

Understanding tree cover transition, drivers and stakeholder perspectives for effective landscape governance

A case study in Na Nhan commune, Dien Bien province, Vietnam

Do Trong Hoan, Nguyen Van Truong and Vu Tan Phuong



**World
Agroforestry
Centre**

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Abstract

Integrated landscape management for sustainable livelihoods and positive environmental outcomes has been desired by many developing countries, especially for mountainous areas where agricultural activities, if not well managed, will likely degrade vulnerable landscapes. This research is our first attempt to characterize the landscape in Na Noi village (Na Nhan commune, Dien Bien province) in Northwest Vietnam, to generate knowledge and understanding of local conditions, and to propose a workable governance mechanism to sustainably manage the landscape. ICRAF, together with national partners (Vietnam Academy of Forest Science, Soil and Fertilizer Research Institute) and local partners (Dien Bien Department of Agriculture and Rural Development, Dien Bien Department of Natural Resources and Environment, and Na Nhan CPC) conducted rapid assessments in the landscape, including land use mapping, land use characterization, household survey, and participatory landscape assessment using the ecosystem services framework. We found that the landscape and peoples' livelihoods are at risk from the continuous degradation of forest and agricultural lands, declining productivity and ecosystems conditions as well as the ecosystem services. Half of households live below the poverty line with insufficient subsistence agricultural production. Unsustainable agricultural practices and other livelihood activities are causing more damage to the forest. Meanwhile, existing forest and landscape governance mechanisms are generally not inclusive of local community engagement. Initial recommendations are provided, including further assessment to address current knowledge gaps.

Keywords

Dien Bien, ecosystem services, forestry, governance, household survey, mapping, land use, land use planning, landscape, Vietnam

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Acronyms

ACIAR	Australian Centre for International Agricultural Research
AF	Agroforestry
asl	Above sea level (altitude)
CFM	Community Forest Management
ES	Ecosystem services
FCPF	Forest Carbon Partnership Facility
FMB	Forest Management Board
GIS	Geographic Information System
ha	Hectare
HH	Household
ICRAF	World Agroforestry Centre
LU	Land use
LUC	Land use change
LUCS	Land use classification system
LUS	Land use system
LUP	Land use planning
m	Meter
MARD	Ministry of Agriculture and Rural Development
MONRE	Ministry of Natural Resources and Environment
NPV	Net Present Value
NRAP	National REDD+ action plan
NTFPs	Non-timber forest products
PFES	Payments for forest ecosystem services
PRAP	Provincial REDD+ action plan
USD	US dollars
VAFS	Vietnam Academy of Forest Science
VND	Vietnamese Dong

Introduction

The conversion of primary forest to other land uses in the Northwest region of Vietnam threatens ecosystem services and sustainability but favors poverty reduction. Small-scale farmers practicing shifting cultivation contribute significantly to deforestation and forest degradation, and thus a drastic decline of environmental functions. However, the conditions necessary for increased productivity of alternative land use systems (LUS) to improve farmer welfare and simultaneously secure ecosystem services (in the forested landscape) are not well understood.

This research attempted to characterize land use systems and land use practices in Na Nhan commune (and subsequently Na Noi village), Dien Bien province in the Northwest region of Vietnam, and link these practices with the socio-economic conditions of local communities. The study also examined existing governance mechanisms and structures, including the legal mandates of governing actors and how they enforce them, as well as how they relate to other stakeholders in the landscape.

Stakeholders' perspectives on aspects of production, forest management, ecosystem services, and landscape governance were generated to draw insights on improving the status quo. The study is part of the project "Developing and Promoting Market-based Agroforestry and Forest Rehabilitation Options for Northwest Vietnam – AFLI-II" with support from the Australian Centre for International Agricultural Research (ACIAR) and the Research programs on Forests, Trees and Agroforestry and Policies, Institutions and Markets of the Consultative Group on International Agricultural Research (CGIAR). The project is implementing comprehensive agroforestry and forest rehabilitation research and development activities with local partners in Northwest Viet Nam.

The research employed mixed methods including land use mapping, GIS tools, rapid landscape assessments such as transect walks, and field survey and observation, survey, and focus group discussions. With a view to provide information for policy and decision making on landscape management, we not only focus on the targeted landscape as described in the AFLI-II project document (Na Noi village, Na Nhan commune), but also the commune level landscape (Na Nhan commune)---the lowest jurisdictional tier of administration system in Vietnam where socio-economic and environmental plans and decisions are made. Three main research activities were conducted in the following order:

(1) Land use mapping

A hierarchical land use/cover classification system was developed to serve as a basis for mapping and characterizing both tree-based and non-tree based land uses, particularly agroforestry. A land use map of Na Nhan commune (including Na Noi village) using satellite images of 2015 and data from about 300 sampling plots was produced and verified, and a characterization of the

landscape meta land uses (key features of topography, soil, water, vegetation, animals and human interventions) was completed.

(2) Characterization of local socio-economic conditions

A survey using a structured questionnaire was completed for 34 households in Na Noi village and the following data was generated: households' demographic information; agricultural land holding and ownership; major farming systems; household socio-economic conditions and food security; households' trees on farm; households' perception towards forestry-agriculture issues including soil fertility, cultivation methods, water scarcity, forest status and protection measures; households' understanding of and participation in local land use planning.

(3) Linking environmental services to sustainable land use and landscape governance (Na Nhan commune)

A participatory assessment with local stakeholders was conducted for the following aspects: stakeholders' concerns on agronomic sustainability and environmental challenges; stakeholders' awareness on ecosystem services provided by the landscape and key ecosystems; stakeholders' assessment of the role of key ecosystems in providing ecosystem services and trend of changes in ecosystem service provision; issues of landscape governance, and some policy and institutional barriers to the adoption of alternative land uses.

Research methods

Study site

Na Nhan commune is located in Dien Bien district, Dien Bien province. The commune's population is about 5,000 distributed in about 1,000 households. The mean elevation of the commune is 850 m above sea level (asl). The average temperature of the commune is 20°C, and average rainfall is 1700mm year⁻¹.

There are three ethnic groups: Thai (72% of total population), Mong (27%), and Kinh (1%). According to the Government's standards, most local households are either poor (421 HHs) or near-poor (253 HHs). Although the total land area designated for forestry is 7,600 ha, the forested land area only accounts for 60%, of which 59% is regenerated forest. There are 4,491 ha of forestry land being used as either agriculture land or fallow. Outside of land designated for forestry, the total cultivation land area is 1,224 ha, including 37 ha of water surface used for aquaculture production. The main agriculture crops are wet rice (229 ha), upland rice (225ha), maize (221 ha), cassava (100 ha), and Canna (180 ha). Agriculture cultivation and forestry were reported to be the two main livelihoods of local communities.

