

REPORT



A mapping of ecosystem services in Quang Tri and Ha Tinh provinces, Viet Nam



MINISTRY FOR FOREIGN
AFFAIRS OF FINLAND



THE CENTER FOR
PEOPLE AND FORESTS



A mapping of ecosystem services in Quang Tri and Ha Tinh provinces, Viet Nam

RECOFTC - The Center for People and Forests

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Acronyms

AGB	Above ground biomass
BEF	Biomass Expansion Factor
BGB	Below ground biomass
CBD	Convention of Biological Diversity
CI	Conservation International
FIPI	Forest Inventory and Planning Institute
FPD	Forest Protection Department
FRA	Forest Resources Assessment
FSC	Forest Stewardship Council
FSC COC	FSC Chain of Custody
FSC FM	FSC Forest management
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
KBA s	Key Biodiversity Areas
MARD	Ministry of Agriculture and Rural Development
MONRE	Ministry of Environment and Natural Resources
PA s	Protected areas
SCBD	Secretariat of the Convention on Biological Diversity
SFM	Sustainable forest management
SNV	Netherlands Development Organization
VNFOREST	Vietnam Forest Administration
WWF	World Wide Fund for Nature

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Background

The Forest Stewardship Council (FSC) focuses on certifying, based on a set of criteria, timber products sourced from sustainably managed forests. FSC has actively recognized and promoted the concept of ecosystem services (ES) as an important forest function. This is reflected by a decision of the FSC membership in 2011 to include specific references to ES in FSC Statutes and By-Laws. In addition, the revised FSC Principles & Criteria (P&C) now explicitly refer to ES by requiring their maintenance, conservation and/or restoration by forest managers.

The Forest Certification for Ecosystem Services (ForCES) project aims to expand FSC certification to include additional ES by researching, analyzing and field testing innovative ways of evaluating and rewarding the provision of critical ES (FSC 2012). ForCES is currently tested across four countries: Viet Nam, Chile, Indonesia and Nepal. The ten selected test sites have different socio-political and environmental conditions.

In Viet Nam, this project is being implemented by SNV Netherlands Development Organization in Huong Son Forest Enterprise in Ha Tinh province and Vinh Tu Commune, Vinh Linh district, Quang Tri province. A key activity in the early phase of the ForCES project is to identify which ES are available within the pilot sites. Identifying the value and distribution of the different ES will be important in identifying the particular ES to target and prioritize under the various project activities. It will also be used in combination with a market demand analysis to determine which ES will be earmarked for use in the development of a business model for each pilot province.

Objective

This study aims to produce maps, using existing and available secondary national level data, that clearly show key ecosystem services in the two pilot areas, including carbon, biodiversity (with the use of appropriate proxy measures), watershed areas and other measurable ES.

Ecosystem services

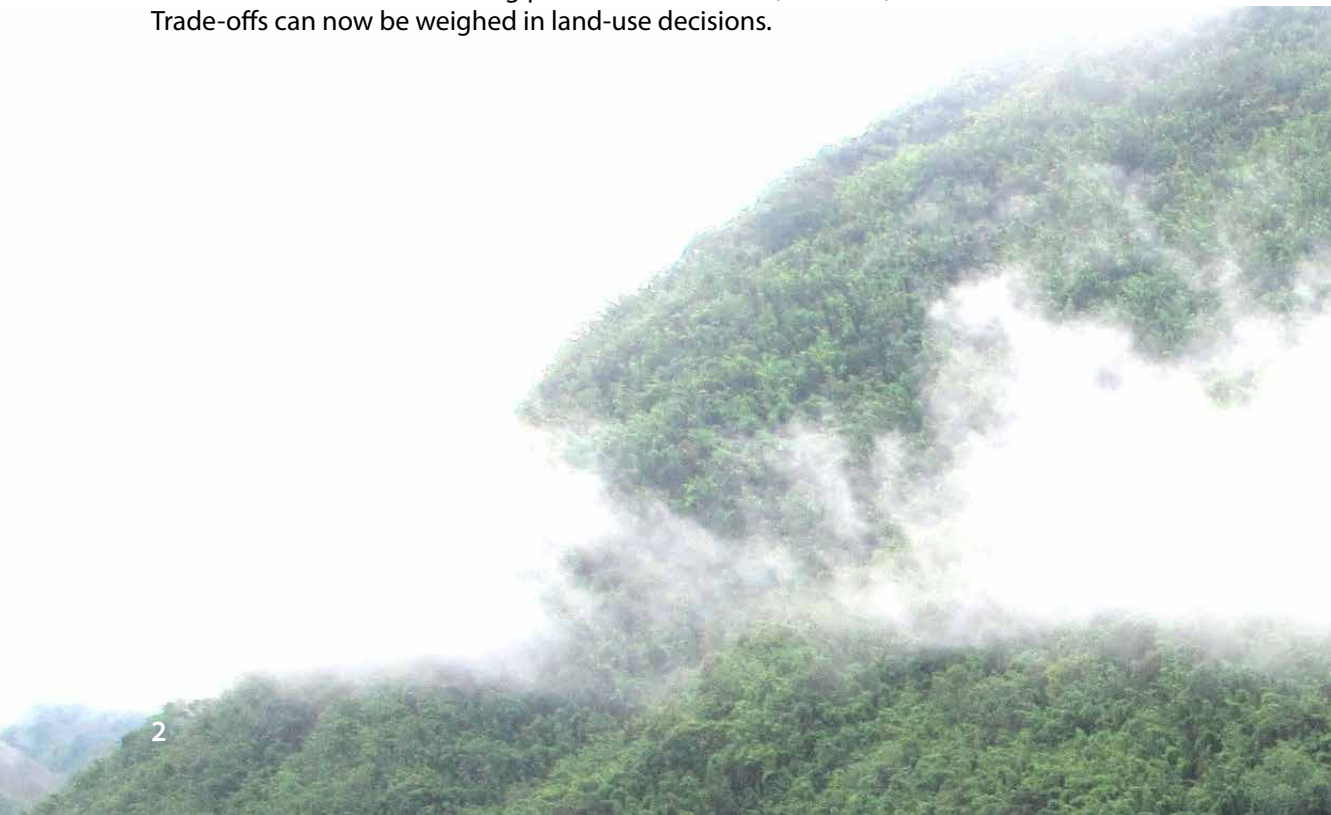
Goods and services provided by functioning ecosystems contribute directly and indirectly to human welfare and therefore represent a significant, yet often uncounted, portion of the total economic value of the landscape we live in. While there are many ways that humans can value their landscape, the ability to estimate the economic value of ecosystem goods and services provided by a landscape is increasingly recognized as

a valuable tool in weighing trade-offs in environmental decision-making and land-use planning.

Ecosystem services have been defined as the benefits people obtain either directly or indirectly from ecological systems (Costanza, d'Arge, and Groot 1998). They include products such as food, timber material, fuel and fiber; regulating services such as climate stabilization and flood control; and nonmaterial assets such as recreational value. They directly and indirectly occur at multiple spatial scales, from climate regulation and carbon sequestration at the global scale, to water supply, flood control and nutrient cycling. They also vary with regard to how directly connected they are with human life, with services like climate regulation being highly indirect, while food, raw materials, and recreational opportunities are far more direct (Wilson and Carpenter 1999).

The 2003 Millennium Ecosystem Assessment divided ES into four categories: provisioning (e.g. food, fresh water, fuel, genetic resources), regulating (e.g. climate, disease and flood regulation), cultural (e.g. recreation, aesthetics, and education), and supporting (services necessary for production of other ecosystem services, e.g. soil formation, waste treatment, and nutrient cycling).

Identifying and quantifying directly and indirectly are increasingly recognized as valuable tools in the assessment of ES and the allocation of these resources among stakeholders. Payment for Ecosystems Services (PES) will be a key element in strategies intending to mainstream forest biodiversity conservation and maintain essential support services, and for meeting Millennium Development Goals (MDG). The Millennium Ecosystem Assessment concluded that more than 60 percent of the world's ecosystem services are either degraded or used unsustainably. By quantifying the value of ecosystem services, benefits and costs that otherwise would have remained hidden, can now be taken into account in the decision-making processes at the local, national, and international levels. Trade-offs can now be weighed in land-use decisions.



Study sites

Viet Nam

Viet Nam is the easternmost country on the Indochina Peninsula, which is in Southeast Asia. The People's Republic of China (PRC) borders it to the north, Lao PDR to the northwest, Cambodia to the southwest, and the Pacific Ocean to the east (Figure 2). Three-fourths of its 329 000 square kilometers (km²) land area is hilly or mountainous, with river deltas and marshlands prominent in the coastal lowlands. With a population of over 89 million, Viet Nam is the 13th most populous country in the world.

Viet Nam is rich in biodiversity with about 11 458 species of fauna, 21 017 species of flora and 3 000 species of microorganisms. The IUCN Red List of Threatened Species ranking of countries with the largest number of threatened species placed Viet Nam 6th, 15th and 18th for reptiles, mammals and birds, respectively (WCMC 1994). The country also harbors globally important populations of some of Asia's most threatened animals, such as the Java Rhinoceros, Crested Argus, Edwards Pheasant, Green Peafowl and Tonkin Snub-nosed Monkey. The unique biodiversity of Viet Nam is under threat by a growing population of 89 million people and the accompanying increases in forest degradation due to economic activity and wildlife trading.

In 1943, Viet Nam had 14.3 million hectares (ha) of natural forest, accounting for 43 percent of the country's total land area.



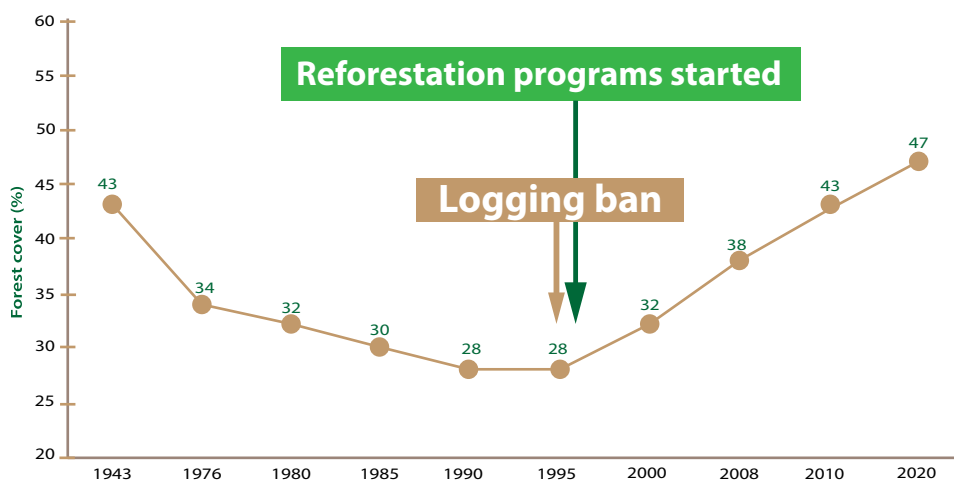


Figure 1. Forest cover of Viet Nam from 1943 to 2010 and projection to 2020 (MARD).

For this ForCES project, the two selected pilot sites are Huong Son SFE, Ha Tinh Province and Vinh Tu Commune, Vinh Linh District, Quang Tri Province.

Huong Son SFE

The site in Ha Tinh Province consists of around 38 000 ha of hilly and lowland forest classified as production forest and managed by the Huong Son State Forest Company. This site is a hot spot for biodiversity value and it plays an important role, serving as the corridor that connects Pu Mat National Park of the Vu Quang Natural Reserve in Viet Nam and Nam Chouan National Park in Lao PDR.

The pilot site faces considerable threats from deforestation and degradation, as well as poaching of its wildlife. Ha Tinh province is also among the proposed new sites for the UN REDD Programme. Huong Son State Forest Company owns forest area in the watershed of Ngan Pho River and has borders with Vu Quang National Park and Lao PDR. Local awareness of the pressures on ecosystem services and the efforts to protect these as well as awareness of the FSC is considerable. TFT had carried out the certification pre-

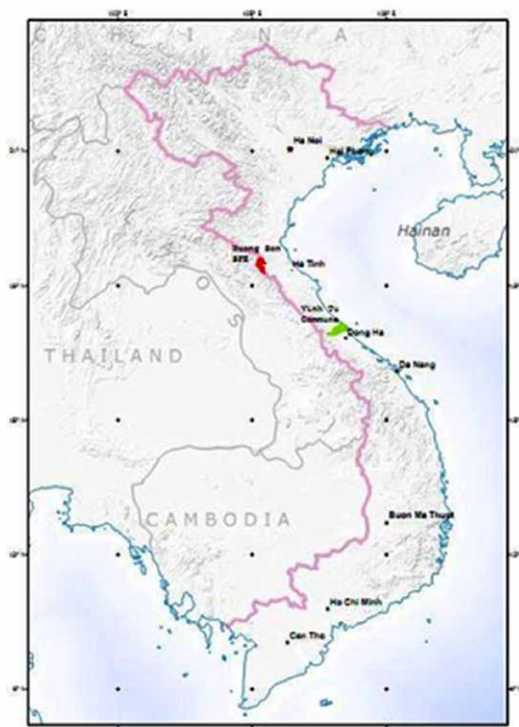


Figure 2. Map of study sites at Huong Son and Vinh Tu

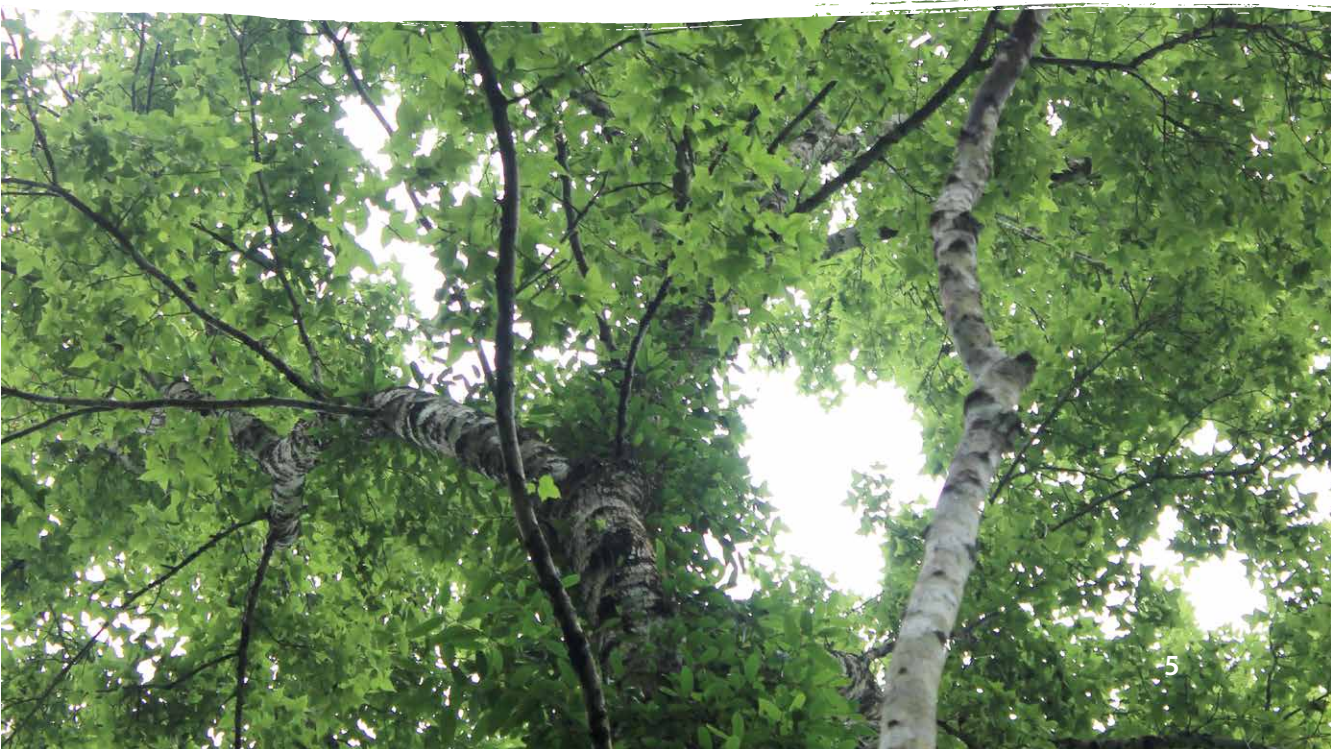
assessment in Huong Son in 2002. Since then, the Huong Son Company has conducted numerous activities to develop capacity and raise awareness on FSC (TFT, 2002). The Ministry of Agriculture and Rural Development in Viet Nam approved the sustainable forest management plan of the company in 2011.

