for ES

- Vietnam has a public payment market for PES on the basis of Decree 99/2010 via the Vietnam Forest Protection and Development Fund (VNFPDF). However, the types of ES identified by this legal framework are limited while the REDD+ scheme is still in the pilot stage. In contrast, the identified ES in the study sites are highly diversified. There is therefore a need to institutionalize a voluntary market for biodiversity ES at the national level. Incorporating forest ES in FSC certification will provide the opportunity to include forest ES into the voluntary PES market and/or public payment markets.
- Payments for water services (water plants and hydroelectric power plants) are possible via the public payment mechanism provided for by Decree 99/2010. However, payment for carbon storage is still in need of a national mechanism (e.g. Vietnam National Carbon Fund).
- In Vinh Tu commune, the local communities are both the forest ES provider and the end-user. In contrast, the ES beneficiaries of Huong Son SFE are external. Local people in Vinh Tu understand and greatly value the vital roles played by their natural forest and they have a high incentive to self-govern their resources for their own benefits. In Huong Son, however, the motivation of the Huong Son SFE to provide selected off-site forest ES (e.g. water reserve, biodiversity conservation, etc.) is low because the opportunity to receive revenue from these services is not significant. However, local people inhabiting areas near the forests of the SFE are willing to contribute (e.g. labor for joint patrolling). Therefore, there is a promising potential that a working mechanism can be established between the SFE and the local communities on SFM for the benefit of both the SFE and the neighboring communities.

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# Annexes

## Annex 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 Cảm | 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 | Nguyễ 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 Hiếu | 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 Vấn | 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 forestland
- What are the major land-use options on forestland 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 forestland?
☐ special-use forest ☐ protection ☐ production

- What are the categories of the FMU plantation land?
☐ special-use forest ☐ protection ☐ production
And the types of species for plantation:
+ ----------
+ ----------
+ ----------
+ ----------

- What are the types of land use for agriculture production on forestland?
+ Pasture
+ Crop production by crop species:
i) Cassava:.....
ii) Rubber:.....
iii).....
iv).....

- Please provid information on each types of land use (e.g. area, location, use purpose, management activities applied (e.g. protection, enrichment, harvesting (clear cutting, selection cutting, HCVF area, NTFPs production, timber production....), current characteristics of each land use (species composition, density, DBH, H, standing volume

**Table : Land-use types and characteristics**

| No | Land-use types/ ecosystems | Area (ha) | Status (Ic,.....V, & forest types (ever-green broad leaf..) | Key site con-dition | Key manage-ment objectives (special use, protection, production...) | Key manage-ment practices | Key attributes (density, DHB, H, Volume/ productivity, rotation) | In case of FSC certification | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Key manage-ment practices | Key attributes |
| 1 | Forestland | | | | | | | | |
| 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 case of no available data on the above land-use options, e.g. crop land inside the FMU, information will be gathered by asking people about the above variables.

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## Tool # 2: Identify available and potential goods and services of each land-use option/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 (lc,.....V, & forest types (evergreen broad leaf..) | Rotation (years) | Kinds and amounts of goods from the land use (per ha/year or rotation) | | | Environmental services | | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Timber ($m^3$)[1] | Fuelwood * | NTFPs (by types) | Carbon storage (ton of C)** | Soil protec-tion *** | Water re-serve **** | Other ***** | |
| 1 | Forestland | | | | | | | | | | | |
| 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-forest-ed 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 from available data from other research

* Fuelwood is estimated by asking how much does a local household collect from land use per year in terms of cubic meter. data will be checked by household interview

NTFPs data is collected in the same way for fuelwood

**, ***,****,***** are estimated by two methods: (i) quantitative methods of which data are reviewed from available data from SNV project, other research projects of VN and international if available, and (ii) qualitative with like 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 discussion) based on the participants experiences.

- In case of a need for more information, using open-ended questionnaires for some important ecosystem:

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

How is the productivity of your rice paddy affected (reduced) (by how many percentage)?

And why?

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

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

### 3.1. Estimation of costs and benefits of natural forested land-use option

*(for each type of land-use option identified in Tool #1)*

(Reviewing secondary data of the fmu)

- Type of forest:.....
- Area (ha):.....
- Status:.....
- Key management objectives and practices:.....
.....
- Key questions about what activities are conducted, their cost and what benefits are derived from their practices 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 | | | | | | | | | | | | | | | | | | |
| - | | | | | | | | | | | | | | | | | | |
| 3.3. Post-harvesting | | | | | | | | | | | | | | | | | | |
| - Sanitation | | | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.4. Other costs | | | | | | | | | | | | | | | | | | |
| - Equipment 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 | | | | | | | | | | | | | | | | | | |
| Cost of surveillance audit | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| **Total (A1+A2)** | | | | | | | | | | | | | | | | | | |
| **B: benefits from the management** | | | | | | | | | | | | | | | | | | |
| **Timber (m3) by class** | | | | | | | | | | | | | | | | | | |
| - | | | | | | | | | | | | | | | | | | |
| - | | | | | | | | | | | | | | | | | | |
| **NTFPs by class** | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

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 | | | | |
| - 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 for cost and revenue structure of plantation**

*Unit: 1000 VND/ha*

| | Costs | | | | | | | | | Revenues | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | ***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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