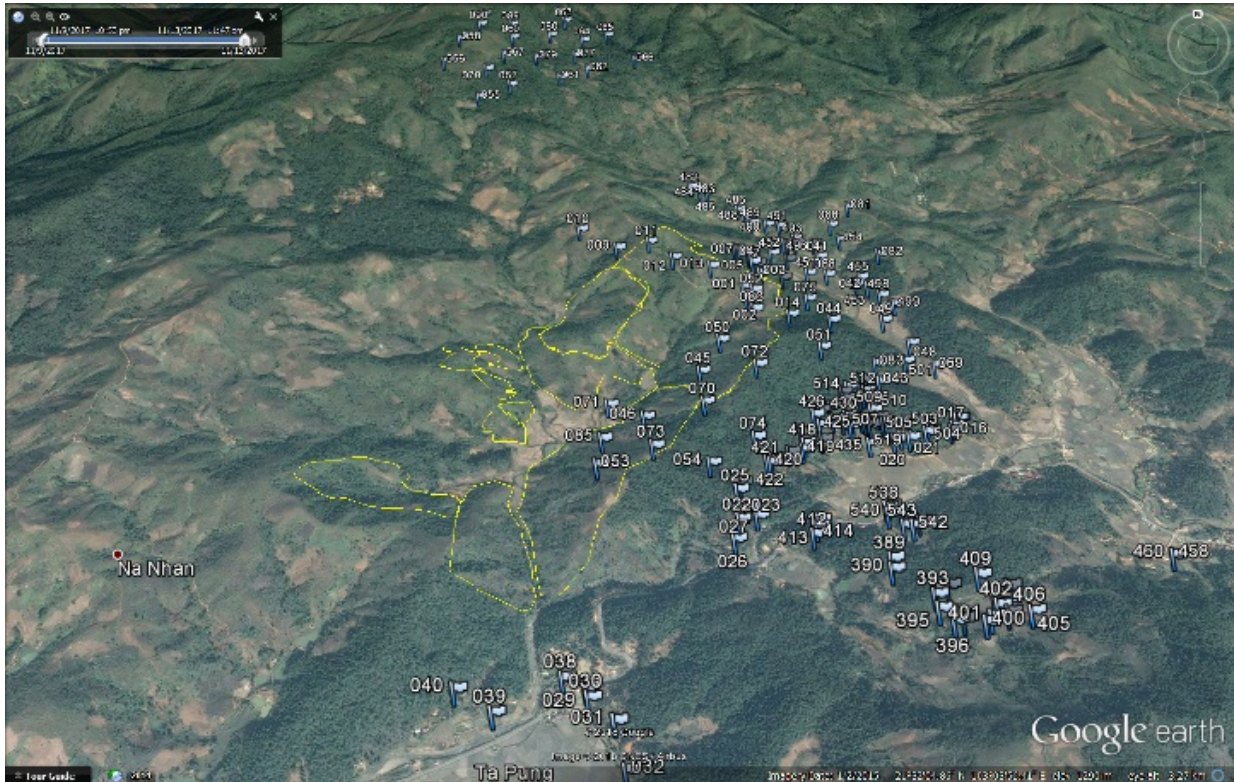


Figure 1. Google Earth image of Na Nhan commune (Na Noi village's border is in yellow)

Na Noi village was one of Na Nhan's 22 villages (Figure 1). In 2016 the village was split into two smaller, adjacent villages: Na Noi 1 and Na Noi 2. Households in one of these two villages often own cultivation and forest lands in the other villages. Therefore, in this study we decided to refer to Na Noi 1 and Na Noi 2 as one village (Na Noi).

Assessment of local perspectives on ecosystem services

Ecosystem services are the benefits that human populations derive, directly or indirectly, from ecosystem functions (Costanza et al 1997; MEA 2005). These services include provisioning (e.g. food, timber, and fuels), regulating (e.g. climate regulation and water purification) and cultural services (e.g. aesthetic values, sense of place). The provision of these services is based upon the performance of ecological structures, processes, and functions. Since ecosystem services play vital roles in human economy and quality, they shape the ways in which we manage environment and development activities in it (Everard and Waters 2013). In recent years, the concept of ecosystem services has been increasingly studied and used in environmental science, policy making, and practical applications.

When using an ecosystem services concept and approach, landscapes play an important role as they provide a wide range of goods and services to humans and development. The approach is to define functions and services at a landscape scale to integrate the concept into land management decisions. In this paper, by assessing ecosystem services on the targeted landscape of Na Noi village, our aims are

not to value or put a price tag on ecosystem services provided by the landscape, but to determine and communicate the role of ecosystem services in decisions and policies, to consider options for the future management of the landscape, and to communicate and enhance local communities' awareness on ecosystem services and their engagement in project activities in this regard.

Household survey

The study employed the use of a structured questionnaire survey with 34 randomly selected households (stratified by economic status) in Na Noi village. The survey aims to generate a baseline of socio-economic conditions of households in Na Noi village, and their perspectives towards landscape management and use, including land, soil, tree, forest, and water management. Data is stored in Microsoft Access and analyzed using Microsoft Excel.

Transect walk

A *transect walk* is a systematic walk along a defined path (transect) across the community/project area together with the local people to explore topography, soil, water, and sanitation conditions by observing, asking, listening, looking, and producing a transect diagram. In Na Nhan commune, we conducted 2 transect walks with a total of 14 residents to gain a better understanding of villages/communes' issues relating to agriculture and forestry. Dominant land-use systems associated with an elevation gradient and slope classes were identified, including current crop varieties, cropping systems and patterns (mono cropping or crop association). Biophysical indicators were registered, such as soil type, erosion status and water resources.

Land cover mapping

A land use/cover map of Na Nhan commune was produced using remote sensing data (see Table 1), and land use maps from the Ministry of Natural Resources and Environment (MONRE) and Ministry of Agriculture and Rural Development (MARD) as references. The land use/cover map was developed using the following steps:

(1) Data collection

- Forest status map (2015) of Na Nhan commune (1:10,000) (Source: Forest Inventory and Planning Institute, Ministry of Agriculture and Rural Development, Vietnam)
- Land use map (2015) of Dien Bien province (1:50,000) (Source: Ministry of Natural Resources and Environment, Vietnam)
- DEM SRTM 1 ARC of Na Nhan commune
- High resolution satellite images from Google Map Satellite and Google Earth for data verification
- Landsat 8 satellite image (LC81280452015077LGN01. Acquired: 03/18/2015)

- (2) Development of land use classification system (see section 3.1.1)
- (3) Development of map and overlay layers
 - Develop topography and slope maps
 - Overlay forest status map with land use maps, topography map, and slope map to identify land use types
- (4) Build a set of classification keys
 - Develop a set of classification keys from the land use map and forest status map based on the land use classification system as shown in Table 1.

Table 1. Classification key used in mapping Na Nhan commune

ID	LUsymb	Land Use	FORsymb	LUMonre
1	EBR	Evergreen broadleaves forest - rich	TXG	
2	EBM	Evergreen broadleaves forest - medium	TXB	
3	EBP	Evergreen broadleaves forest - poor + regenerated	TXP, TXN, TXDK	
4	MXF	Other natural forests (bamboo, mixed timber and bamboo)	HG1, RTTN	
5	PFR	Planted forest	RTG	
6	PLA	Tree crop plantation	NN	NNP
7	BST	Bare land with scattered trees	DT2	
8	BGS	Bare land with grass and shrubs	DT1	
9	HGN	Home garden	DKH	ONT
10	UPC	Upland crops	NN	NHK
11	LLC	Lowland crops	NN, DKH	BHK
12	PDR	Paddy rice	NN	LUN
13	WTR	Water bodies	MN	NTS, DTL, SON
14	ONF	Other non-forests (settlement, etc.)		DCS, DTS, NTD, DNL, ...