Vinh Tu Commune

Vinh Tu Commune is located in the sandy coastal area of Vinh Linh district, Quang Tri province, 30 kilometers (km) to the North from Dong Ha City and adjacent to National Highway 1. The commune population is 3 265 within 943 households, 7.1 percent of which fall into the “poor” category. Vinh Tu has a total natural area of 3 539 ha with 350 ha of shrub forests on sand dunes and 1 800 ha of plantation forest scattered throughout ten villages. Initial research shows that Vinh Tu’s sand forests are homes to rich biodiversity resources typical of Viet Nam’s coastal sand ecosystems.

Presently, the Vietnamese government puts the shrub forests under communal administration management. While this is a positive policy in handling the managing and giving ownership of forests to local people, there remain issues on the enforcement of forest protection measures due to the commune’s limited resources and capacity.

In November 2011, Ben Hai Forest Company located in Vinh Chap, a neighboring commune, acquired the FSC Forest Management certificate for 9 463 ha of forest. With the increasing demand for FSC-certified timber, the provincial and district government is highly interested in expanding FSC certification to other forest owners, specially the FSC Group Certification for Smallholders. For this reason, Vinh Tu was selected as a pilot site for ForCES project in Viet Nam





Methods and data

Ecosystem service identification

Ideally, the best method for defining ecosystem services (ES) is by quantifying its economic value. By estimating and accounting for the economic value of ES, social costs or benefits that otherwise would remain hidden can potentially be revealed and vital information that might otherwise remain outside of the economic decision making calculus at local, national, and international scales can be internalized (Millennium Ecosystem Assessment 2003).

Such an approach is employed in payment for ecosystem service (PES) and for carbon payment mechanisms such as the Clean Development Mechanism (CDM) or recently, REDD+. However, it is not feasible or practical in this study to estimate the monetary value of the entire ecosystem services of Huong Son and Vinh Tu site because of the significant cost and time required for this activity.

An alternative approach that can be used for this study is to define ES by its functions and use it as a proxy to estimate the ES. The Millennium Ecosystem Assessment (2003) proposed four main functions of an ecosystem:

- Provision: timber, material, water
- Regulation: regulation of hydrological system, flood control
- Culture: recreation, historical site, well-being, research and education
- Support: soil nutrition cycle, biodiversity

The following services can be identified as particular to the study sites in Huong Son and Vinh Tu:

Provisioning service

- The Timber/Wood Volume Map can be derived from forest cover maps (by type, therefore the quality of forest). Enables identification, by area, of the timber/wood production provided by a particular forest.
- A Biomass Carbon Map can be derived following the same logic.
- NTPT value, mostly from bamboo forest, can be estimated by statistics (area of bamboo and density of bamboo within an area of one hectare) or derived from the forest status map extracted based on type of bamboo.
- Other NTPT values mostly from bamboo shoots, mushroom, medicines, etc., can be estimated from socio-economic surveys or from questionnaires. However, these data are difficult to convey in maps.

Regulating service

- A Soil Loss/Erosion Potential Map can be derived based on a universal soil loss equation (USLE), mostly using factors such as land cover, soil, slope, and rainfall. We can assess the service of regulating hydrological regime, thus preventing soil erosion.
- A Watershed Protection Classification Map can be derived from soil erosion maps and slope/hydrological maps. This value can help assess the regulating services needed by forests.
- Riparian Area Protection Maps can be derived from river network and probably slope maps. This map will help identify areas sensitive to riverbank erosion.

Supporting service

- This service supporting other ES (such as primary production, nutrient process) is directly or indirectly related to biodiversity conservation.
- Map of neighborhood to biodiversity centers (national park, nature reserve) can be derived showing distance of the site to nearest park/reserve.
- The information related to species richness and endangered species can be used to assess biodiversity.

Cultural service

- This service concerns mainly the aesthetic, spiritual, educational and recreational values of the forest.
- The maps showing cultural protection sites or nature-based tourist or recreational sites can be used as cultural service.
- For some cases, ethnic minority communities practice traditional cultivation methods related to forests and ecosystems. Maps from ethnic minority communities can be used to show the cultural services of forests. The preceding ES are summarized in Table 1.

Table 1. Proposed ecosystem services at study sites.

1	Provisioning	
1.1	Forest status map	Map
1.2	Timber volume map	Map
1.3	Biomass carbon map	Map
1.4	NTPF value	Data table and report
2	Regulating	
2.1	Soil erosion potential	Map
2.2	Watershed protection classification	Map
2.3	Riparian area protection	Map
3	Support	
3.1	Habitat: national park, natural reserve	Map
3.2	Species richness, threaten species	Data table and report
3.3	Species card	Report
4	Cultural / social function	
4.1	Cultural site protection	Map
4.2	Agriculture and other uses	Map

Data used

The data used to make an ES map of the study area is summarized in Table 2. Due to the availability of a new forest inventory in Huong Son, a highly detailed forest status map was developed with a scale of 1:25 000. For Vinh Tu, the team collected the most updated forest map with detailed information on the age of plantation forests, which is important in the accurate calculation of biomass carbon.

For soil mapping and topographic mapping, the team tried to source the largest scale (1:100 000 for soil map and 1/50 000 for topographic map) available for the study areas. Although the requirement is to produce an ecosystem map at a scale of 1:25 000, the actual scale of the output is constrained by the scale of the component. This is a technical issue that many mapping projects have to deal with. Map users must take into account the fact that the ES map was compiled from different data sources with different scales.



Table 2. Data used for ecosystem mapping.

	Scale	Source	Application
Topographic map	1:50 000	MONRE	Making DEM, elevation, slope map. Use as base map for visualization
Soil map	1:100 000	NIAP	Input for soil erosion map
Forest status map 2012 of Huong Son SFE and Vinh Tu Commune	1:25 0000	Provincial DoF	To calculate carbon map, input for soil erosion map
Timber standing volume for each forest type		Huong Son SFE and Quang Tri DoF	To calculate carbon density
IUCN Red list spatial database	Global scale	IUCN	To identify species richness and threatened species
Biodiversity report and map of Huong Son district	1:50 000	CRES	Distribution of rare and threatened species at Huong Son

Forest biomass carbon estimation

The method used for forest biomass carbon stock estimation has three main steps: 1) estimation of above ground biomass (AGB); 2) estimation of below ground biomass (BGB); and 3) estimation of forest carbon stock in total biomass. In this study, the soil carbon was not estimated because there is no direct research reference for soil carbon content in the two study sites and the global data on soil carbon is too coarse to be used at the scale of this work.

Step 1 Estimation of above ground biomass of forests

Overall formula for estimation of AGB is:

$$AGB = VOB * WD * BEF$$

Where:

VOB is inventoried wood volume over bark expressed in m³;

WD is basic wood density expressed in tonnes/ m³; and

BEF is the biomass expansion factor.

In this formula, each variable is calculated as follows:

VOB is averaged wood volume taken from the national forest inventory carried out for the period 2000 – 2005 by the Forest Planning and Inventory Institute (FIPI). VOB will be analyzed for defined forest types.

WD is the average basic wood. The average basic wood density for tropical trees is 0.55 (0.40 – 0.69) (Reyes et al. 1992).

BEFs are calculated for defined forest types using volume data from the national inventory. The calculation of BEF of tropical forests follows the equation developed by Brown, S. et al (1989), as follows:

i) If $SB < 190$ tonnes dry matter/ha

$$BEF = \text{Exp} (3.123 - 0.506 \cdot \ln(SB))$$

ii) If $SB \geq 190$ tonnes/ha

BEF take a default value of 1.74

Where

SB is stem biomass and is calculated as: $SB = VOB \cdot WD$

Step 2 Estimation of below ground biomass of forests

BGB is estimated from ratio of BGB to AGB (R factor). The formula for BGB estimation is:

$$BGB = AGB \cdot R$$

In this formula, the default value for R used for estimation of BGB is 0.275 (FAO 2008).

Step 3 Estimation of carbon stock in forest biomass

Carbon stock in forest biomass is calculated based on forest biomass and carbon fraction. The default carbon fraction used for calculation of carbon stock in forest biomass is 0.50 (IPCC 2003). Although there are established wood density databases for different tree species in both international and country-specific literature, they are not applicable for use with the scale of this study where forests are understood and accessed as large strata. Therefore, rather than individual tree species values, an average wood density should be used instead.

By applying the three steps explained above using average wood volume provided by Huong Son and Vinh Tu (Tables 3 and 4), we can calculate ABG and BGB for each forest type in the two study sites. The biomass carbon was calculated for different species and ages in Vinh Tu where plantation forest data is available down to plot level. In Huong Son, the average standing volume of 55 m³/ha was used for all plantation plots.

Table 3. Standing volume and biomass carbon of Huong Son SFE.

Forest type	Standing volume (m ³)	AGB carbon (tC/ha)	BGB carbon (tC/ha)	AGB+BGB carbon stock (tC/ha)
Evergreen broadleaves forest – Rich	220	133	37	169
Evergreen broadleaves forest – Medium	150	110	30	140
Evergreen broadleaves forest – Poor	75	78	21	100
Evergreen broadleaves forest – Regrowth	49	63	17	81
Bamboo forest	21	11	3	14
Mixed wood-bamboo forest	91	86	24	109
Coniferous forest	163	54	15	69
Plantation forest	55	67	18	85

Table 4. Standing volume and biomass carbon of Vinh Tu Commune.

Forest type	Standing volume (m ³)	AGB carbon (tC/ha)	BGB carbon (tC/ha)	AGB+BGB carbon stock (tC/ha)
Evergreen broadleaves forest – Poor	70	75	21	96
Evergreen broadleaves forest – Regrowth	49	63	17	81
Bamboo forest	21.6	11	3	14
Mixed wood-bamboo forest	91	86	24	109
Rubber 2008	12	32	9	40
Acacia 1997	47	62	17	79
Acacia 2000	41	58	16	74
Acacia 2001	39	57	16	72
Acacia 2003	35	54	15	68
Acacia 2004	28	48	13	62
Acacia 2005	22	43	12	55
Acacia 2006	17	37	10	48
Acacia 2007	14	34	9	43
Acacia 2008	12	32	9	40
Acacia 2009	7	25	7	32
Acacia 2010	2	16	4	20
Acacia 2011	2	13	4	17
Acacia + Casuarina 2005	18	39	11	49
Casuarina 2005	15	35	10	45

Soil loss potential estimation

Soil loss was estimated using the universal soil loss equation (USLE). The equation takes the form:

$$A = R * K * L * S * C$$

Where

A = estimated average soil loss in tonnes per acre per year
R = rainfall-runoff erosivity factor
K = soil odibility factor
L = slope steepness factor
S = slope steepness factor
C = cover-management factor

For this study, rainfall data was taken from 30-year average spatial data at one km² grid (Worldclim v1.4)

K is estimated from soil texture data taken from soil map

LS is derived from DEM that was interpolated from 1:50 000 scale topographic map. C factor is adapted from Morgan 2005 and with adjustment for site condition

Soil loss is calculated as tonnes/ha/ year.

Biodiversity assessment

Biodiversity of the two sites are accessed through the following two main data sources.

IUCN Red list of threatened species spatial database

- The IUCN Red List spatial database shows the areas of distribution of threatened species on a global scale. The database consists of GIS layers that represent the natural distribution of each species. There are associated attributes on taxonomy and threat levels that help the user filter the database using different criteria.
- By overlaying the boundary of the study area with the IUCN database, it is possible to obtain the species richness of the site, extract the list of species and their distribution. However, because the sites of Huong Son and Vinh Thu used in this study are small compared to the scale used by the IUCN Red list, we could only extract the list of species but not the map of distribution. In other words, the potential distribution of

each species that are mapped in the IUCN is already larger than those in the study sites, and therefore we could only extract information on “what species could be potentially found there” but not the “spatial boundaries of species distribution” within the sites.

Biodiversity data from literature

It was not possible to conduct a field-level biodiversity assessment as part of the study. Therefore, the main source of information for biodiversity was from literature. For Huong Son, an important research report has been conducted by CRES (2005): “Biodiversity Assessment of North Truong Son conservation area.” This report provides key information on the biodiversity found in the study area, such as distribution of key fauna and flora species and zoning of important areas for conservation activities.



Results

Forest biomass carbon

Huong Son biomass carbon

Forest biomass carbon (AGB+BGB) in Huong Son is presented in Table 5 and the biomass carbon map in Figure 3.

Table 5. Biomass carbon stock in Huong Son SFE.

Carbon density tC/ha	Area (ha)	% area	Carbon stock (tC)	% carbon
Low (<109)	16 698	43.9	1 647 517	35.1
Medium (109-150)	19 791	52	2 773 781	59.2
High (150-169)	1 574	4.1	266 592	5.7
Total	38 064	100	4 687 890	100

There are a total of 4.68 million tonnes of forest biomass carbon in Huong Son. The average carbon density is very high at 124 tC/ha (tonnes carbon per hectare), which is about two times higher than the Viet Nam national average of 72 tC/ha as reported by FAO (FAO 2010). More than half of the area (56.1 percent), consisting of rich and medium forests, falls into medium and high carbon density classifications. These rich and medium forests are mainly located in the steep slopes along the mountain area of Lao PDR's border. Protection of this high quality forest is the key not only to maintaining the carbon pool in Huong Son SFE but also in protecting soil from erosion.

Vinh Tu biomass carbon

Vinh Tu is a populated coastal commune and therefore has no rich or medium forest left. The total forest biomass in Vinh Tu is 123.201 tC of which 71 percent (87 624 940 tC) is from plantation forest and 29 percent (35 577 tC) is from shrub forest. The dominant plantation forest is acacia plantation (1 802 ha) accounting for 54.5 percent of the area. Coastal shrub forest (370 ha) accounts for 11.2 percent of the area. The average carbon density for the whole commune is 54 tC/ha, almost four times lower than Huong Son.

Table 6. Biomass carbon stock in Vinh Tu Commune.

Carbon density tC/ha	Area (ha)	% Area	Carbon stock (tC)	% Carbon stock
Low 0 - 32	1 659	48.9	5 988	4.9
Medium 32 – 56	849	25	41 751	33.9
High 56-96	885	26.1	75 463	61.3
Total	3 395	100	123 202	100

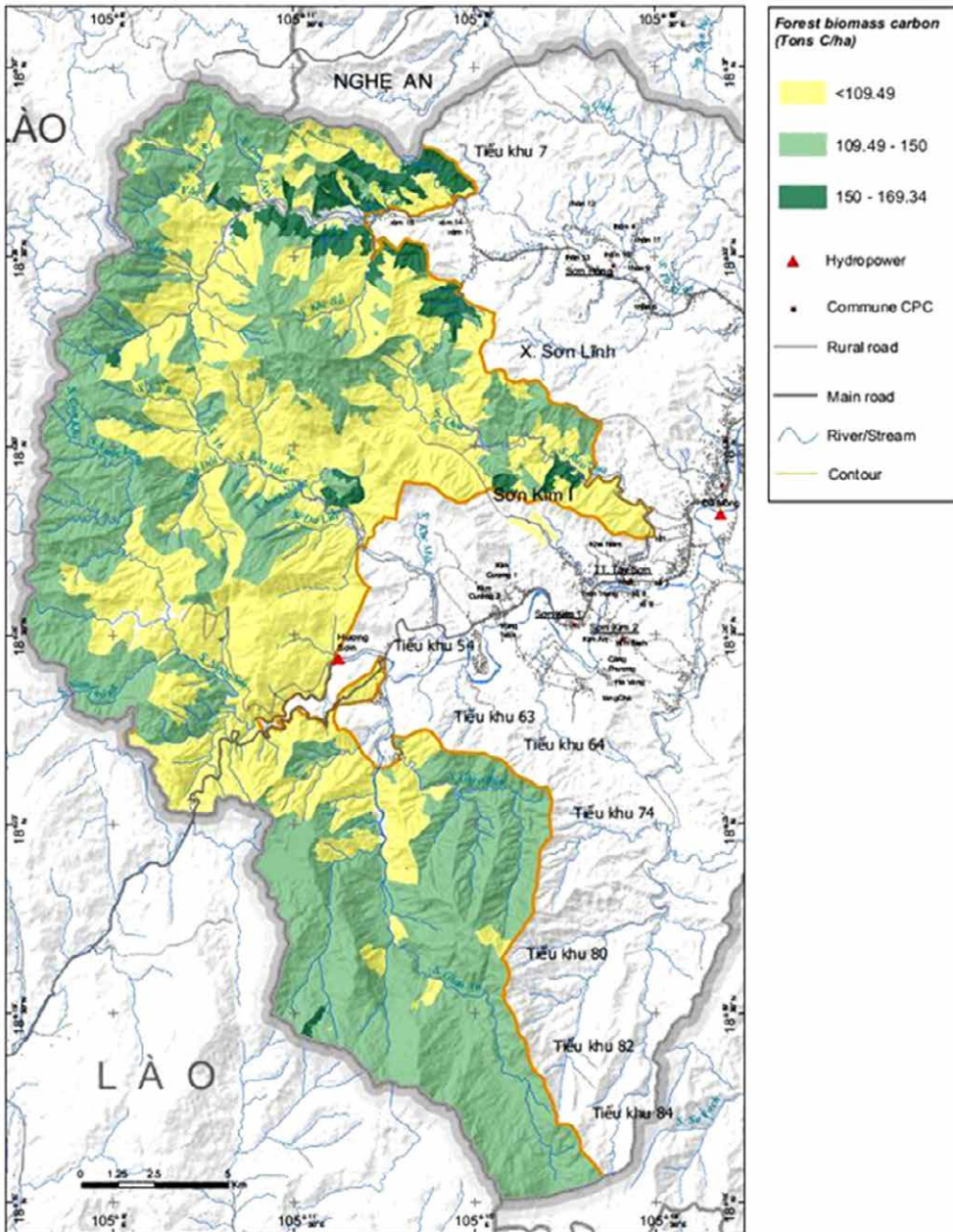


Figure 3. Forest biomass carbon map of the Huong Son forest enterprise.