- Supervised classification: This is to find out the common characteristics of different objects and name them. Identifying key spectrum is called creating the test pattern or region. From this area, the remaining pixels that make up the entire image were examined and sorted using the same key principles of best choice in order to add the named target groups. This process will be conducted with all the pixels on the satellite images or different spectral channels. Each pixel in the image data layer is then matched to the interpretation key and is named after the group with the highest probability. There are many ways to match the pixel values of the unknown to a class that corresponds to the key in the classification.
- (5) Ground truthing: Using the GPS device, the surveyor gathered information on location, coordinates of the sample, as well as collected information to describe the the status of land use and the surrounding area, weather, date, time and photos.
 - Identify transects on the map

- Identify GPS points and collect field information
 - Mark down areas where classification is either incorrect or unclear
- (6) Accuracy assessment: After the classification and verification fieldtrip, accuracy was assessed. Methods of accuracy evaluation for interpretation results is used as a error matrix. This is a common method for evaluating the accuracy of image interpretation.

Stakeholder workshop

In the context of integrated landscape management, multi-stakeholder platforms are important means to contribute to sustainable landscapes, i.e., achieving conservation, livelihoods and production goals. In this study, we conducted one stakeholder consultation workshop with 17 participants representing Na Nhan commune's stakeholders including the commune leader, agriculture extension staff, environmental and cadastral staff, and some village heads. The overall objective of the workshop was to capture general issues regarding forest protection, agricultural production, land use management, and environmental protection in Na Nhan commune as the baseline for discussion on issues of landscape ecosystem services, assessment of ecosystem services, and governance structures. The workshop employed simple and visual methods to aid participants in content comprehension and discussion. Participants actively engaged in this one-day workshop because they learned the term ecosystem services, defined as benefits to people, as socially meaningful and can be used easily to communicate on issues they encounter in their daily life.

Review of policies and regulations

Analyses and interpretations of stakeholder workshop results were substantiated with rapid assessment of policies and regulations, institutional roles, and existing governance structures. Government agencies and institutions involved in governing the landscape were analysed with respect to their mandates and functions. Legal regulations related to forest management were also reviewed.

Results

Tree cover transition

Land use classification

At sub-national levels, the two main government agencies responsible for the management of land including, forests, are the Department of Agriculture and Rural Development (DARD) and the Department of Natural Resources (DONRE) both of which are members of the Provincial People's Committee (PPC). Although both departments maintain data on land use, their classifications are

different. The DARD's classification system focuses on ecological structure and vegetation cover, while DONRE's classification system focuses on functions and uses of land.

We therefore suggest a more comprehensive land use/cover classification system that can capture both the ecological and management status of the land (Table 2 below) and, more importantly, the presence and management of trees in the landscape. Accordingly, there are seventeen land use types, including six types of forests, one type of mosaic land use, nine types of non-forest vegetation, four types of agriculture, and three types of non-vegetated land. Classification of forest land cover types is based on circular 34/2009/TT-BNNPTNT.

Table 2. Land use/cover classification system of Na Nhan commune/Na Noi village

Legend			No	Forest and land use type	Code
Forest	Tree-based	Vegetated	1	Evergreen broadleaves forest - rich	EBR
			2	Evergreen broadleaves forest - medium	EBM
			3	Evergreen broadleaves forest - poor	EBP
			4	Mixed forest (bamboo + timber)	MXF
			5	Regenerated forest	RGF
			6	Planted forest	PFR
Non-forest	Tree-based	Vegetated	7	Tree crop plantation	PLA
			8	Bare land with scattered trees	BST
			9	Bare land with grass and shrubs	BGS
			10	Agro-forestry	AGR
			11	Home garden	HGN
			13	Upland crops	UPC
	Non-tree-based	Non-veg	14	Low land crops	LLC
			15	Paddy rice	PDR
			16	Water bodies	WTR
			17	Residence and construction (settlement, etc.)	ONF

One important purpose of mapping was to identify tree-base land use types. Therefore, we developed a set of criteria for land use/cover classification as shown in Table 3 below. These criteria include slope, tree cover, dominant tree species, dominant tree types, and origin of trees (planted or spontaneous trees).

Table 3. Land cover classification indicators to identify land cover types

Land use/cover	Slope		Tree cover			Planted trees		Dominant tree species		Dominant tree types			
	< 20%	> 20%	< 10%	10-30%	30-60%	> 60%	5-50%	> 50%	< 66%	> 66%	Timber	Tree crops	Fruit trees
Evergreen broadleaves forest - rich	X	X				X			X				
Evergreen broadleaves forest - medium	X	X			X				X				
Evergreen broadleaves forest - poor	X	X		X					X				
Mixed forest (bamboo + timber)	X	X		X					X				

Land use/cover	Slope		Tree cover				Planted trees		Dominant tree species		Dominant tree types		
	< 20%	> 20%	< 10%	10-30%	30-60%	> 60%	5-50%	> 50%	< 66%	> 66%	Timber	Tree crops	Fruit trees
Regenerated forest	X	X		X			X		X				
Planted forest - mature (closed canopy, e.g. >2 years)	X	X			X	X		x		X	X		
Tree crop plantations (rubber)	X	X			X	X		X		X		X	
Bare land with scattered trees	X	X	X										
Bare land with grass and shrubs	X	X	X										
Agroforestry		X		X	X	X	X	X	X		X	X	X
Home garden (tree cover >30%) on flat land					X	X	X	X				X	X
Grass and shrubs	X	X	X										
Mixed annual crops (tree cover <10%) on flat land		X	X										
Mixed annual crops (tree cover <10%) on sloping land	X		X										
Paddy rice	X			X			X		X				
Settlement, constructions	X	X	X	X									
Water bodies													

Meta land uses

Not all the land use/cover types of the classification above exist in Na Noi village. For example, rich forest (timber stock per hectare of more than 200 m³ ha⁻¹) has been either degraded to become poor/regenerated forest (degradation) or other (non-forest) land use types, primarily upland agriculture (deforestation). In general, land uses in Na Noi village can be grouped into six meta land use types as described in Table 4 below.

Table 4. Meta land uses of Na Noi village and Na Nhan commune

Land uses	General description
Natural forest	Degraded, poor, broad-leave evergreen forest at elevation of about 800- 1,000m asl, black soil (degraded). Managed by forest management board and community
Planted forest	Mono-plantation and mixed plantation of Melia, Michelia, and Mangletia Conifera on ferallite on red clay at 750m or above asl. Managed mainly by individual households.
Upland agriculture	Cassava, canna, sweet potato, and rain-fed rice are the most common crops. This type of land is often found on clay soils at elevation of 750m or above asl. In some places where irrigation is available, terrace rice is also found at this elevation.
Fallow	Fallow is often applied 3-4 years or longer depending on soil fertility, after 1-2 year of crop cultivation. This land use type occurs on the same soil type and elevation with planted forest and upland agriculture. Vegetation cover is mainly grass, shrubs, bananas, and small woody plants.
Lowland agriculture	Wet rice is the prominent type of crop. This type of land use is often found in flat valleys at an elevation of about 700m asl. Depending on water availability, farmers can cultivate one or two crops a year.
Home garden and settlement	This land use type distributes mostly in low valleys and on relatively flat land. Most common tree species found are plum, pomelo, peach, and jack fruit.

Land use/cover map of the landscape

The land use map of Na Nhan commune (including Na Noi village bordered by red line) is shown in Fig.2 below. The map was developed based on satellite images captured in the year 2015. It can be

seen from the map that poor and regenerated forest and upland annual crops (shifting cultivation) are the two main land use types in the landscape. Some small areas of rich forest can still be found on the hilltops within the commune, but none of these plots exist in Na Noi village. In general, the landscape is very much degraded and does not seem to be sustainable from a land use perspective. Even within poor forest areas there are mosaics of bare lands that could either be “unused” by local farmers (thus can be left for forest regeneration) or just a fallow stage of shifting cultivation. The cultivation area is wide, open along the stream, and cut into forest patches. Outside of the natural forest, tree-based land uses including planted forest and tree crop plantation exist but in small, fragmented areas. Na Noi village can be seen as one of the most degraded sub-divisions of the whole landscape with very small forest areas and is heavily dominated by upland annual crops and bare lands.

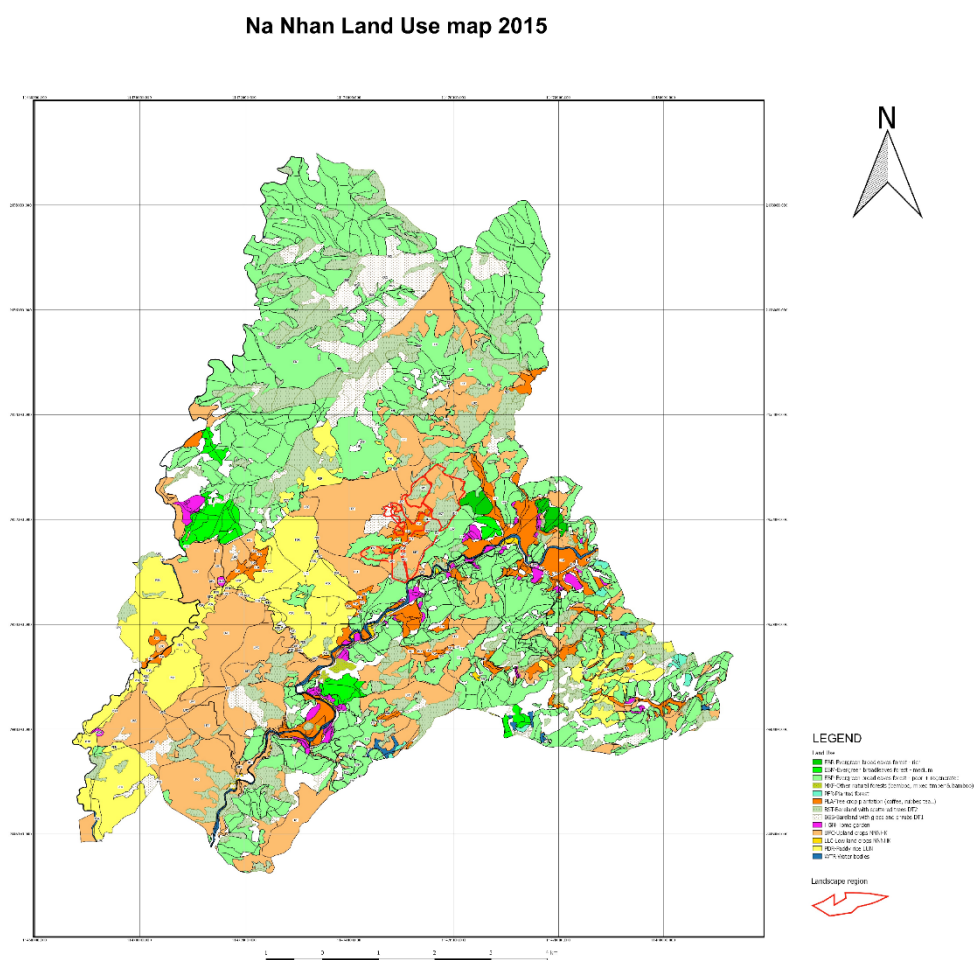


Figure 2. Land use map of Na Nhan commune (2015) with Na Noi village’s border in red.

Characterization of land uses through transect walks

Two transect walks were conducted to record environmental conditions (those arising in the natural, built, and experienced environments) and to capture the main issues relating to forest, tree, and crop management. Transect walks were conducted in two villages (Na Noi and Huoi Hoc) of Na Nhan commune, with participants including two researchers from the study team, one agricultural extension

staff, one cadastral staff, head of the village, and two other households in the village. Results of transect walks are shown in Figures 3 and 4 below.

In both villages, the transect runs from the upland down across the village and to the road, the low land and the stream. Na Noi village is located at an elevation gradient 750 to 1000masl, while Huoi Hoc village is from 860 to 1000masl. On top of the hill in both villages are community forests functioning as watershed protection forests. Heavy logging in the past led to the currently poor conditions of the forests that consists of many regenerated species and small timber such as *Melia*. Only small wild animals, such as squirrel, can be found in the landscape. Institutionally, these forests are under community ownership with support from the government through the PFES program. On mid hills, the slopes are about 20-25%, and the main crops (belonging to individual households) are cassava, canna, taro, and maize. These crops are all rain-fed. Trees can be found on the slopes but are low in density (tree cover is less than 10%). In Na Noi, villagers mostly planted fruit trees (e.g. pomelo, canarium, and plum) while in Huoi Hoc, villagers often plant fast growing timber species such as acacia, eucalyptus, and pine trees. By law, this mid-hill land is classified as forestry land, thus most of the households cultivating agriculture crops do not obtain land use right certificates. Although they maintain *de facto* rights to use the land, people are hesitant to put in long-term investment.

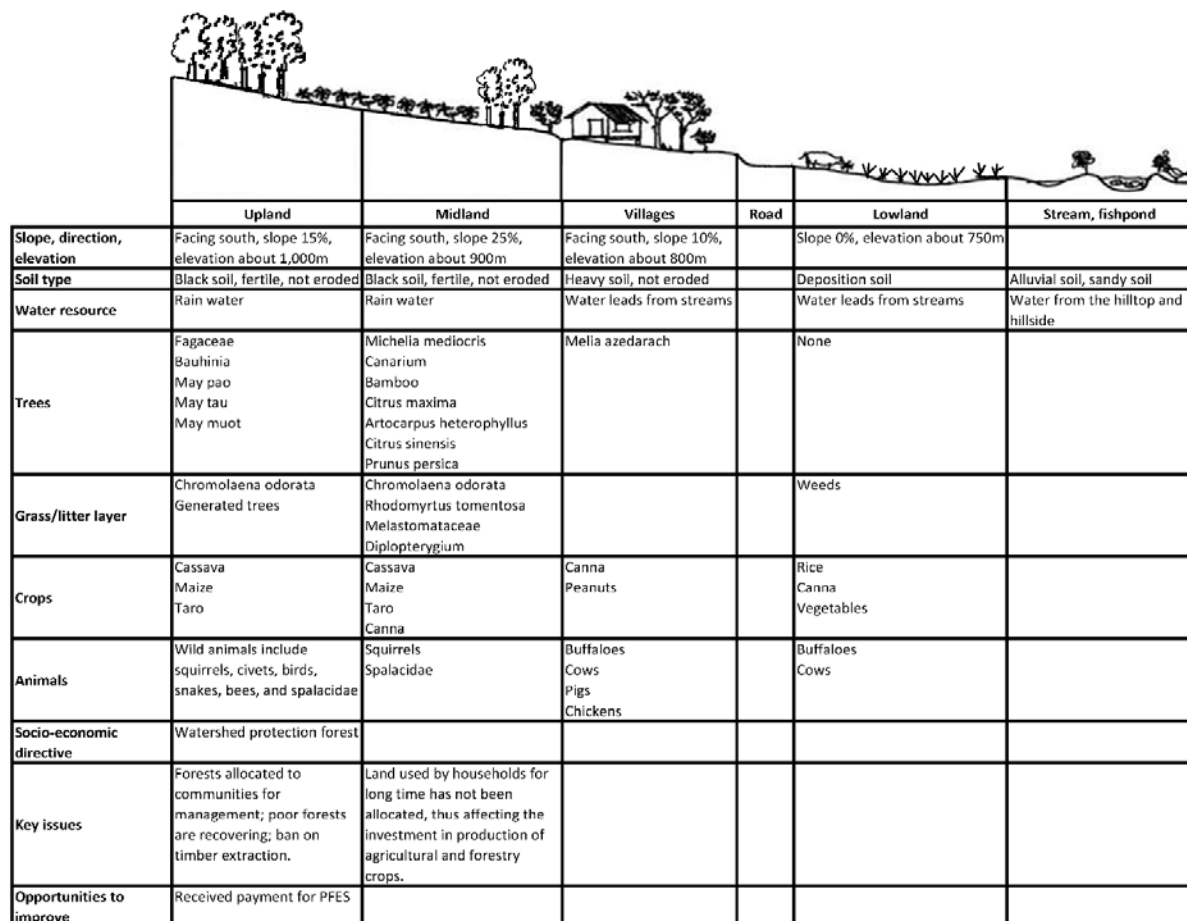
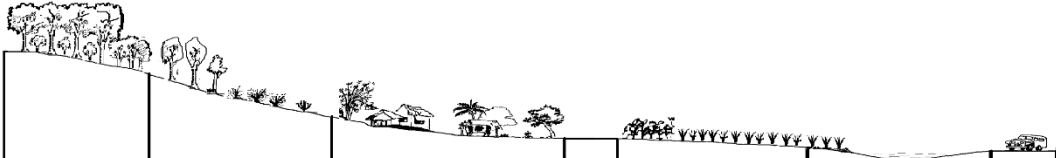