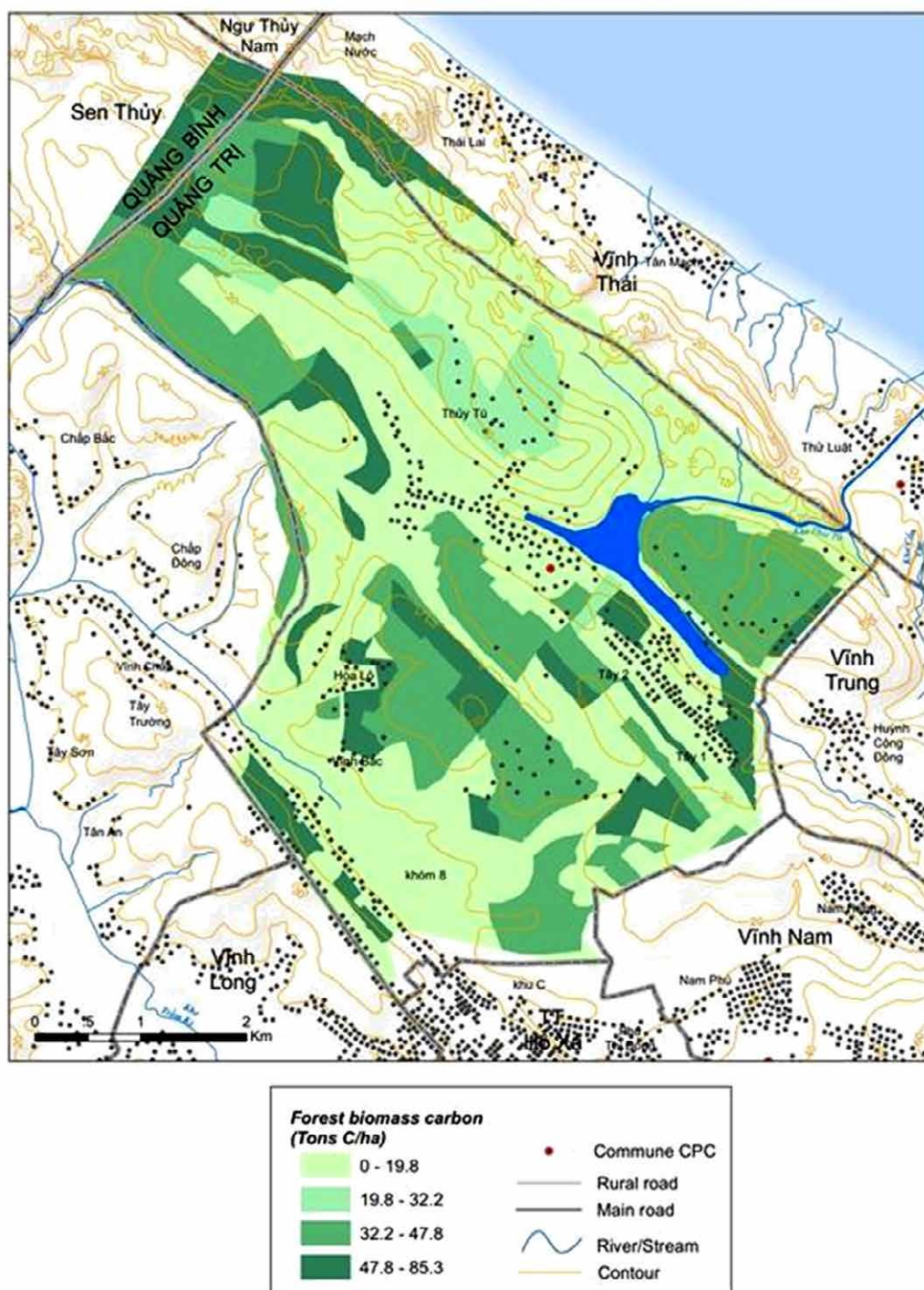


Figure 4. Forest biomass carbon of Vinh Tu Commune, Vinh Linh District, Quang Tri Province.

Potential soil loss

The result of soil loss for Huong Son and Vinh Tu are presented in tables 7 and 8 and in figures 5, 6 and 7.

Huong Son soil loss

Huong Son has very low risk of soil loss with 88 percent of the area having a soil loss rate of less than 1 tonne/ha/year, which is classified as no erosion by the Viet Nam standard TCVN 5299 (STAMEQ 2009). This low rate of soil loss can be attributed to the dense canopy of rich and medium forests that cover majority of the area of Huong Son. The soil loss rate is still very low even at the steep slope mountain area along the Lao PDR border (see map in Figure 5). Only in the areas with very steep slopes – at Nuoc Sot stream, Giao An stream, and Giao Bun stream – does soil loss rise to medium and high rates. However, this area is rather small, accounting for less than one percent of the total area. On average, the compartments with the highest rate of soil loss are: 61, 67, 68, 70, 72, 72, 73, 74, 78, 80 and 81 (see Figure 6).

Table 7. Soil loss in Huong Son.

Soil loss (t/ha/year)	TCVN 5299 classification	Area (ha)	%
Low (0-1)	No erosion	33 540	88.2
Medium (1-2.5)	Slight erosion	3 995	10.4
High (>2.5)	Slight erosion	529	1.4
Total		38 064	100

A simulation of forest cover was conducted to find out how rich and medium forests help in reducing soil loss. In the USLE model, rich and medium forest areas were transformed into poor forests while other indicators were kept unchanged. The result showed that the total soil loss for the whole Huong Son increased by 40 820 tonnes/year or on average about 1.02 tonne/ha/year. This change affected more than 80 percent of the study area from no erosion to slight erosion, and the remaining areas to high erosion. This result showed one of the important services forests provide in decreasing the risk of soil erosion in Huong Son FE.

Vinh Tu soil loss

For Vinh Tu, a very flat area, the average soil loss rate is rather low. Table 8 shows that 79.6 percent of the area is having soil loss that is less than 1 tonne/ha/year which is equivalent to “no erosion” based on Viet Nam standard TCVN 5299.

Table 8. Soil loss in Vinh Tu.

Soil loss (t/ha/year)	TCVN 5299 class	Area (ha)	%
Low (0-1)	No erosion	2 702	79.6
Medium (1-2.5)	Slight erosion	241	7.1
High (>2.5)	Slight erosion	450	13.3
Total		3 395	100

The area with medium and high rates of soil loss accounts for 21.4 percent of the area and mainly occurs in residential areas. These higher rates of soil loss in residential areas, however, are still rather low and can be classified as slight erosion based on the national standard, TCVN 5299. On average, the soil loss potential in Vinh Tu is low and should not pose a major risk in the near future. Because the area of Vinh Tu is rather small and soil loss is not significant, we did not calculate the compartment's average value for this site.

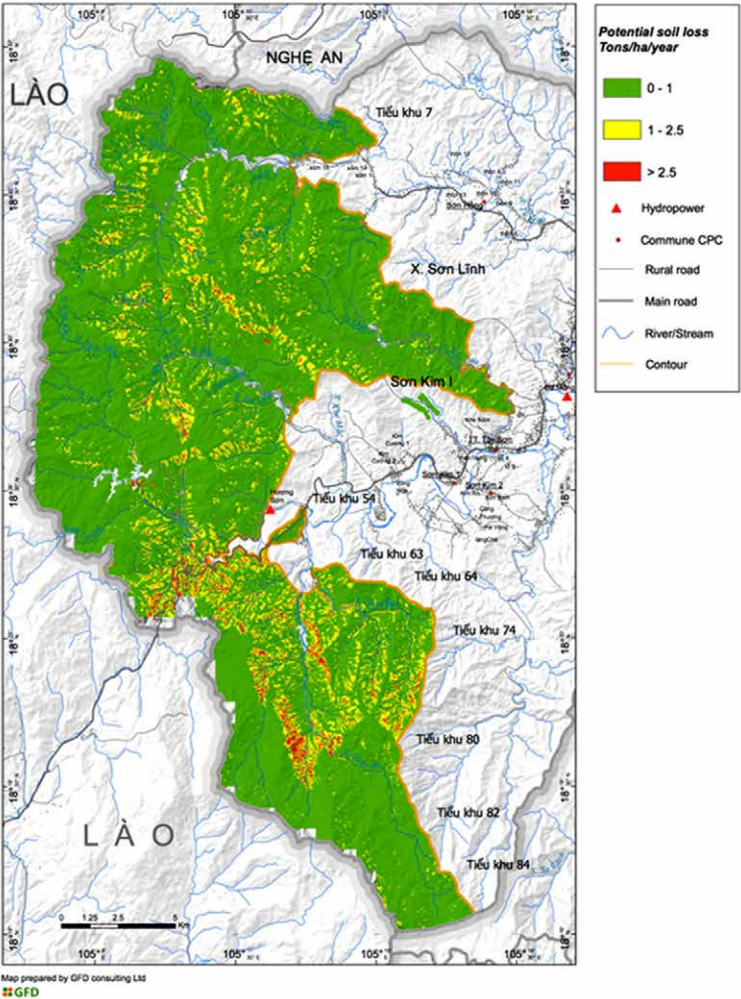


Figure 5. Soil loss map of Huong Son SFE.

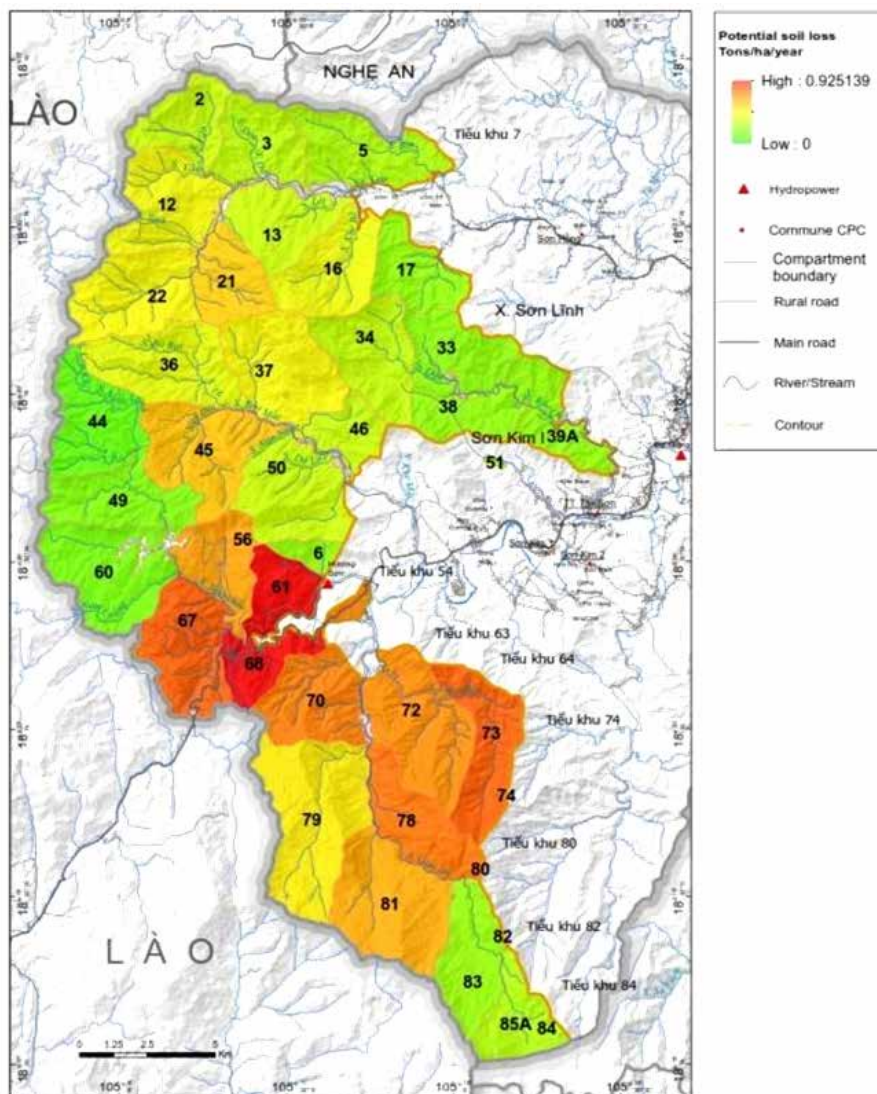


Figure 6. Soil loss map of Huong Son SFE averaged by compartment.



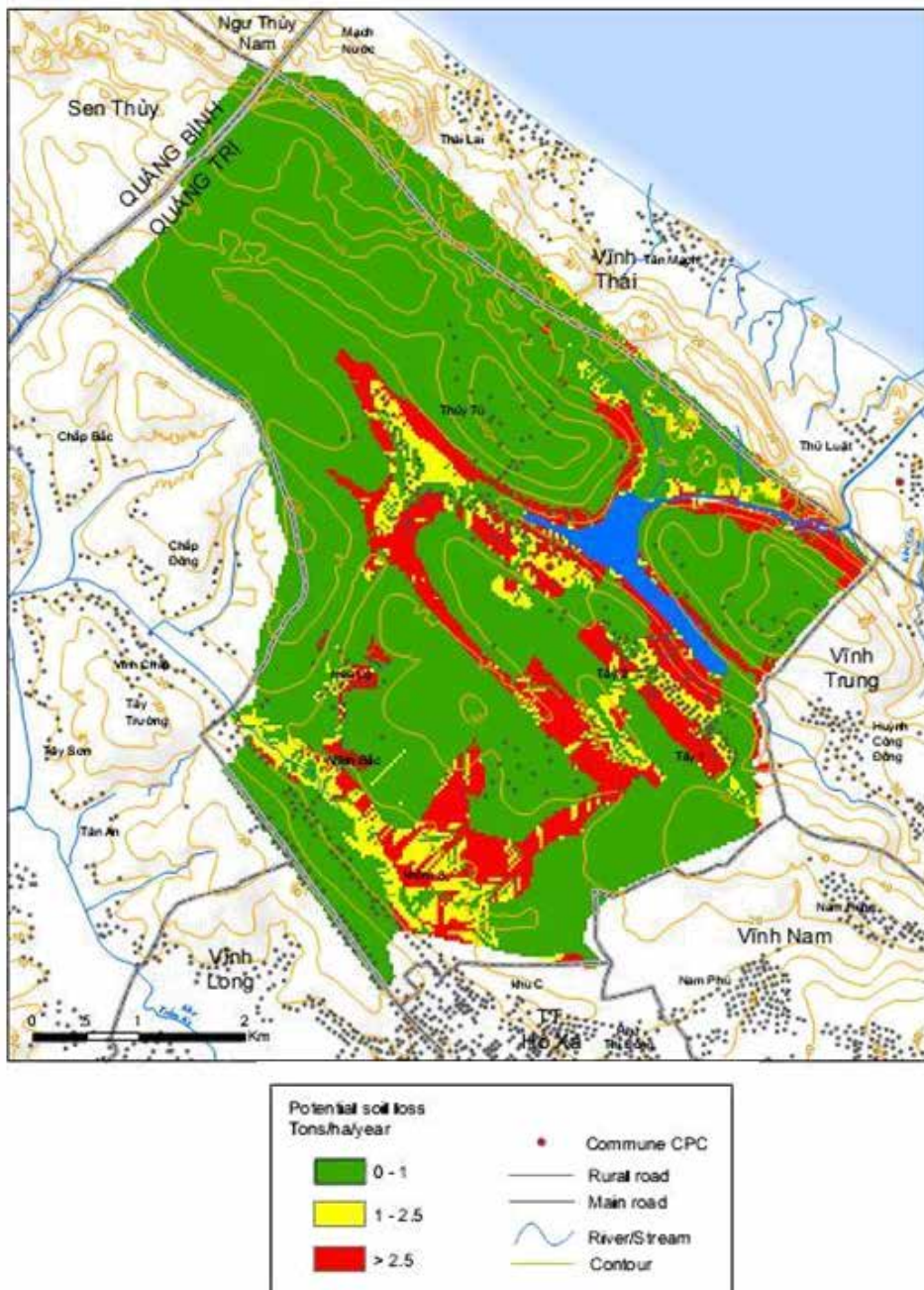


Figure 7. Soil loss map of Vinh Tu Commune.