Figure 3. A transect of Na Noi village, Na Nhan commune



	Upland	Midland	Villages	Road	Lowland	Stream, fishpond	Highway
Slope, direction, elevation	Facing southeast, slope 15%, elevation about 1,000m	Facing southeast, slope 20%, elevation about 950m	Facing southeast, slope 8%, elevation about 900m		Slope 0%, elevation about 860m		
Soil type	Heavy soil with sand, slight erosion, fertile	Heavy soil with sand	Heavy soil, red, not eroded		Deposition soil, not eroded		
Water resource	Rain water	Rain water	Water leads from streams		Water leads from streams	Water from the hilltop and hillside	
Trees	Fagaceae Schima Michelia mediocris Melia azedarach May rom May tuu May pao	Acacia Pinus Eucalyptus Planted monoculture or intercropping	Grapefruit Peach Jackfruit Guava Plum Canarium Bamboo		None		
Grass/litter layer	Imperata Chromolaena	Imperata Chromolaena Rhodomyrtus			Weeds		
Crops	None	Maize Cassava Canna Peanuts Sweet potatoes Taro Ginger Turmeric	Cabbages Kohlrabi Cauliflower Onions Garlic		Rice Cabbages Canna Cassava Taro		
Animals	Squirrels Foxes Jungle fowl Spalacidae Muntjac	Squirrels Jungle fowl	Buffaloes Cows Pigs Chickens Dogs		Buffaloes Cows		
Socio-economic directive	Watershed protection forest						
Key issues	Forests allocated to communities for management; ban on timber extraction; poor or medium forests are recovering.	Agriculture production land used by households for long time has not been allocated, thus affecting the investment in production.					
Opportunities to improve	Received payment for PFES						

Figure 4. A transect of Huoi Hoc village, Na Nhan commune

The residential area (village) is located in the lowland near the road and the wet-rice cultivation area. In Na Noi village, people often plant *Melia azedarach* (timber tree) in this area, while in Huoi Hoc village fruit trees such as guava and plum are common. Most households in both villages obtain land use right certificates for their homes and home-gardens. In the lowland area, the presence of irrigation system allows local farmers to cultivate two rice crops annually.

Socio-economic conditions of Na Noi village

A total of 34 households were randomly selected for the socio-economic survey, accounting for 20% of total households in Na Noi village, with a higher proportion being represented by women (Table 5). Although the majority (88%) of the sampled households were male-headed, the high proportion of female-headed households indicates a greater challenge in terms of labor and financial capacity to address livelihood-related issues. The average age of respondents was 39 years, belonging to the mid-level working age group of the agricultural sector.

Table 5. Population and sample size

	Na Nhan commune	Na Noi village
Population (people)	5,081	
Number of respondents (people)		34
Percent over population (%)		
Average age of respondents (year)		39
Female respondents (%)		70.6
Male respondents (%)		29.4
Male-headed (% HHS)		88.2
Female-headed (% HHS)		11.8
Female-headed (absentee husband)		

Demographic profile of sample households

Table 6 summarizes the demographic profile of sampled households in Na Noi village. The majority of surveyed households were from the Thai ethnic minority, while the Kinh only contributed to 1.3%. The average household size is small (5 members), indicating a potentially low availability of labor. All the surveyed households were native to the communes. Most of the household heads attended education up to college level, but a significant number of respondents (about 12%) never attended school.

Table 6. Demographic profile of household respondents (2016)

	Na Noi
Ethnic group (% HHS)	
<i>Thai</i>	98.7
<i>Kinh</i>	1.3
Average age of household head (year)	42
Average household family size (people)	5
Migrant (%HHS)	0
Native resident (% HHS)	100
Education of household head (% HHS)	
<i>Primary</i>	41.2
<i>Secondary</i>	35.3
<i>High school</i>	5.9
<i>University</i>	0
<i>College</i>	5.9
<i>Never</i>	11.8

Socio-economic conditions

Based on Commune records, almost half (48%) of Na Noi village households are considered non-poor, notably higher than the commune's average (33%) (Table 7). About 20% of households are in near-poor status, although the difference between near poor and non-poor households is not so wide. The poor households made up to about one third of Na Noi's total households. Farming is the main occupation of most household heads (87%) (Table 8), and the main income source for households, consequently. However, a significant number of households in Na Noi village also reported other income sources such as employment and wage labor. Employment is often as civil servants such as teachers and staff of people's committees.

Table 7. Economic status of households (2016)

	Na Nhan	Na Noi
Socio-economic status (% HHs)		
<i>Non-poor</i>	33.4	47.7
<i>Near-poor</i>	25.0	19.9
<i>Poor</i>	41.6	32.5

Table 8. Main occupation of household heads and sources of income (2016)

Occupation	% of total number of household
<i>Farmer</i>	87.1%
<i>Employment</i>	0
<i>Wage labor</i>	0
<i>Official</i>	2.9%
<i>Trading</i>	0
<i>Business</i>	0
<i>Farming</i>	55.9%
<i>Employment</i>	35.3%
<i>Wage labor</i>	8.8%
<i>Business</i>	0

In Na Noi, the common source of farm income is arrowroot plantation (35% of hhs) followed by other crops (18% of hhs), pig raising (13% of hhs), rice production (9%) and chicken raising (9%). There is no income from timber tree plantation (yet) as the trees, if any, have only been planted very recently (Table 9). Apparently, trees provided none to very little economic benefit to households in Na Noi village in this context.

Table 9. Income from agricultural products (% of total agricultural income)

Crops	% of total agricultural income
Cassava	6%
Cow	0%
Maize	2%
Pig	13%
Buffalo	0%
Rice	9%
Chicken	9%
Fruit tree	0%
Timber tree	0%
Arrowroot	35%
Duck (Ngan)	1%
Other	18%

As indicated above, although farming is considered the main income source for most households across the four communes, several non and off-farm activities also significantly contributed to household incomes, particularly non-poor households. It is clear that poor and near-poor households obtain very little income from non and off-farms activities, while their agricultural income is also lower than that of non-poor households (Fig. 5).