Table 9. The most species rich family in Huong Son.

1	Euphorbiaceae - Họ Dầu	87
2	Leguminosae - Họ Đậu	71
3	Compositae - Họ Cúc	52
4	Rubiaceae - Họ Cà phê	37
5	Gramineae - Họ Lúa	36
6	Orchidaceae - Họ Lan	35
7	Lauraceae - Họ Long não	26
8	Melastomaceae - Họ Mua	26
9	Araceae - Họ Ráy	23
10	Labiatae - Họ Bạc hà	22
	Total species of the 10 family	
	% of all species	30.5%

In the mountain area of Son Kim 2 commune, there are also appearances, although in small numbers, of floral species that have migrated from the Northern temperate system such as Hoàng đàn giả (*Dacrydium elatum*), Pơ-mu (*Fokienia hodginsii*), Hồng quang (*Rhoiptelea cimpionii*), Tần Trung Quốc (*Fraxinus chinensis*), Chắp tay (*Symingtonia populnea*) and Song dục Trung Hoa (*Dipteris chinensis*). These species form the semi-tropical vegetation system that is unique to the study area, giving it a high conservation value.

Table 10. High priority conservation flora species in Huong Son.

#	Scientific name	Viet Nameese name	Conservation status	Land-scape
1	<i>Aquilaria crassna</i> Pierre ex Lec.	Trầm hương	E	o
2	<i>Aristolochia indica</i> L.	Khoai ca, Sơn dịch	R	i, j
3	<i>Caesalpinia sappan</i> L.	Tô mộc	T	t
4	<i>Calamus platyacanthus</i> Warb. ex Becc.	Song mật, Mây gai dẹt	V	j, p
5	<i>Chukrasia tabularis</i> A. Juss.	Lát hoa	K	j
6	<i>Cibotium barometz</i> (L.) J.Sm.	Lông cu li	K	j
7	<i>Cinnamomum balansae</i> Lec.	Vù hương	R	j, o
8	<i>Codonopsis javanica</i> (Bl.) Hook.	Ngân đăng Java, Đăng	V	o
9	<i>Cycas pectinata</i> Griff.	Thiên tuế lược	V	n
10	<i>Dacrydium elatum</i> Wall. ex Hook.	Hoàng đàn giả	K	p
11	<i>Dialium cochinchinensis</i> Pierre.	Xoay, Xây	K	h, i, j
12	<i>Docynia indica</i> (Wall.) Dcn.	Táo mèo	R	o
13	<i>Drynaria fortunei</i> (Mett.) J.Sm.	Ráng đuôi phượng	T	i, j, q
14	<i>Erythrophloeum fordii</i> Oliv.	Lim xanh	K	i, j
15	<i>Fibraurea recisa</i> Pierre	Hoàng đăng	V	j, o
16	<i>Fokienia hodginsii</i> Henry & Thom.	Pơ mu	K	p
17	<i>Fraxinus chinensis</i> Roxb.	Tần Trung Quốc, Sầm	R	o, s
18	<i>Hedyosmum orientale</i> Merr. & Chun.	Mã thương đông	R	p
19	<i>Hopea pierrei</i> Hance.	Kiểm kiển	K	j
20	<i>Limnophila rugosa</i> (Roxb.) Merr.	Rau vi, Hối nước	R	b, d, e
21	<i>Lithocarpus longipedicellata</i> (H.&C.) A.Cam.	Dẻ cuống dài	R	o
22	<i>Madhuca pasquieri</i> (Dub.) H. J. Lam.	Sến dừa	K	j, o

#	Scientific name	Vietnamese name	Conservation status	Land-scape
23	<i>Mahonia nepalensis</i> DC.	Mã hồ, Hoàng liên ô rô	7V	p
24	<i>Markhamia stipulata</i> (Wall.) Seem. ex	Thiết đỉnh lá bẹ	V	c, j
25	<i>Melanorrhoea usitata</i> Wall.	Sơn đào	R	j
26	<i>Ophiopogon tonkinensis</i> Rodr..	Mạch môn Bắc	R	p
27	<i>Paris polyphylla</i> Sm.	Bảy lá một hoa	R	k, p
28	<i>Platanus kerrii</i> Gagn.	Chò n-ớc	T	c
29	<i>Podocarpus brevifolius</i> (Thunb.) D. Don.	Thông tre lá ngắn	K	p
30	<i>Podophyllum tonkinense</i> Gagn.	Bát giác liên	E	p
31	<i>Pothos kerrii</i> Buch.	Cơ lênh kerr	R	l, q
32	<i>Psilotum nudum</i> (L.) P. Beauv.	Lá thông	K	l, m
33	<i>Rauvolfia cambodiana</i> Pierre ex Pit.	Ba gác cambốt	T	c, k
34	<i>Rhodoleia championii</i> Hook. f.	Hồng quang	V	o
35	<i>Rhopalocnemis phalloides</i> Junghun.	Chùy đầu dương hình	R	o, p
36	<i>Scaphium macropodium</i> (Miq.) Beum..	Lưỡi ươi	K	i, j
37	<i>Sindora siamensis</i> Teysm. ex Miq.	Gụ mật	K	o
38	<i>Smilax glabra</i> Roxb.	Thổ phục linh	V	h
39	<i>Strophanthus divaricatus</i> (Lour.) Hook.& Arn	Sừng dê	T	h, i
40	<i>Tinospora sinensis</i> (Lour.) Merr.	Dây đau xương	K	h, i, k, p
41	<i>Tournefortia montana</i> Lour.	Bò cạp núi	T	i, o
42	<i>Vitex sumatrana</i> var. <i>urceolata</i> King & Gamb	Bình linh lục lạc	V	h

Fauna

There are 30 fauna species found in Huong Son that are in the IUCN Red list, of which eight are classified as endangered, 18 as vulnerable and four as critically endangered.

- All five newly discovered mammal species in Viet Nam could be found in Huong Son: Sao La (*Pseudoryx nghetinhensis*), Mang lớn (*Megamuntiacus vuquangensis*), Cây giồng Tây Nguyên (*Viverra taynguyenensis*), Thỏ vằn (*Nesolagus timminsi*) và Mang Trường Sơn (*Muntiacus truongsongensis*).
- Two rare and important species that should be prioritized for conservation are Voi (*Elephas maximus*) and Thỏ vằn (*Nesolagus trimminsi*).
- Primate communities of Voọc vá chân nâu (*Pygathrix nemaneus*) (E), Cu li nhỏ (*Nycticebus pygmaeus*), Cu li lớn (N. Concan), Khỉ mốc (*M. asamensis*), Khỉ mặt đỏ (*M. arctoides*) can be found in the high mountains of Son Kim 1, Son Kim 2 and Son Hong communes.

A complete list of species of other taxa such as birds and amphibians of Huong Son are attached in Appendix 2

Vinh Tu biodiversity

The team conducted an extensive literature review on biodiversity of Vinh Tu but did not find any direct reference for this area. The closest protected area to Vinh Tu are Bach Ma National Park (VNM 7) and Son Tra Natural Reserve (VNM 81, Figure 8). However, these two areas represent different ecosystems and therefore should not be used as a reference for Vinh Tu. Thus, the IUCN Red list database was used as the primary source for Vinh Tu's biodiversity assessment.

Fauna

In the IUCN Red list database, there are 143 fauna species to be found in Vinh Tu, of which 16 species are amphibian, 21 species are bird, 89 species are mammal and 17 species are reptile. All amphibian species in Vinh Tu are classified as Least Concerned (LC). Two bird species are classified Endangered (EN) and two as Critically Engangered . For mammal species, six are classified as Vulnerable (VU) and three as Near Threatened (NT). There are also two VU reptile species. The list of these species is included as Appendix 7.1.2.

It is important to note that IUCN is a global database and the occurrence of a species on its map (i.e. Vinh Tu) is merely an indication that an area is within the natural distribution reach of that species. That is, the occurrence does not mean that a species was confirmed to be present, either by sighting or capture, in this area.

Vegetation and forest

Most of the natural forest in Vinh Tu has been converted to agriculture land, plantation forest and residential property. There are about 370 ha of natural coastal shrub forest remaining that is actively protected by local people because of its importance in coastal protection and the regulation of ground water. The main vegetation type for this forest is lowland evergreen broad leaf mixed with dry resistance hard-leaf shrub on coastal sand dune. The dominant species on the sand dunes are: *Xylosma controversum*; *Syzygium chalos*; *Castanopsis ceratacantha*; *Lithocarpus concentricus*; *Cratoxylon prunifolium*; *Vatica obtusifolia*; *C. ceratacantha*, *L. sabulicolus*, *L. dinhensis*; *Melaleuca cajeputi*. In Viet Nam, this forest type is unique to the coastal sandy area of the Northern Middle ecological zone (Thai Van Trung 1978). Today, because the coastal area is heavily exploited, this forest type exists in but a few areas and therefore has high value for biodiversity conservation.

It is highly recommended that all remaining coastal shrub forests be protected and subjected to biodiversity conservation (Figure 10). Sustainable use and protection of this shrub forest is also important for Vinh Tu to obtain a future FSC certificate.



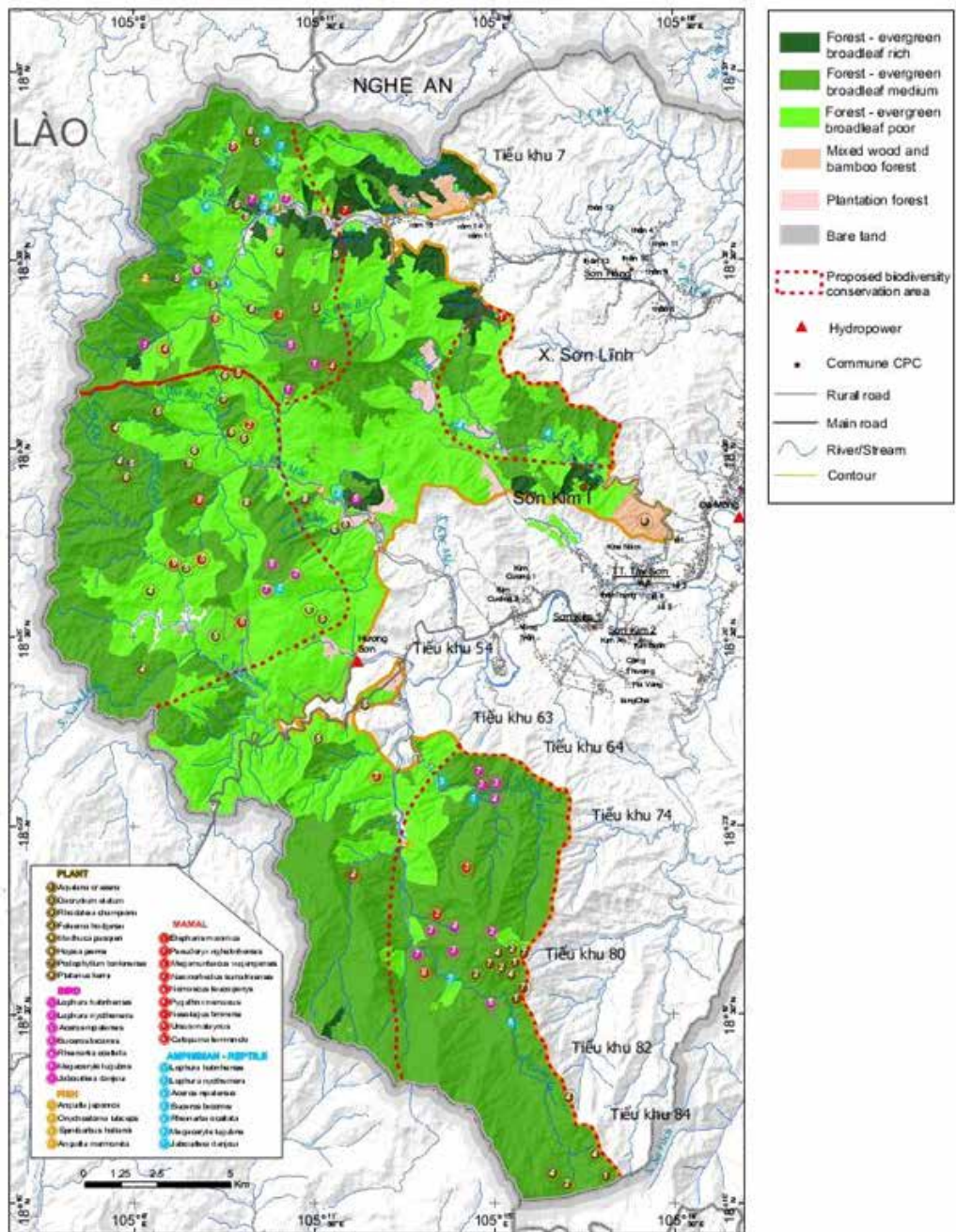


Figure 9. Distribution of rare species and zoning of conservation areas in Huong Son SFE.

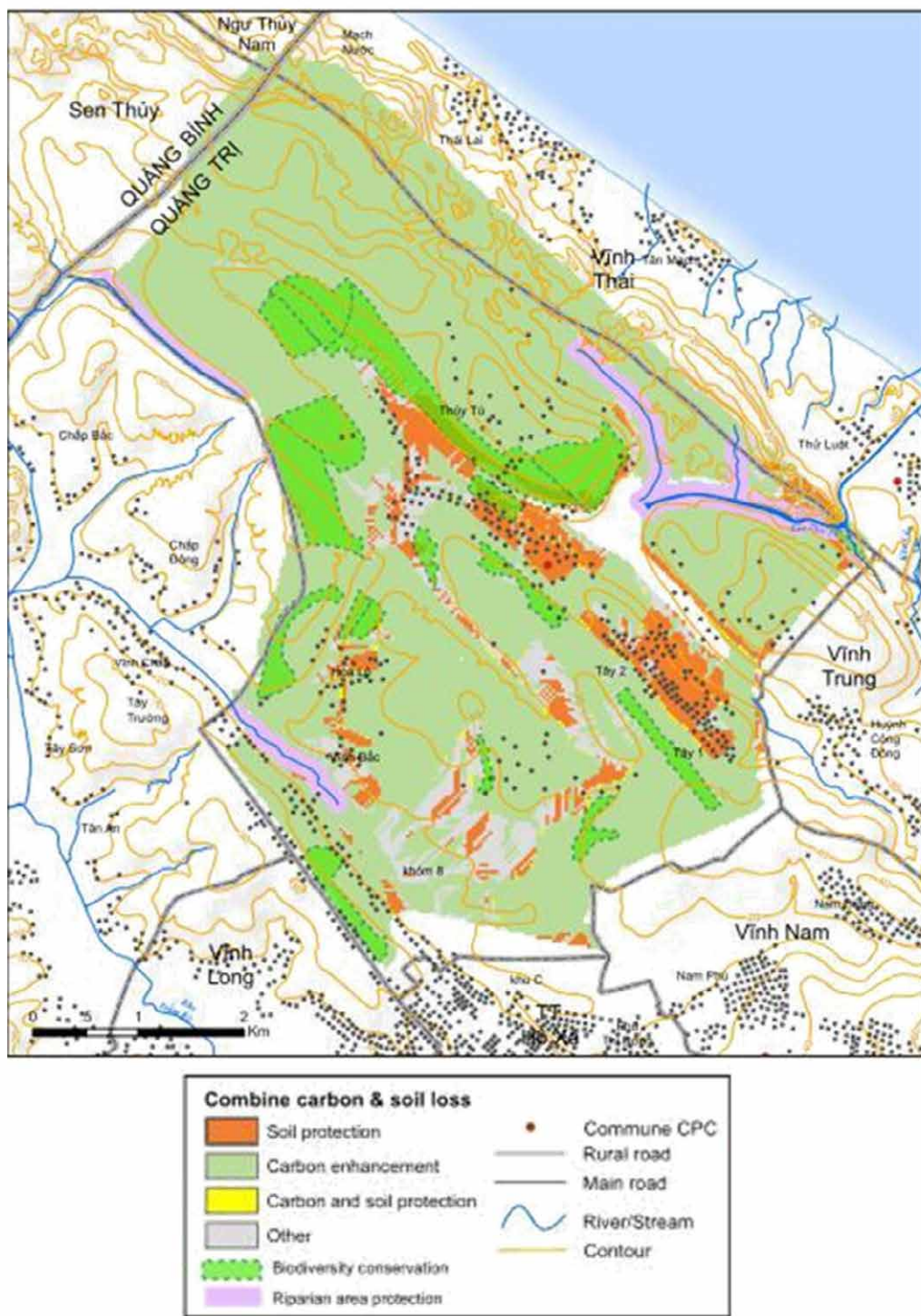


Figure 10. Area reserve for biodiversity conservation in VinhTu Commune.

Integration of ecosystem service map

In order to map the prioritized area for each service, the three component maps for biomass, potential soil loss and biodiversity were combined. As a first step, the biomass carbon and soil loss map were combined using a matrix with nine cells that were made up from 3x3 individual classes of carbon density and soil loss. The combination of cells in the matrix is presented in Figure 11. One difference in the carbon/soil loss matrix of Vinh Tu is that the combination of s1c2, low soil loss and medium carbon, is assigned as “carbon enhancement.” This is to address the fact that the medium carbon class in Vinh Tu belongs to plantation forests that are suitable for carbon enhancement.

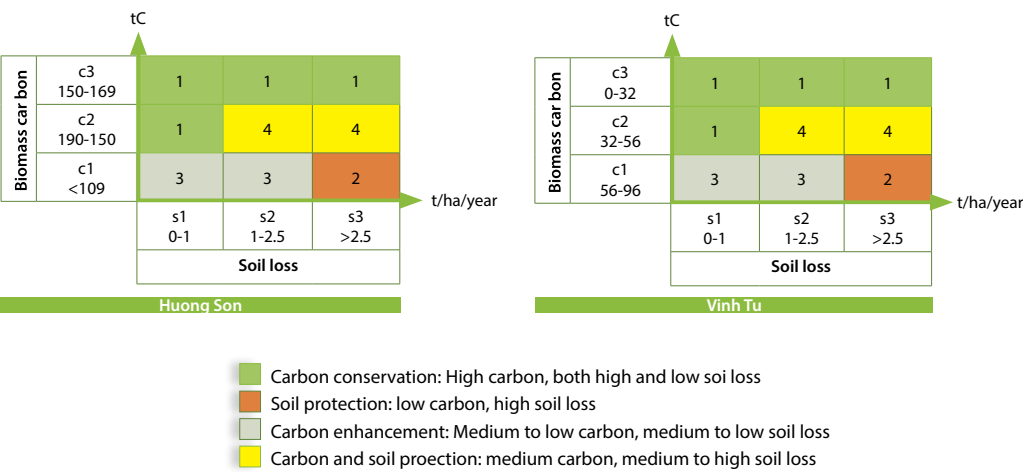


Figure 11. Matrix of biomass carbon and soil loss.

In the second step, biodiversity zoning is overlaid on top of the integrated carbon and soil loss map. The biodiversity zoning might cross with the boundary of the carbon/soil loss map and therefore should be considered as a soft zone that could override the carbon/soil loss map. For example, flat shrub land would normally be used for forest plantation or carbon enhancement. However, if the zoning of biodiversity indicated that this area is a key habitat of endangers species, the planner might need to consider other options geared towards the conservation of biodiversity. In addition, the riparian area protection is mapped using a buffer distance of 100 meters (m) to the main river and 50 m to the stream. The final result of map integration is shown in Figures 12 and Figure 16.

Huong Son integrated ES map

For Huong Son SFE, the majority of its area can be used for carbon conservation (51 percent) and carbon enhancement (43.2 percent). Sloping areas with moderate to high soil loss (4 percent) should be protected to reduce soil loss. Areas along the stream and river (264 ha, 0.7 percent) should receive riparian protection.

Table 11. Ecosystem service in Huong Son.

Ecosystem service	Activity	Area (ha)	%
Carbon conservation Location: rich and medium forest mainly located in the mountain area along the Lao PDR border.	Protection of exiting rich forest and forest maintenance, intervention should be keep at minimum	19 245	51
Soil protection Location: step slope of Nuoc Sot stream, Giao An stream, and Giao Bun stream at compartment 61, 67, 68, 70, 72, 73, 74, 78, 80 and 81	Forest enrichment and natural assisted regeneration.	364	0.9
Carbon enhancement Location: most of compartment with poor forest with mean elevation < 500 m	Forest enrichment, natural assisted regeneration in combination with additional planting	16 132	43.2
Carbon and soil protection Location	Forest enrichment and natural assisted regeneration along the contour line to reduce soil erosion.	1 585	4
Riparian protection Location: 100 m buffer from river and 50 m from stream. Provide stream corridors to protection plant and animal that live in the area between land and river/ stream. Stream corridors link the ecosystems through which the streams flow, by providing transportation highways for wildlife, and facilitating nutrient transfer.	Forest protection of 100 m along river and 50 m from stream. Prioritize of self-sustaining riparian and aquatic ecosystems that already exist.	264	0.7

Biodiversity conservation zones (Zone 1, 2, 3 and 4) can be considered as soft functional zoning where both carbon and soil protection come together. Activity planning for these zones should take the value of biodiversity into account. The list of rare and endangered species in these zones should be used as a guide in designing interventions. For example, interventions in the area along the Con River, Van stream and Sinh stream in Zone 1, and the area along Giao An stream in Zone 4, should pay special attention to amphibians and reptiles. Species in these taxa live close to bodies of water or wetland and do not have the ability to travel long distances to new habitats. The character of the interventions in these areas should be designed so that they leave migration corridors and stepping stone areas that will enable amphibians to leave for new habitats. The data presented in Table 10, Figure 9 and appendix 7.1.1 can serve as a starting point for such planning.

Forestry planning usually uses the compartment/sub-compartment boundary as the unit of management. The ecosystem map in Figure 12 had been summarized by compartment in Figure 13 to show the ecosystem service category with the greatest area. In this way, each compartment is prioritized for one activity that matters the most in terms of providing optimum ecosystem services.

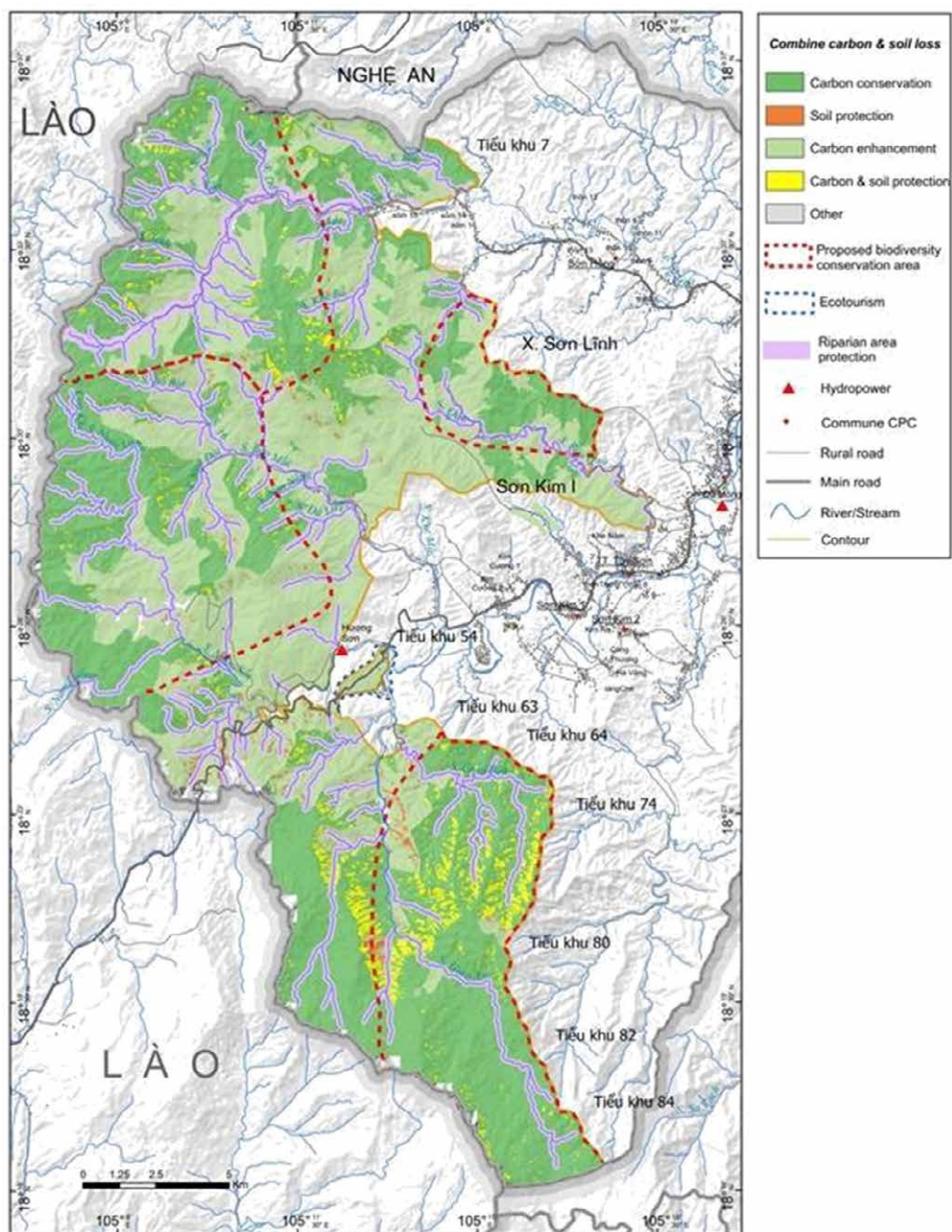
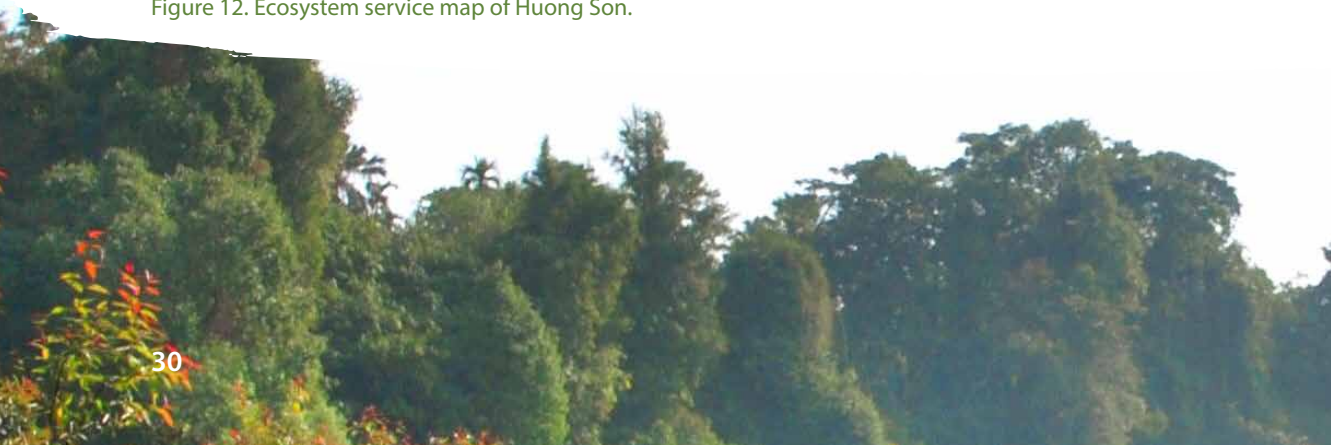


Figure 12. Ecosystem service map of Huong Son.



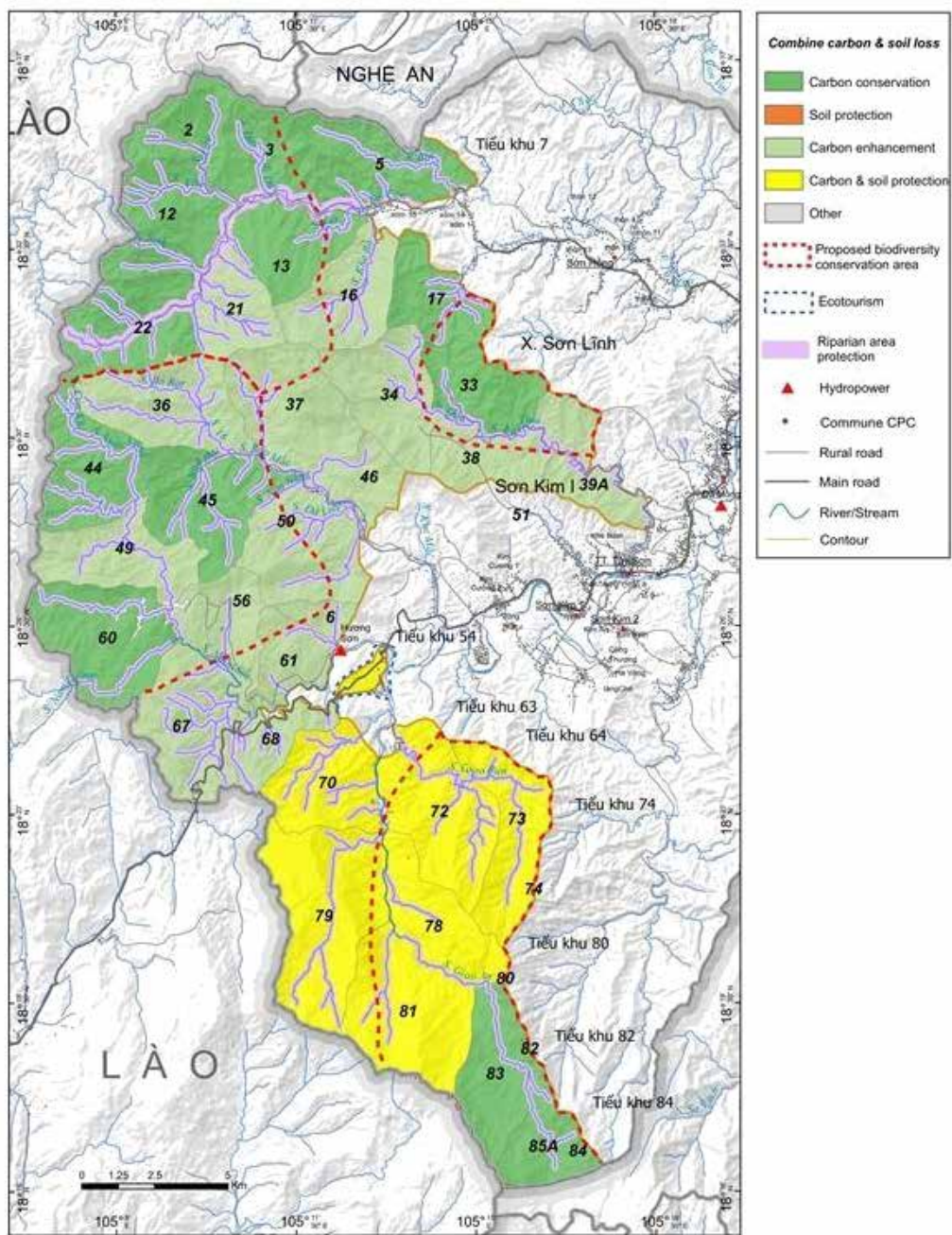


Figure 13. Ecosystem service map of Huong Son by compartment.