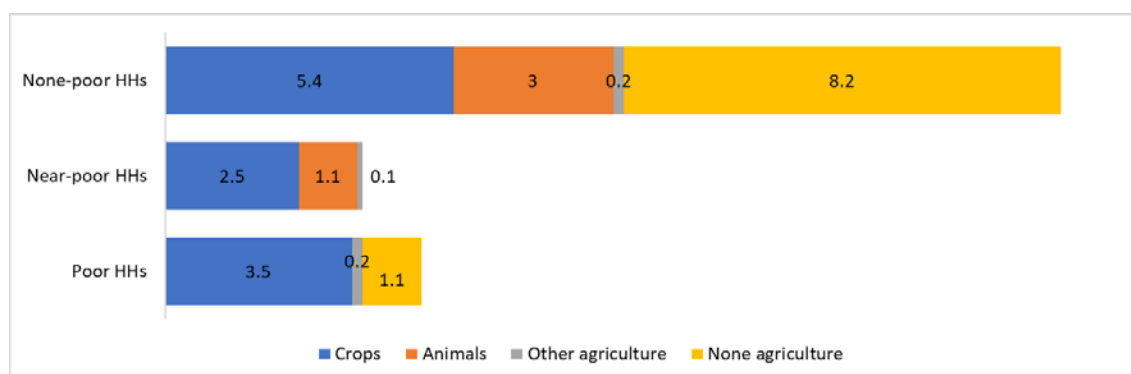


Figure 5. Sources of incomes by socioeconomic status of households in Na Noi village (Unit: million VND/household/year)

Land size and ownership

The average total land size of households in Na Noi is 1.8 ha. However, it is unequally distributed across household groups. The poor and near-poor groups own only 0.3 and 0.55 ha/household respectively, while the non-poor group owns 3.7 ha of land/household on average (Table 10). In all groups, the annual upland crops cover the largest land area. This is expected, considering that the village is located on hilly areas where flat land for rice and other annual crops cultivation is extremely limited. However, this may also bring potential threats to forest and ecosystem services (anti-soil erosion, water regulation, etc.) if proper land use management methods are not applied.

Table 10. Average household landholding by socio-economic status

Agriculture land	Poor	Near-poor	Non-poor	Total
Wet rice	742	899	2,047	1,355
Upland annual crops	2,218	4,538	34,473	16,994
Home garden	15	11	67	37
Other annual crops	0	63	100	59
Total	2,976	5,510	36,687	18,444
Minimum land owned	175	1,570	500	
Maximum land owned	13,000	13,840	303,000	

Table 11. Ownership of agriculture land by households in Na Noi village

Agriculture land	Land use right certificate	Rent	De facto	Total
Wet rice	21,670	1,360	23,026	46,056
Upland annual crops	11,300		566,500	577,800
Home garden			1,255	1,255
Other annual crops			2,000	2,000
Total	32,970	1,360	592,781	627,111

*No household land use right status can be taken over by the government anytime.

Land ownership varies with the type of land use. Overall, about half of households have better land tenure status for wet rice (holding Redbooks). However, many of the upland annual crops (classified

as forest land by the Government) are under *de facto* use— whereby informal and/or customary property rights regimes have been practiced with no security of tenure for this land use type (Table 11). Regarding forest land ownership, there are only two out of 34 households that are officially allocated natural forest land for production purposes. A community forest has also been allocated to the whole village.

Food sources and security

When it comes to food sources, only one third (35%) of households in Na Noi depend on their own farms. Deficits in farm-produced food are offset by buying food supplies from the market and borrowing from neighbors, while the farmlands and their products are limited in size, quantity, and diversity. On average, food shortages (from one’s own farm) last for about 2.1 months/year. The causes of the shortage of farm-produced food are varied, but the principle drivers are limited and lack of land to cultivate food crops, as well as low land productivity. The ways in which households overcome food shortages also vary, ranging from buying foodstuffs from the market, borrowing grains or money from neighbors, to eating less and harvesting wild plants (Table 12). While non-poor households can offset food shortages through a cash income from non-farm sources, poor and near-poor households with very limited income may have to find jobs elsewhere and borrow food/money from others.

Table 12. Food sources and food shortage

	% of total respondents
If from own-farm, is food sufficient for the whole year? (% HHs)	
<i>No</i>	65%
<i>Yes</i>	35%
No of months food shortage is experienced	2.1
Months of lean periods (% HHs)	
Causes of food shortage (% HHs)	
<i>Limited land</i>	41%
<i>Low land productivity</i>	21%
<i>Infertile soil</i>	21%
<i>Poor quality of water for irrigation</i>	
<i>Lack of labor</i>	
<i>Financial limitation for crop cultivation</i>	12%
<i>Big family size</i>	
<i>Not a farmer so didn't cultivate the land</i>	
<i>Crop failure</i>	
<i>Others</i>	
Ways to overcome shortage (% HHs)	
<i>Buying from market</i>	24%
<i>Borrow grain from neighbors</i>	35%
<i>Consume fewer meals</i>	3%
<i>Borrow money to buy food</i>	21%
<i>Harvest wild plants</i>	3%
<i>Consume other food</i>	
<i>Others* (look for jobs elsewhere)</i>	9%

* For example, migrate for work, getting support from family

Farming systems and issues in Na Noi village

The majority (about 75%) of total farm land in Na Noi village are under extensive, long-fallow rotation cultivation of annual crops. Intensive, continuous cultivation of annual crops on land where soil fertility and water/irrigation is suitable accounts for only 16% of total farm land (Table 13). This presents a challenge to local households in obtaining sufficient food and income from their degrading cultivation land. Tree plantation is the only tree-based cultivation activity disclosed by respondents, and accounts for only 0.5% of their total land area.

Table 13. Farming practices of households in Na Noi village

Farming practices	Area (m ²)	%
Extensive, long rotation cultivation of annual crop with long fallow period (more than 5 years)	472,600	75.4%
Intensive, continuous cultivation of annual crops (no fallow)	101,011	16.1%
Intensive annual crop cultivation with short fallow period (2-3 years)	45,800	7.3%
Intensive annual crop cultivation with a medium fallow period (3-5 years)	4,700	0.7%
Mono-plantation of timber tree	3,000	0.5%
Total	627,111	100%

The respondents said that wet rice and paddy rice are the most common agricultural crops, followed by arrowroot and cassava (Table 14). Wet and paddy rice provide the most important source of staple food, but not the main income source by most households. Most households also have some plots of arrowroot, cassava or often a mix of the two. While cassava is commonly used as a fodder, arrowroot is often sold to traders for cash income for the family as, currently, the market demand for it is high.

Table 14. Most common agricultural crops, as perceived by respondents

Crop	Total area (m ²)
Wet rice and paddy rice	47.756
Arrowroot	31.200
Cassava	14.600
Cassava + Arrowroot	10.600
Cassava + Maize	10.100
Maize	1.000
Taro	300
Peanut	200
Vegetable	40
Melon	15

Respondents reported that moderate to severe soil erosion is taking place in different farming systems due to the cultivation on (steep) sloping land (Table 15). Majority of cultivated land is facing moderate soil erosion. The “no erosion” area is reported to be around 5 ha, mostly flat land for wet rice cultivation. Serious and severe soil erosion occurs on hilly areas being continuously cultivated with soil erosion control.