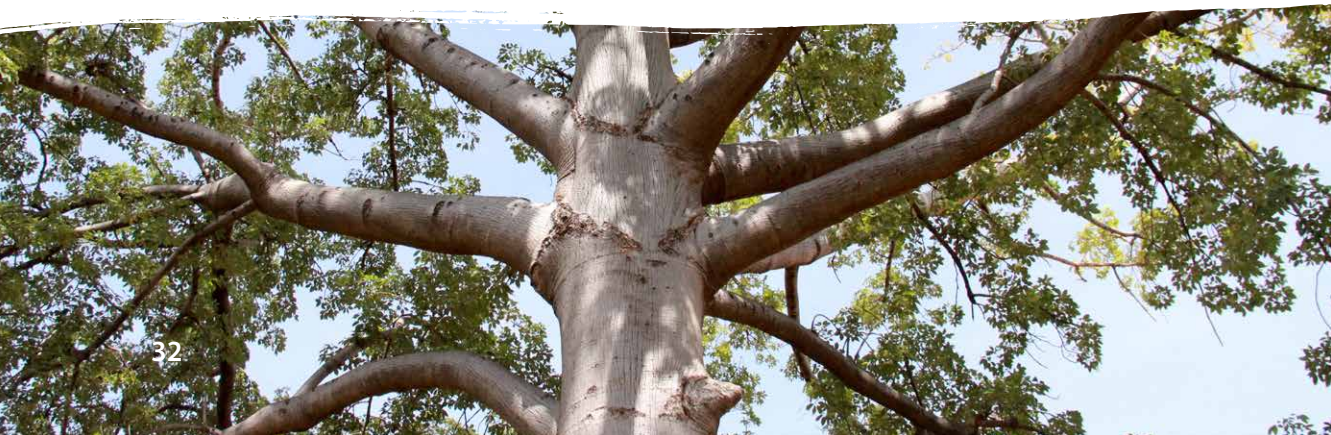
Vinh Tu integrated ES map

For Vinh Tu, both plantation forest and coastal shrub forest can be utilized for carbon enhancement. While a forest plantation can quickly increase the carbon pool through the introduction of high yield species, the coastal shrub forest is a unique natural ecosystem and should be protected not only for carbon but also for its biodiversity value. During field interviews, the villagers of Vinh Tu demonstrated understanding of and enthusiasm in maintaining their coastal shrub forest since it acts as a green belt protecting the village from storms and sand drifting in from the sea. The remaining natural forest also provides valuable non-timber forest products (NTFPs) such as herbal medicine. It also contributes to the well-being of the local community.

Table 12. Ecosystem service in Vinh Tu.

Ecosystem service	Activity	Area (ha)	%
Soil protection: Location: mainly in residential area	Plantation of dry resistant tree such as Casuarina, Eucalyptus, as a green belt to protect house and home garden	437	13.2
Carbon enhancement Location: mainly in plantation forest area	Plantation of commercial timber species such as Acacia. Plantation of coastal protection species such as Casuarina and multiple- age, multiple-species plantation should be promoted	2 409	73.2
Carbon enhancement and biodiversity conservation Location: shrub forest on sandy soil	Protection of shrub forest, enrichment with local species and application of carefully designed silviculture measures. Strengthen the community management of forest	370	11.2
Riparian protection	Plantation of trees along river banks to provide habitats for water loving species	75	2.28

In terms of integrated functions, the plantation forest that accounted for 72.4 percent of the area in Vinh Tu could be used for carbon enhancement and the shrub forest that accounted for 11.3 percent of the commune's land area could be used for both carbon enhancement and biodiversity conservation. To assist Vinh Tu and other communes with similar conditions in acquiring an FSC FM certificate for their plantation forest, it is very important for the local community to manage the plantation forest using sustainable methods that do not have negative effects on the natural shrub forest.



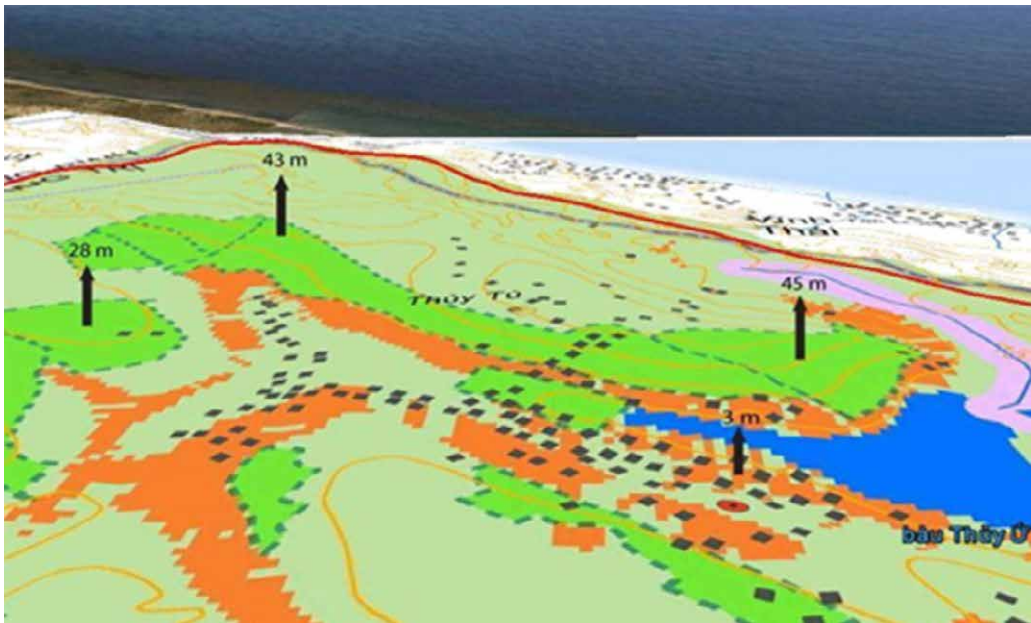


Figure 14. Location of natural coastal shrub forest of Vinh Tu viewed in perspective. Figures on top of arrows indicate elevation.

The shrub forest, as shown in the Vinh Tu map, is actually located near the residential areas. This pattern suggests that villagers might be able to keep the remaining natural shrub forest. One explanation of this land-use practice is that the natural forest located near the village is protecting the village from moving sand dunes and sea storms. Therefore, villagers keep these forest plots on purpose while locating plantation forests at distances further from their residential and agriculture areas. By viewing the map in perspective (Figure 14), it becomes clear that the main area of surviving shrub forest forms a green bell on coastal dunes resulting in the protection of residential lands located in low-lying areas.

Minor CAR 2011-11	
Scope of CAR:	<input checked="" type="checkbox"/> Forest Management Enterprise, resp. Group Entity <input type="checkbox"/> Group Member(s):
FSC P & C	Interim Standards for Forest Stewardship in the Socialist Republic of Vietnam, V 1.0
Standard/Norm	6.3.6 Biodiversity is routinely maintained by the retention of marginal habitats e.g. streamside vegetation, vegetation on rocky outcrops, swamps and heathlands.
Deviation/Explanation	It was found that there is no protection of marginal habitats. This was checked by the field visit and by interviews.
Corrective action	The company shall implement appropriate measures to correct the nonconformity detected in this audit and described above within the given timeline. The measures shall be adequate to correct the current problems and to eliminating causes of nonconformities in order to avoid recurrence. Evidence for implemented measures shall be sent to certification@gfa-group.de .

Minor CAR 2011-11	
Timeframe	Next audit
Status	Not fulfilled
Reason or next steps	Upgrade to Major CAR 2012-1

Figure 15. Result of FSC audit for Biodiversity and marginal habitat protection of the Ben Hai Forest Company (GFA 2012).

Although within the community there is a general consensus to protect the natural forest for the benefits of its ecological functions, the forest is surrounded by dense rural communities, which creates a significant pressure on the forest. The provincial policy to allocate the forestland to community management must be enforced with strong community-based regulations and a system of independent monitoring and evaluation. In addition, because plantation forests surround this natural forest, there is a risk that new plantations might encroach or produce negative effects on the natural forest brought about by the construction of roads. Even in the case of FSC-certified forests, the task of protecting biodiversity and marginal habitats is not always enforced. The FSC audit report of the Ben Hai Forest Company located in Vinh Chap, a neighboring commune, shows that the company has not been able to provide adequate “protection of marginal habitats” and that this biodiversity indicator is not fulfilled (GFA 2012).

Although the audit report mentions that the company would “implement appropriate measures to correct the nonconformity detected” and that evidence for implemented measures should be sent to the auditor, this is still a post-monitoring and action process. In several FSC audit reports in Viet Nam that we have reviewed, there is a general trend showing that biodiversity is poorly managed and monitored, which could be attributed to the lack of biodiversity data at the local level. Outside of national parks and natural reserves, biodiversity information is very thin and scattered. Biodiversity assessments are not only costly and time consuming but also require specialists that may not be locally available. Therefore, such assessments are usually ignored even by forest enterprises that manage fairly large areas of forest.

Alternatively, there are several data sources that could be used for biodiversity assessments such as the Viet Nam Red list of Fauna and Flora (VAST 2000, VAST 1996) and Flora of Viet Nam (Ho 2000). However, these data sources are only available in hard copy and have not been designed for cross-dataset comparison and aggregation. There is no easy way to filter through this dataset using location information to identify all species that could be distributed in one area. Thus, there is a strong need for a standardized biodiversity database that is open to the public that would provide scientific taxonomic information, species description and spatial distribution.

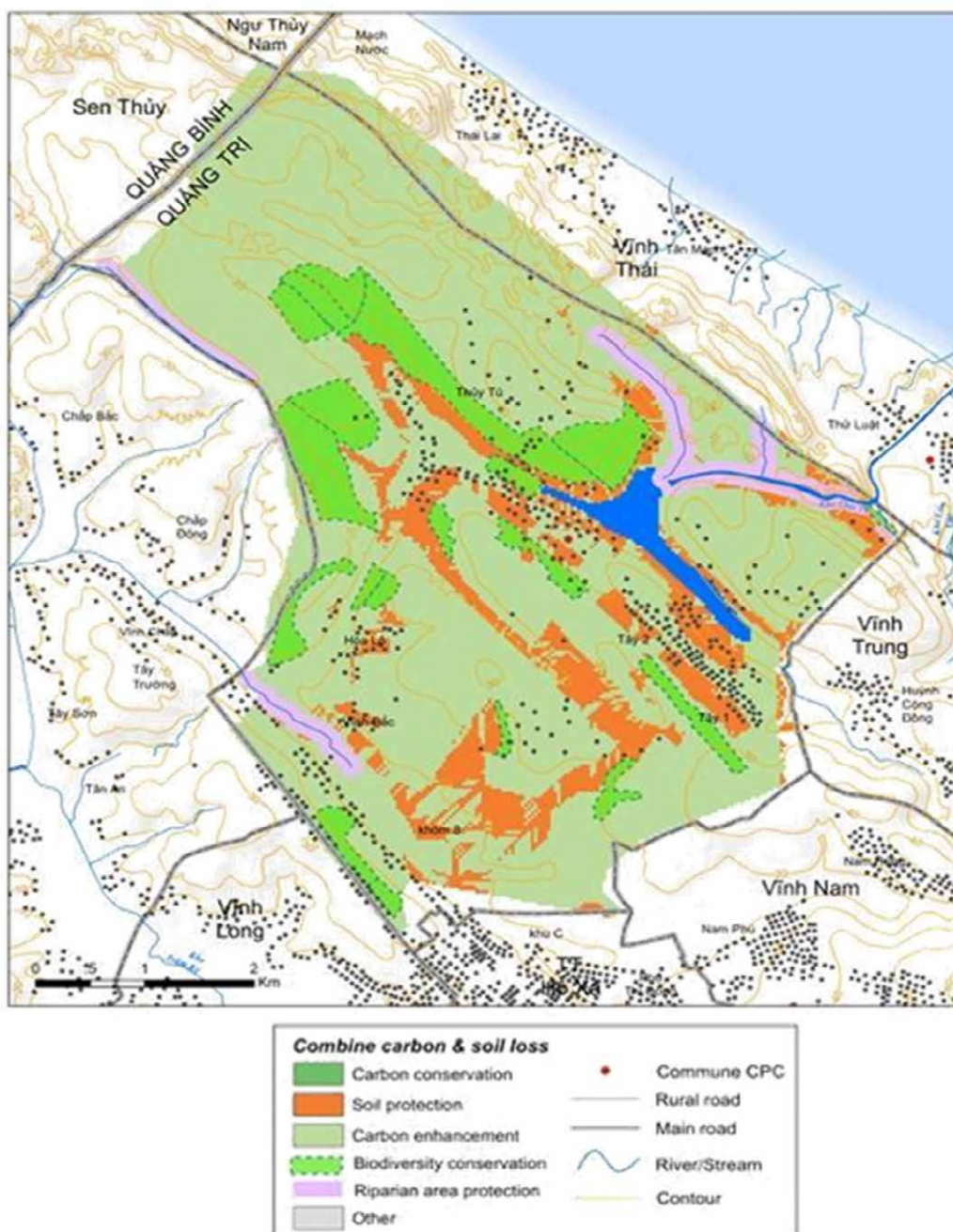


Figure 16. Ecosystem service map of Vinh Tu.



Conclusions and recommendations

In Huong Son, about 51 percent of its area falls into the “medium” and “high carbon” classes and therefore should be protected to conserve the existing carbon pool. About 43 percent of the area that falls into the “poor” forest category has potential for carbon enhancement. Among the recommended activities for this area are forest enrichment and natural assisted regeneration in combination with additional planting. About four percent of the Huong Son area accounts for areas with both medium carbon density and medium soil loss potential. A map that prioritizes the activity for each forest compartment has been produced to aid in ecosystem services planning.

In addition to its high potential for biomass carbon sequestration, Huong Son is also the home of many valuable fauna and flora species. All five new mammal species that were recently discovered in Viet Nam can be found in Huong Son including Sao la (*Pseudoryx nghetinhensis*), Mang lớn (*Megamuntiacus vuquangensis*), Cây giông Tây Nguyên (*Viverra zibethica*), Thỏ vằn (*Nesolagus timminsi*) and Mang Trường sơn (*Muntiacus truongsonensis*). Huong Son also has a strategic position in biodiversity conservation by serving as a natural corridor connecting several existing national parks and natural reserves, such as Pu Mat and Vu Quang in Viet Nam and the Eastern Bolikhamxay mountains and Nakai-Nam Theun in Lao PDR. Therefore, fresh activity planning for this area should take biodiversity conservation into account. Lists and maps of rare and endangered species presented in this report could be used as guides in designing responsive activities that will minimize negative effects on marginal habitats. A full list of flora and fauna species derived by ground survey (Hoc, Tran, and Vo 2005) and by IUCN is presented in the Appendix.

Because of high coverage of quality forest, the rate of potential soil loss in Huong Son is rather low. About 88.2 percent of the area has no soil loss (<1 tonne/ha/year) and 10.4 percent of the area experiences only slight soil loss. The result of simulations derived by changing all rich and medium forests to poor forests showed that soil loss would increase by 40 820 tonnes/year. This result clearly highlighted the important service high quality forests render in reducing soil erosion.

Vinh Tu is a flat area and the incidence of soil loss is minor. About 73 percent of the area is Acacia plantation forest in various ages of maturity. This area has a high potential for carbon enhancement. There are about 370 ha of natural coastal shrub forests remaining and these are actively protected by local people because of the important role they play in coastal protection and the regulation of ground water. This forest type is unique to the coastal sandy soil area of the Northern Middle ecological zone and only few of its kind remain today, giving this type of forest a high value for biodiversity conservation. In order for Vinh Tu and communes with similar conditions to get FSC certification for their plantation forests, it is important that the commercial plantations do not create negative effects on the last surviving natural forests.

It was also observed that in the forest area's of the Ben Hai forest company (located in a neighboring commune), where FSC for forest management has been certified, biodiversity monitoring and protection of marginal habitat has not been fulfilled. In the current FSC certification process and reporting there is no requirement that the forest owner or the auditor provide detailed information on biodiversity. Typically only the actual encroachment on protection or special-use forest is recorded as evidence of disturbance, though monitoring of species composition and richness is not part of the FSC auditing process. The effort to incorporate additional ecosystem services into FSC certification is therefore a important initiative moving forward for mainstreaming biodiversity into the production sector.