Table 15. Soil erosion as reported by respondents in different farming systems

Soil erosion	Area (m ²)
3. Moderate	533,700
4. No erosion	50,211
2. Serious	42,700
1. Severe	500
Total	627,111

Although respondents were aware of a soil erosion on their agricultural land, only 12% applied soil conservation measures (tree planting, soil cover, grass strips, etc.) (Table 16). The main reason is a lack of 1) knowledge to protect the land, 2) financial capacity, and 3) experience.

Table 16. Soil conservation measures as reported by respondents

Soil conservation measures	Number of household	Percentage (%)
No	30	88%
Yes	4	12%
Total	34	100%

Water shortage affects farm irrigation for nearly two third of households in Na Noi, commonly for up to 3 months (Table 17). Farmers reported that they can sometimes cultivate one additional crop on slope land in years with high rainfall, thus significantly increasing household income. Therefore, if addressed, water scarcity, can significantly improve local livelihoods.

Table 17. Water scarcity on farms as reported by respondents

	Number of HHs	%	Months in a year, water shortage is experienced
Not experienced water scarcity	12	35%	
Experienced water scarcity	22	65%	3.2

Trees on farm and support needed for expanding tree plantation

Trees on farm is an important indicator of sustainable farming and land use practices. During the household survey, we used a combination of methods including questionnaires and field observations to determine the presence of tree species on respondents' farms. In total, there were 22 tree species identified (Table 18). Plum (fruit tree) and Mangletia (timber tree) were found most abundant and, together, these two species account for 59% of total number of trees on farm. Peach tree is also common (10% of total tree number). In contrast, only one or two trees of some species such as Macadamia, Pine, and Tamarin could be found during our survey. Some common fruit trees such as pomelo, guava, jackfruit, avocado, and mango were mainly found in home-gardens but not in significant quantity. The main purpose of planting fruit trees was to harvest fruits for household consumption. Some species including Michelia, Schima, and Canarium were planted for collecting seeds, fruits, and leaf that have high market value. Coffee was found planted on one farm by the owner as a trial. This species is commonly planted in highlands of the Northwest with very promising economic benefits. The two timber tree species (Mangletia and Acacia) were intended to be sold as

raw materials like pulp. Overall, on-farm tree density was calculated as 35 trees/ha, but the actual number could be lower as some respondents tended to overestimate the number of trees on their farms.

Table 18. Trees on farms as reported by respondents

Local name	English name	Scientific name	Number of tree	%
Mận	Plump	<i>Prunus salicina</i>	849	39%
Mỡ	Mangletia	<i>Manglietia conifera Dandy</i>	435	20%
Đào	Peach	<i>Prunus persia</i>	220	10%
Keo	Acacia	<i>Acacia mangium</i>	165	8%
Bưởi	Pomelo	<i>Citrus grandis</i>	115	5%
Cà phê	Coffee	<i>Coffea robusta</i>	100	5%
Giổi	Michelia	<i>Michelia mediocris Dandy</i>	89	4%
Bơ	Avocado	<i>Persea americana Miller</i>	53	2%
Vối thuốc	Schima	<i>Schima wallichii Choisy</i>	45	2%
Trám đen	Canarium	<i>Canarium tramdenum Dai & Ykovl</i>	38	2%
Xoài	Mango	<i>Mangifera indica</i>	16	1%
Chanh	Lemon	<i>Citrus limonia</i>	15	1%
Xoan	Melia	<i>Melia azedarach</i>	14	1%
Táo mèo	Hmong's apple	<i>Docynia indica</i>	10	0%
Mạ lúa	-	-	4	0%
Mít	Jack fruit	<i>Artocarpus heterophyllus</i>	4	0%
Ổi	Guava	<i>Psidium guajava</i>	4	0%
Sầu	Dracontomelon	<i>Dracontomelon duperreanum</i>	3	0%
Trứng gà	-	<i>Pouteria lucuma</i>	3	0%
Mắc Ca	Macadamia	<i>Macadamia integrifolia</i>	2	0%
Thông nhựa	Pine	<i>Pinus latteri</i>	2	0%
Me	Tamarin	<i>Tamarindus indica</i>	1	0%
Total			2187	

When it comes to tree planting as a livelihood activity, the majority (74%) of the respondents expressed a desire to obtain support to plant more trees. Those who expressed their uncertainty later revealed that they were constrained by a lack of labor and, more significantly, by a lack of land. When asked about the support needed for tree planting, more respondents mentioned input supports such as seedlings, and fertilizers and pesticides (59%), followed by training on new techniques (tree management support) (38%). Only 12% of households wished to obtain financial support or credit (Table 19). According to farmers, their hesitation towards investing in tree plantation was not about a lack of financial capital, but rather to do with concerns about the quality of seedlings and agricultural inputs, as well as a lack of knowledge on how to manage the trees.

Table 19. Key challenges related to farm-based livelihoods

Do you need support to plant more trees?	Percentage of respondents (%)
No answer	26
Yes	74

Support needed to establish/expand tree-systems	
Farm equipment	0
New techniques/training	38
More agricultural/arable land	0
Fertilizer, pesticide	59
Seedlings	59
Capital/credit	12
Market support (buying products)	3

Landscape governance for ecosystem services

Landscape management decisions are considered complex due to the multiple-use nature of goods and services, difficulty in quantifying ecosystem services, and the involvement of all stakeholders on the landscape. In this section, we provide a quick assessment of stakeholders' perspectives of ecosystem services provided by the landscape, the forest and key agro-ecosystems in the landscape, insights of current forest/landscape governance mechanisms, and local stakeholders' recommendations on how to improve landscape governance to secure and enhance ecosystem services flows which, in turn, can be used as inputs for policy making and decisions regarding sustainable landscape management.

Environmental and agricultural challenges, and forest status in the landscape

To elicit stakeholders' perceptions of landscape ecosystem services—which can be an unfamiliar concept to them, we first explore issues concerning forest, agriculture and environment to be gradually incorporated into the discussions. As shown in Table 20 below, the three most pressing issues perceived by farmers are changing climate, degrading soil (quality), and increasing pest and diseases affecting agricultural crops; these were all related to agricultural production. More specifically, stakeholders highlighted issues of seasonal change and rainfall pattern (climate change), declining productivity and increasing demand for fertilizer (degrading soils), declining productivity and increasing demand and use of agricultural chemicals, pesticides and herbicides (pest and diseases). These are consistent with results of the household survey where farmers reported an increase in the application of chemical fertilizers and pesticides to ensure crop productivity.

Table 20. Environmental and agriculture issues reported by farmers

Environmental and agricultural issues	Number of respondent select (%)	Most mentioned issues
Lack of water for domestic use	x x x x x	62.5%
Drought	x x	25.0%
Flood	x x	25.0%
Changing climate	x x x x x x x	87.5%
Lack of fuelwood	x	12.5%
Degrading landscape scenery	x x	25.0%
Reducing number of natural species	x x x	37.5%
Landslide	x x x	37.5%

Environmental and agricultural issues		Number of respondent select (%)	Most mentioned issues
Lack of timber	x	12.5%	
Lack of NTFPs	x x	25.0%	
Lack of agriculture land	x x x x x	62.5%	
Degrading soil	x x x x x x x	87.5%	X
Soil erosion	x x x	37.5%	
Pest and diseases	x x x x x x x	87.5%	X
Low agricultural productivity	x x x x x	62.5%	

(source: focused group discussion)

In terms of forest quality, in the past a declining trend was observed by respondents, followed by a recent increase (Fig. 6). However, during the survey, many respondents seemed to mistakenly recognize forest quality as forest cover, an indicator used intensively in governmental reports and propaganda program. Therefore, when asked about forest quality, they instead provided their assessment on forest cover. Accordingly, it shows that current forest quality has been recently improved, and that the trend will be positive in the future. This coincides with the commune’s report on forest status and environmental protection activities.