Information on biodiversity is very limited outside of national parks and natural reserves. Quick assessment relies on literature such as the Viet Nam Flora and Fauna Red List and the Flora of Viet Nam (Ho 2000). However, this data source is only available in hardcopy form, and its ability to filter and aggregate data based on location and other biodiversity indicators is limited. There is a strong need for basic data to be stored into a standardized database that will be open to the public. By following data standards such as the Darwin Core and using metadata, it will be possible to connect and compare the Viet Nam database to international databases such as IUCN Red list, Nature Serve and Conservation International. This will not only help make the assessment of biodiversity easier, but will also develop the capacities of relevant partners.

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Appendix

IUCN threatened species in Huong Son and Vinh Tu

	IUCN Red list group
Extinct (EX)	No known individuals remaining.
Extinct in the Wild (EW)	Known only to survive in captivity, or as a naturalized population outside its historic range.
Critically Endangered (CR)	Extremely high risk of extinction in the wild.
Endangered (EN)	High risk of extinction in the wild.
Vulnerable (VU)	High risk of endangerment in the wild.
Near Threatened (NT)	Likely to become endangered in the near future.
Least Concern (LC)	Lowest risk. Does not qualify for a more at risk category. Wide-spread and abundant taxa are included in this category.
Data Deficient (DD)	Not enough data to make an assessment of its risk of extinction.
Not Evaluated (NE)	Has not yet been evaluated against the criteria.

IUCN threatened species in Huong Son

Amphibians			
SPP	STATUS	SPP	STATUS
<i>Duttaphrynus melanostictus</i>	LC	<i>Microhyla pulchra</i>	LC
<i>Ingerophrynus galeatus</i>	LC	<i>Amolops archotaphus</i>	LC
<i>Fejervarya limnocharis</i>	LC	<i>Amolops cremnobatus</i>	NT
<i>Hoplobatrachus rugulosus</i>	LC	<i>Babina chapaensis</i>	LC
<i>Limnonectes blythii</i>	NT	<i>Hylarana erythraea</i>	LC
<i>Limnonectes hascheanus</i>	LC	<i>Hylarana macrodactyla</i>	LC
<i>Limnonectes khammonensis</i>	DD	<i>Hylarana maosonensis</i>	LC
<i>Limnonectes kuhlii</i>	LC	<i>Hylarana nigrovittata</i>	LC
<i>Occidozyga lima</i>	LC	<i>Hylarana taipehensis</i>	LC
<i>Occidozyga martensii</i>	LC	<i>Odorrana andersonii</i>	LC

Amphibian			
SPP	STATUS	SPP	STATUS
Quasipaa verrucospinosa	NT	Odorrana chloronota	LC
Hyla simplex	LC	Odorrana morafkai	LC
Leptobrachium chapaense	LC	Odorrana nasica	LC
Leptolalax pelodytoides	LC	Odorrana orba	DD
Ophryophryne microstoma	LC	Rana johnsi	LC
Ophryophryne pachyproctus	LC	Chiromantis vittatus	LC
Xenophrys major	LC	Kurixalus verrucosus	LC
Kalophrynus interlineatus	LC	Polypedates leucomystax	LC
Kaloula pulchra	LC	Polypedates mutus	LC
Microhyla butleri	LC	Rhacophorus dennysi	LC
Microhyla fissipes	LC	Rhacophorus orlovi	LC
Microhyla heymonsi	LC	Rhacophorus rhodopus	LC
Microhyla marmorata	LC	Theloderma asperum	LC
Birds			
SPP	STATUS	SPP	STATUS
Aquila clanga	VU	Emberiza aureola	VU
Aquila heliaca	VU	Sterna acuticauda	NT
Ichthyophaga humilis	NT	Pelecanus philippensis	NT
Ichthyophaga ichthyaetus	NT	Pavo muticus	EN
Sarcogyps calvus	CR	Rheinardia ocellata	NT
Alcedo hercules	NT	Mulleripicus pulverulentus	VU
Cairina scutulata	EN	Picus rabieri	NT
Anhinga melanogaster	NT	Pavo muticus	EN
Anorrhinus austeni	NT	Rheinardia ocellata	NT
Buceros bicornis	NT	Mulleripicus pulverulentus	VU
Mycteria leucocephala	NT	Picus rabieri	NT
Corvus torquatus	NT	Numenius arquata	NT
Emberiza aureola	VU	Sitta formosa	VU

Mammals			
SPP	STATUS	SPP	STATUS
<i>Rattus rattus</i>	LC	<i>Hipposideros pomona</i>	LC
<i>Tragul kanchil</i>	LC	<i>Ia io</i>	LC
<i>Bandicota savilei</i>	LC	<i>Kerivoula hardwickii</i>	LC
<i>Chiromyscus chiropus</i>	LC	<i>Kerivoula picta</i>	LC
<i>Hapalomys delacouri</i>	VU	<i>Macroglossus sobrinus</i>	LC
<i>Niviventer tenaster</i>	LC	<i>Megaderma lyra</i>	LC
<i>Tamiops maritimus</i>	LC	<i>Megaderma spasma</i>	LC
<i>Tamiops rodolphii</i>	LC	<i>Megaerops niphanae</i>	LC
<i>Crociodura indochinensis</i>	LC	<i>Miniopterus pusillus</i>	LC
<i>Euroscaptor klossi</i>	LC	<i>Murina aurata</i>	LC
<i>Crociodura fuliginosa</i>	LC	<i>Murina aurata</i>	LC
<i>Crociodura attenuata</i>	LC	<i>Murina cyclotis</i>	LC
<i>Chimarrogale himalayica</i>	LC	<i>Murina tubinaris</i>	LC
<i>Vandeleuria oleracea</i>	LC	<i>Myotis annectans</i>	LC
<i>Rhizomys pruinosus</i>	LC	<i>Myotis horsfieldii</i>	LC
<i>Ratufa bicolor</i>	NT	<i>Myotis montivagus</i>	LC
<i>Rattus tanezumi</i>	LC	<i>Myotis muricola</i>	LC
<i>Rattus nitidus</i>	LC	<i>Myotis siligorensis</i>	LC
<i>Rattus exulans</i>	LC	<i>Pipistrellus cadornae</i>	LC
<i>Petaurista philippensis</i>	LC	<i>Pipistrellus coromandra</i>	LC
<i>Petaurista elegans</i>	LC	<i>Pipistrellus javanicus</i>	LC
<i>Niviventer langbianis</i>	LC	<i>Pipistrellus paterculus</i>	LC
<i>Niviventer fulvescens</i>	LC	<i>Pipistrellus tenuis</i>	LC
<i>Mus pahari</i>	LC	<i>Rhinolophus affinis</i>	LC
<i>Mus cookii</i>	LC	<i>Rhinolophus luctus</i>	LC
<i>Arctogalidia trivirgata</i>	LC	<i>Rhinolophus pearsonii</i>	LC
<i>Leopoldamys sabanus</i>	LC	<i>Rhinolophus pusillus</i>	LC
<i>Leopoldamys edwardsi</i>	LC	<i>Rousettus leschenaultii</i>	LC
<i>Hystrix brachyura</i>	LC	<i>Scotomanes ornatus</i>	LC
<i>Hylopetes alboniger</i>	LC	<i>Scotophilus heathii</i>	LC
<i>Dremomys rufigenis</i>	LC	<i>Scotophilus kuhlii</i>	LC
<i>Chiropodomys gliroides</i>	LC	<i>Sphaerias blanfordi</i>	LC
<i>Callosciurus erythraeus</i>	LC	<i>Taphozous melanopogon</i>	LC
<i>Berylmys bowersi</i>	LC	<i>Tylonycteris pachypus</i>	LC
<i>Bandicota indica</i>	LC	<i>Tylonycteris robustula</i>	LC
<i>Atherurus macrourus</i>	LC	<i>Suncus murinus</i>	LC
<i>Viverricula indica</i>	LC	<i>Elephas maximus</i>	EN

Mammals			
SPP	STATUS	SPP	STATUS
<i>Viverra zibetha</i>	NT	<i>Galeopterus variegatus</i>	LC
<i>Viverra megaspila</i>	VU	<i>Hylomys suillus</i>	LC
<i>Prionodon pardicolor</i>	LC	<i>Nesolagus timminsi</i>	DD
<i>Paradoxurus hermaphroditus</i>	LC	<i>Callosciurus inornatus</i>	LC
<i>Paguma larvata</i>	LC	<i>Hylopetes phayrei</i>	LC
<i>Herpestes urva</i>	LC	<i>Maxomys surifer</i>	LC
<i>Herpestes javanicus</i>	LC	<i>Mus caroli</i>	LC
<i>Chrotogale owstoni</i>	VU	<i>Myotis pilosus</i>	NT
<i>Arctictis binturong</i>	VU	<i>Rattus andamanensis</i>	LC
<i>Arielulus aureocollaris</i>	LC	<i>Rhizomys sumatrensis</i>	LC
<i>Aselliscus stoliczkanus</i>	LC	<i>Cervus nippon</i>	LC
<i>Glischropus tylopus</i>	LC	<i>Muntiacus rooseveltorum</i>	DD
<i>Hipposideros scutinares</i>	VU	<i>Muntiacus truongsongensis</i>	DD
<i>Kerivoula kachinensis</i>	LC	<i>Muntiacus vaginalis</i>	LC
<i>Kerivoula titania</i>	LC	<i>Muntiacus vuquangensis</i>	EN
<i>Miniopterus fuliginosus</i>	LC	<i>Rusa unicolor</i>	VU
<i>Myotis chinensis</i>	LC	<i>Neofelis nebulosa</i>	VU
<i>Phoniscus jagorii</i>	LC	<i>Panthera pardus</i>	NT
<i>Pipistrellus pulveratus</i>	LC	<i>Bos gaurus</i>	VU
<i>Rhinolophus malayanus</i>	LC	<i>Panthera tigris</i>	EN
<i>Rhinolophus marshalli</i>	LC	<i>Pardofelis marmorata</i>	VU
<i>Rhinolophus paradoxolophus</i>	LC	<i>Pardofelis temminckii</i>	NT
<i>Rhinolophus shameli</i>	LC	<i>Prionailurus bengalensis</i>	LC
<i>Rhinolophus stheno</i>	LC	<i>Canis aureus</i>	LC
<i>Rhinolophus thomasi</i>	LC	<i>Capricornis milneedwardsii</i>	NT
<i>Rousettus amplexicaudatus</i>	LC	<i>Capricornis milneedwardsii</i>	NT
<i>Tadarida latouchei</i>	DD	<i>Pseudoryx nghetinhensis</i>	CR
<i>Tupaia belangeri</i>	LC	<i>Helarctos malayanus</i>	VU
<i>Martes flavigula</i>	LC	<i>Helarctos malayanus</i>	VU
<i>Sus scrofa</i>	LC	<i>Helarctos malayanus</i>	VU
<i>Manis javanica</i>	EN	<i>Helarctos malayanus</i>	VU
<i>Manis pentadactyla</i>	EN	<i>Ursus thibetanus</i>	VU
<i>Aonyx cinerea</i>	VU	<i>Ursus thibetanus</i>	VU
<i>Arctonyx collaris</i>	NT	<i>Ursus thibetanus</i>	VU

Mammals			
SPP	STATUS	SPP	STATUS
<i>Lutra lutra</i>	NT	<i>Ursus thibetanus</i>	VU
<i>Lutrogale perspicillata</i>	VU	<i>Miniopterus magnater</i>	LC
<i>Melogale moschata</i>	LC	<i>Nomascus siki</i>	EN
<i>Melogale personata</i>	DD	<i>Nycticebus bengalensis</i>	VU
<i>Mustela kathiah</i>	LC	<i>Nycticebus pygmaeus</i>	VU
<i>Mustela strigidorsa</i>	LC	<i>Macaca arctoides</i>	VU
<i>Coelops frithii</i>	LC	<i>Macaca assamensis</i>	NT
<i>Cynopterus brachyotis</i>	LC	<i>Macaca leonina</i>	VU
<i>Cynopterus sphinx</i>	LC	<i>Macaca mulatta</i>	LC
<i>Eonycteris spelaea</i>	LC	<i>Pygathrix nemaeus</i>	EN
<i>Harpiocephalus mordax</i>	DD	<i>Trachypithecus phayrei</i>	EN
<i>Hipposideros armiger</i>	LC	<i>Mus musculus</i>	LC
<i>Hipposideros cineraceus</i>	LC	<i>Cuon alpinus</i>	EN
<i>Hipposideros larvatus</i>	LC	<i>Prionailurus viverrinus</i>	EN
Reptiles			
SPP	STATUS	SPP	STATUS
<i>Acanthosaura lepidogaster</i>	LC	<i>Draco maculatus</i>	LC
<i>Ahaetulla prasina</i>	LC	<i>Naja siamensis</i>	LC
<i>Calamaria septentrionalis</i>	LC	<i>Oligodon cinereus</i>	LC
<i>Naja kaouthia</i>	LC	<i>Oligodon cyclurus</i>	LC
<i>Protobothrops mucrosquamatus</i>	LC	<i>Ophiophagus hannah</i>	VU
<i>Ptyas carinata</i>	LC	<i>Protobothrops sieversorum</i>	LC
<i>Sibynophis collaris</i>	LC	<i>Sinonatrix aequifasciata</i>	LC
<i>Takydromus hani</i>	DD	<i>Varanus bengalensis</i>	LC
<i>Takydromus sexlineatus</i>	LC	<i>Varanus salvator</i>	LC
<i>Typhlops diardii</i>	LC	<i>Hemidactylus frenatus</i>	LC
<i>Xenopeltis unicolor</i>	LC	<i>Hemidactylus frenatus</i>	LC
<i>Cryptelytrops albolabris</i>	LC		

IUCN threatened species in Vinh Tu

Amphibians			
SPP	STATUS	SPP	STATUS
<i>Duttaphrynus melanostictus</i>	LC	<i>Microhyla heymonsi</i>	LC
<i>Fejervarya limnocharis</i>	LC	<i>Microhyla pulchra</i>	LC
<i>Hoplobatrachus rugulosus</i>	LC	<i>Hylarana guentheri</i>	LC
<i>Occidozyga lima</i>	LC	<i>Hylarana macrodactyla</i>	LC
<i>Occidozyga martensii</i>	LC	<i>Hylarana nigrovittata</i>	LC
<i>Kaloula pulchra</i>	LC	<i>Hylarana taipehensis</i>	LC
<i>Microhyla butleri</i>	LC	<i>Polypedates leucomystax</i>	LC
<i>Microhyla fissipes</i>	LC	<i>Ichthyophis kohtaoensis</i>	LC
Birds			
SPP	STATUS	SPP	STATUS
<i>Aquila clanga</i>	VU	<i>Sterna acuticauda</i>	NT
<i>Aquila heliaca</i>	VU	<i>Pavo muticus</i>	EN
<i>Ichthyophaga humilis</i>	NT	<i>Rheinardia ocellata</i>	NT
<i>Ichthyophaga ichthyaetus</i>	NT	<i>Mulleripicus pulverulentus</i>	VU
<i>Sarcogyps calvus</i>	CR	<i>Pavo muticus</i>	EN
<i>Anhinga melanogaster</i>	NT	<i>Rheinardia ocellata</i>	NT
<i>Anorrhinus austeni</i>	NT	<i>Mulleripicus pulverulentus</i>	VU
<i>Buceros bicornis</i>	NT	<i>Eurynorhynchus pygmeus</i>	CR
<i>Mycteria leucocephala</i>	NT	<i>Numenius arquata</i>	NT
<i>Emberiza aureola</i>	VU	<i>Jabouilleia danjoui</i>	NT
<i>Emberiza aureola</i>	VU		
Mammals			
SPP	STATUS	SPP	STATUS
<i>Rattus rattus</i>	LC	<i>Cynopterus brachyotis</i>	LC
<i>Tragulid kanchil</i>	LC	<i>Cynopterus sphinx</i>	LC
<i>Bandicota savilei</i>	LC	<i>Hipposideros armiger</i>	LC
<i>Berylmys berdmorei</i>	LC	<i>Hipposideros larvatus</i>	LC
<i>Rattus argentiventer</i>	LC	<i>Hipposideros pomona</i>	LC
<i>Rattus losea</i>	LC	<i>Kerivoula hardwickii</i>	LC
<i>Tamias maritimus</i>	LC	<i>Kerivoula picta</i>	LC
<i>Tamias rodolphii</i>	LC	<i>Macroglossus sobrinus</i>	LC
<i>Crocivura fuliginosa</i>	LC	<i>Megaderma lyra</i>	LC
<i>Crocivura attenuata</i>	LC	<i>Megaderma spasma</i>	LC
<i>Ratufa bicolor</i>	NT	<i>Megaerops niphanae</i>	LC

Mammals			
SPP	STATUS	SPP	STATUS
<i>Rattus tanezumi</i>	LC	<i>Miniopterus pusillus</i>	LC
<i>Rattus exulans</i>	LC	<i>Murina cyclotis</i>	LC
<i>Petaurista philippensis</i>	LC	<i>Myotis horsfieldii</i>	LC
<i>Niviventer fulvescens</i>	LC	<i>Myotis muricola</i>	LC
<i>Leopoldamys sabanus</i>	LC	<i>Myotis siligorensis</i>	LC
<i>Leopoldamys edwardsi</i>	LC	<i>Pipistrellus cadornae</i>	LC
<i>Hystrix brachyura</i>	LC	<i>Pipistrellus coromandra</i>	LC
<i>Hylopetes alboniger</i>	LC	<i>Pipistrellus javanicus</i>	LC
<i>Dremomys rufigenis</i>	LC	<i>Pipistrellus tenuis</i>	LC
<i>Callosciurus erythraeus</i>	LC	<i>Rhinolophus affinis</i>	LC
<i>Bandicota indica</i>	LC	<i>Rhinolophus luctus</i>	LC
<i>Atherurus macrourus</i>	LC	<i>Rhinolophus pusillus</i>	LC
<i>Viverricula indica</i>	LC	<i>Rousettus leschenaultii</i>	LC
<i>Viverra zibetha</i>	NT	<i>Scotomanes ornatus</i>	LC
<i>Paradoxurus hermaphroditus</i>	LC	<i>Scotophilus heathii</i>	LC
<i>Paguma larvata</i>	LC	<i>Scotophilus kuhlii</i>	LC
<i>Herpestes urva</i>	LC	<i>Taphozous melanopogon</i>	LC
<i>Herpestes javanicus</i>	LC	<i>Tylonycteris pachypus</i>	LC
<i>Glischropus tylopus</i>	LC	<i>Tylonycteris robustula</i>	LC
<i>Kerivoula kachinensis</i>	LC	<i>Suncus murinus</i>	LC
<i>Miniopterus fuliginosus</i>	LC	<i>Hylomys suillus</i>	LC
<i>Rhinolophus malayanus</i>	LC	<i>Maxomys surifer</i>	LC
<i>Rhinolophus stheno</i>	LC	<i>Mus caroli</i>	LC
<i>Rhinolophus thomasi</i>	LC	<i>Muntiacus vaginalis</i>	LC
<i>Rousettus amplexicaudatus</i>	LC	<i>Rusa unicolor</i>	VU
<i>Dendrogale murina</i>	LC	<i>Prionailurus bengalensis</i>	LC
<i>Tupaia belangeri</i>	LC	<i>Helarctos malayanus</i>	VU
<i>Martes flavigula</i>	LC	<i>Ursus thibetanus</i>	VU
<i>Pipistrellus abramus</i>	LC	<i>Miniopterus magnater</i>	LC
<i>Sus scrofa</i>	LC	<i>Nycticebus bengalensis</i>	VU
<i>Aonyx cinerea</i>	VU	<i>Nycticebus pygmaeus</i>	VU
<i>Lutra lutra</i>	NT	<i>Macaca mulatta</i>	LC
<i>Melogale personata</i>	DD	<i>Pygathrix nemaeus</i>	EN

Reptiles			
SPP	STATUS	SPP	STATUS
Ahaetulla prasina	LC	Draco maculatus	LC
Lycodon paucifasciatus	VU	Oligodon cinereus	LC
Naja kaouthia	LC	Oligodon cyclurus	LC
Ptyas carinata	LC	Ophiophagus hannah	VU
Sibynophis collaris	LC	Varanus bengalensis	LC
Takydromus sexlineatus	LC	Varanus salvator	LC
Typhlops diardii	LC	Hemidactylus frenatus	LC
Xenopeltis unicolor	LC	Hemidactylus frenatus	LC
Cryptelytrops albolabris	LC		

List of species from CRES (2005) study for Huong Son

Vietnam Red list species in Huong Son

E= Endangered, V= Vulnerable, T= Threatened, T NT = Near threatened, R=Rare, K= Insufficiently known

Flora (42 species)			
TT	Latin name	Vietnam name	Vietnam Red list class
1	<i>Aquilaria crassna</i>	Trầm hương	E
2	<i>Aristolochia indica</i>	Khoai ca, Sơn địch	R
3	<i>Caesalpinia sappan</i>	Tô mộc	T
4	<i>Calamus platyacanthus</i>	Song mật,	V
5	<i>Chukrasia tabularis</i>	Lát hoa	K
6	<i>Cibotium barometz</i>	Lông cu li	K
7	<i>Cinnamomum balansae</i>	Vù hương	R
8	<i>Codonopsis javanica</i>	Ngân dăng java	V
9	<i>Cycas pectinata</i>	Thiên tuế lược	V
10	<i>Dacrydium elatum</i>	Hoàng đàn giả	K
11	<i>Dialium cochinchinensis</i>	Xoay, Xây	K
12	<i>Docynia indica</i>	Táo mèo	R
13	<i>Drynaria fortunei</i>	Ráng đuôi phượng	T
14	<i>Erythrophloeum fordii</i>	Lím xanh	K

Flora (42 species)			
TT	Latin name	Vietnam name	Vietnam Red list class
15	<i>Fibraurea recisa</i>	Hoàng đẳng	V
16	<i>Fokienia hodginsii</i>	Pơ mu	K
17	<i>Fraxinus chinensis</i>	Tần trung quốc, Sầm	R
18	<i>Hedyosmum orientale</i>	Mã thương đông	R
19	<i>Hopea pierrei</i>	Kiến kiến	K
20	<i>Limnophila rugosa</i>	Rau vi, Hối nước	R
21	<i>Lithocarpus longipedicellata</i>	Dẻ cuống dài	R
22	<i>Madhuca pasquieri</i>	Sến dừa	K
23	<i>Mahonia nepalensis</i>	Mã hổ, Hoàng liên ô rô	V
24	<i>Markhamia stipulata</i>	Thiết đỉnh lá bẹ	V
25	<i>Melanorrhea usitata</i>	Sơn đào	R
26	<i>Ophiopogon tonkinensis</i>	Mạch môn bắc	R
27	<i>Paris polyphylla</i>	Bảy lá một hoa	R
28	<i>Platanus kerrii</i>	Chò nước	T
29	<i>Podocarpus brevifolius</i>	Thông tre lá ngắn	K
30	<i>Podophyllum tonkinense</i>	Bát giác liên	E
31	<i>Pothos kerrii</i>	Cơ lênh kerr	R
32	<i>Psilotum nudum</i>	Lá thông	K
33	<i>Rauvolfia cambodiana</i>	Ba gác cambốt	T
34	<i>Rhodoleia championii</i>	Hồng quang	V
35	<i>Rhopalocnemis phalloides</i>	Chùy đầu dương hình	R
36	<i>Scaphium macropodium</i>	Lưỡi ươi	K
37	<i>Sindora siamensis</i>	Gụ mật	K
38	<i>Smilax glabra</i>	Thổ phục linh	V
39	<i>Strophanthus divaricatus</i>	Sùng dê	T
40	<i>Tinospora sinensis</i>	Dây đau xương	K
41	<i>Tournefortia montana</i>	Bò cạp núi	T
42	<i>Vitex sumatrana var. urceolata</i>	Bình linh lục lạc	V

Mammal (22 species)			
TT	Latin name	Vietnam name	Vietnam Red list class
1	<i>Cynocephalus veriegatus</i>	Chồn dơi	R
2	<i>Manis pentadactyla</i>	Tê tê vàng	V
3	<i>Manis javanica</i>	Tê tê	V
4	<i>Nycticebus coucang</i>	Cu li lớn	V
5	<i>Nycticebus pygmaeus</i>	Cu li nhỏ	V
6	<i>Macaca assamensis</i>	Khỉ mốc	V
7	<i>M. nemestrina</i>	Khỉ đuôi lợn	V
8	<i>M. aretoides</i>	Khỉ cộc	V
9	<i>Semnopithecus phayrei</i>	Voọc xám	V
10	<i>Pygathrix nemaeus</i>	Chà vá chân nâu	E
11	<i>Nomascus leucogenys</i>	Vượn má trắng	E
12	<i>Cuon alpinus</i>	Sói đỏ	E
13	<i>Ursus malaynus</i>	Gấu chó	E
14	<i>U. thibetanus</i>	Gấu ngựa	E
15	<i>Lutra lutra</i>	Rái cá thường	V
16	<i>Aoryx cinerea</i>	Rái vuốt bé	V
17	<i>Vierra tainguensis</i>	Cầy giông tây nguyên	V
18	<i>Prionodon pardicolor</i>	Cầy gấm	R
19	<i>Arctictis binturong</i>	Cầy mực	V
20	<i>Chrotogale owstoni</i>	Cầy vằn bắc	V
21	<i>Catopuma temmincki</i>	Báo lửa	E
22	<i>Pardofelis nebulosa</i>	Báo gấm	V
23	<i>Panthera tigris</i>	Hổ	E
24	<i>Elephas maximus</i>	Voi châu á	V
25	<i>Tragulus javanicus</i>	Cheo cheo Java	V
26	<i>Megamuntiacus vuquangensis</i>	Mang lớn	V
27	<i>Naemorhedus sumatraensis</i>	Sơn dương	V
28	<i>Pseudoryx nghetinhensis</i>	Sao la	E

TT	Latin name	Vietnam name	Vietnam Red list class
29	<i>Ratufa bicolor</i>	Sóc đen	R
30	<i>Petaurista petaurista</i>	Sóc bay lớn	R
Bird (16 species)			
1	<i>Lophura hatinhensis</i>	Gà lôi lam đuôi trắng	E
2	<i>Lophura nycthemera</i>	Gà lôi trắng	T
3	<i>Rheinartia ocellata</i>	Trĩ sao	T
4	<i>Treron seimundi</i>	Cu xanh Seimun	R
5	<i>Carpococcyx renauldi</i>	Phướn đất	T
6	<i>Alcedo hercules</i>	Bồng chanh rừng	T
7	<i>Megaceryle lugubris</i>	Bói cá lớn	T
8	<i>Ptilolaemus tickelli</i>	Niệc nâu	T
9	<i>Aceros nipalensis</i>	Niệc cổ hung	E
10	<i>Buceros bicornis</i>	Hồng hoàng	T
11	<i>Serilophus lunatus</i>	Mỏ rộng xanh	T
12	<i>Pitta nipalensis</i>	Đuôi cụt bụng vàng	T
13	<i>Pitta cyanea</i>	Đuôi cụt đầu đỏ	R
14	<i>Jabouilleia danjoui</i>	Khướu mỏ dài	T
15	<i>Paradoxornis davidianus</i>	Khướu mỏ dẹt đuôi ngắn	T
16	<i>Temnurus temnurus</i>	Chim khách đuôi cờ	T
Amphibian and reptiles (18 species)			
1	<i>Bufo galeatus</i>	Cóc rừng	R
2	<i>Rana andersoni</i>	Chàng anderson	T
3	<i>Rhacophorus nigropalmatus</i>	Ếch cây chân đen	T
4	<i>Gekko gecko</i>	Tắc kè	T
5	<i>Acanthosaura lepidogaster</i>	Ô rô vảy	T
6	<i>Physignathus cocincinus</i>	Rồng đất	V
7	<i>Varanus salvator</i>	Kỳ đà hoa	V
8	<i>Python molurus</i>	Trăn đất	V
9	<i>Ptyas korros</i>	Rắn ráo	T
10	<i>Ptyas mucosus</i>	Rắn ráo trâu	V

TT	Latin name	Vietnam name	Vietnam Red list class
11	<i>Bungarus fasciatus</i>	Rắn cạp nong	T
12	<i>Naja naja</i>	Rắn hổ mang	T
13	<i>Ophiophagus hannah</i>	Rắn hổ chúa	E
14	<i>Platysternum megacephalum</i>	Rùa đầu to	R
15	<i>Cistoclemmys galbinifrons</i>	Rùa hộp trán vàng	V
16	<i>Cuora trifasciata</i>	Rùa hộp ba vạch	V
17	<i>Testudo elongata</i>	Rùa núi vàng	V
18	<i>Manouria impressa</i>	Rùa núi viễn	V
Fish (4 species)			
1	<i>Anguilla japonica</i>	Cá Chình Nhật	E
2	<i>Onychostoma laticeps</i>	cá Sình gai	V
3	<i>Spinibarbus hollandi</i>	cá Chày đất	V
4	<i>Anguilla marmorata</i>	Cá Chình hoa	R
Insect (4 species)			
1	<i>Phyllium succifolium</i>	Bọ lá	V
2	<i>Attacus atlas</i>	Bướm Khế	R
3	<i>Argema maenas</i>	Bướm đuôi xanh dài lá chuối	R
4	<i>Troides helena</i>	Bướm phượng cánh sau vàng	E

IUCN Red list species in Huong Son

LC= Least concerned, NT= Near threatened, VU=Vulnerable, EN=Endangered, CR= Critically endangered, EW= Extinct in the wild, EX= Extinct

Mammal (22 species)			
#	Latin name	Vietnam name	IUCN class (2000)
1	<i>Manis pentadactyla</i>	Tê tê vàng	LR/nt
2	<i>Manis javanica</i>	Tê tê	LR/nt
3	<i>Nycticebus coucang</i>	Cu li lớn	VUA1 cd
4	<i>Nycticebus pygmaeus</i>	Cu li nhỏ	VUA1 cd
5	<i>Macaca assamensis</i>	Khỉ mốc	VUA1 cd
6	<i>M. nemestrina</i>	Khỉ đuôi lợn	VUA1 cd
7	<i>M. mulatta</i>	Khỉ vàng	LR/nt
8	<i>M. aretoides</i>	Khỉ cộc	VUA1 cd
9	<i>Pygathrix nemaeus</i>	Chà vá chân nâu	ENA1 cd
10	<i>Nomascus leucogenys</i>	Vượn má trắng	DD
11	<i>Cuon alpinus</i>	Sói đỏ	VUC 2a
12	<i>Ursus malaynus</i>	Gấu chó	DD
TT	Tên khoa học	Tên Việt	Sách Đỏ IUCN (2000)
13	<i>U. thibetanus</i>	Gấu ngựa	VUA1 cd
14	<i>Lutra lutra</i>	Rái cá thường	VU A2 cde
15	<i>Chrotogale owstoni</i>	Cầy vằn bắc	VUA1 cd
16	<i>Catopuma temmincki</i>	Báo lửa	VUC2a(i)
17	<i>Pardofelis nebulosa</i>	Báo gấm	VUC2a(i)
18	<i>Panthera tigris</i>	Hổ	ENC2a(i)
19	<i>Elephas maximus</i>	Voi châu á	ENA1 cd
20	<i>Naemorhedus sumatraensis</i>	Sơn dương	VUA 2 cd
21	<i>Pseudoryx nghetinhensis</i>	Sao la	ENC1 +2a (i)
22	<i>Nesolagus timminsi</i>	Thỏ vằn	DD

Bird (7 species)			
#	Latin name	Vietnam name	IUCN class (2000)
1	<i>Lophura hatinhensis</i>	Gà lôi lam đuôi trắng	EN
2	<i>Rheinartia ocellata</i>	Trĩ sao	VU
3	<i>Arborophila charltonii</i>	Gà so ngực gụ	LR/nt
4	<i>Alcedo hercules</i>	Bồing chanh rừng	LR/nt
5	<i>Ptilolaemus tickelli</i>	Niệc nâu	LR/nt
6	<i>Aceros nipalensis</i>	Niệc cổ hung	VU
7	<i>Anthracoceros malabaricus</i>	Cao cát bụng trắng	LR/nt
Amphibian & reptiles (10 species)			
1	<i>Python molurus</i>	Trăn đất	LR
2	<i>Platysternum megacephalum</i>	Rùa đầu to	EN
3	<i>Cistoclemmys galbinifrons</i>	Rùa hộp trán vàng	CR
4	<i>Cuora trifasciata</i>	Rùa hộp ba vạch	CR
5	<i>Pyxidea mouhoti</i>	Rùa sa nhân	EN
6	<i>Sacalia quadriocellata</i>	Rùa bốn mắt	EN
7	<i>Testudo elongata</i>	Rùa núi vàng	EN
8	<i>Manouria impressa</i>	Rùa núi viền	VU
9	<i>Palea steindachneri</i>	Ba ba gai	EN
10	<i>Pelodiscus sinensis</i>	Ba ba trơn	VU





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