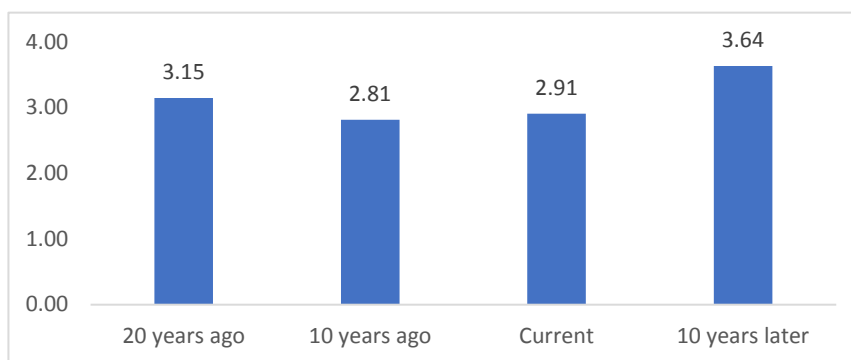


Figure 6. Past and future forest quality (Average rank by respondents whereby 1: depleted; 2: poor; 3: medium; 4: fair; 5: good)

Despite this positive trend in forest cover, the forest resources and wildlife continue to be threatened by rampant deforestation, illegal logging and poaching, and conversion of forest to agricultural land, likely by surrounding forest-dependent populations who lack alternative economic means to cover their daily expenses. This could explain the fact that, although forest cover is increasing, the quality of forest is declining. This reality is also reflected in the Provincial REDD+ Action Plan (PRAP), which mentioned that ‘judging from provincial circumstances and existing data of forest status, degradation and regeneration of forest are widely spread in entire province recently’ (Dien Bien PPC, 2014).

According to respondents, illegal logging is most frequently found as a cause of degraded forest quality, followed by forest fire and forest conversion to agricultural land that could likely be combined, as forest fire is often a consequence of slash and burn cultivation (Fig. 7). Interestingly, although the timber plantation area of the village is small, six respondents reported this to be a cause

natural forest loss. It is likely that forest conversion was reported (to the commune) as being for timber plantation (so that it is easier to get permission), but the actual use is planting annual crops for short-term income.

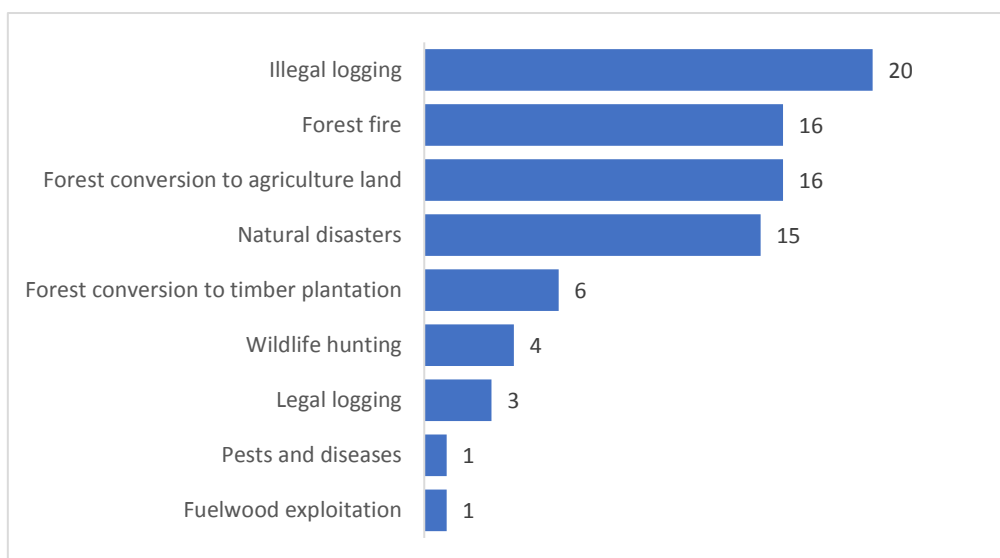


Figure 7. Main causes of deforestation and forest degradation (number of choices made by respondents)

Stakeholders' awareness of ecosystem services provided at landscape level

To ensure that stakeholders could more easily understand the concept of ES, we interpreted ES as “benefits” that the landscape provide to local communities in their daily life and for future generations. Stakeholders were then asked whether they recognized each of the benefits. The result (Table 21) shows that most of stakeholders were aware of these benefits. Carbon storage and cultural values- due to their abstract nature- are the two ES that stakeholders were least aware of (29% of stakeholders were either not sure or not aware of these ES). Indeed, comprehension of carbon storage could have been much lower if there was no REDD+ education campaign organized in the commune some months before our workshop.

Table 21. Stakeholders' awareness of ecosystem services

Ecosystem services	Yes (%)	No (%)	Not sure (%)
Soil formation	100%	0%	0%
Nutrients cycling	88%	6%	6%
Biodiversity	88%	6%	6%
Climate and weather regulation	82%	6%	12%
Regulation of water flows	88%	6%	6%
Mitigation of natural disaster	100%	0%	0%
Water purification and waste treatment	100%	0%	0%
Anti-soil erosion	94%	0%	6%
Carbon storage	71%	0%	29%
Biological control	82%	0%	18%
Pollination	82%	0%	18%
Clean water	94%	0%	6%
Food	94%	0%	6%

Ecosystem services	Yes (%)	No (%)	Not sure (%)
Fuel	88%	0%	12%
Wood and fiber	88%	0%	0%
Fodder and fertilizer	94%	0%	6%
Medicine	100%	0%	0%
Natural scenery	88%	12%	0%
Tourism and entertainment	82%	6%	12%
Cultural and spiritual values originated or derived from nature/natural resources	71%	0%	29%

Local perspectives on ecosystem services

Based on existing studies and frameworks, we identified 20 ecosystem services that aligned with four functional domains: life-support, regulation, provision, and information (Table 21). By eliciting residents' assessments for these 20 ecosystem services, we were able to compare their relative importance, their trends (declining, improving, or unchanged), and the roles of key ecosystems in providing such services. The result suggest that stakeholders were aware of the role of tree-base ecosystems in providing environmental services (the scores indicating the importance of natural forest, planted forest, perennial plantation, fallow, and mixed home garden in providing ES are 88/100, 61/100, 40/100, 37/100, and 24/100, respectively, while the non-tree-based ecosystems including upland annual crops and flat land annual crops were both well under 20/100) (Table 22). Specifically, there was a strong correlation between the number of trees in the ecosystem (relatively) and their role in ES provision, as perceived by stakeholders. This result also reaffirms forest status assessment mentioned above; that forests quality (and thus their ES provision capacity) is declining in the whole landscape of Na Nhan commune. On the positive side, according to stakeholders' perceptions, perennial plantation and fallow are the two ecosystems that are improving in most aspects of ES provision. This result had strong implications for stakeholders regarding the role of forest and tree-based land uses in securing their well-being and agriculture production. Later when asked about recommendations for landscape governance, they expressed their wishes to enhance forest management and sustainable upland cultivation (see section 3.4).

Table 22. Stakeholders' assessment of roles of forest and agro-ecosystems in providing ecosystem services in Na Nhan commune

Ecosystem services	Natural forest	Planted forest	Upland annual crops	Perennial plantation	Mixed home garden	Wet rice and flat land annual crops	Fallow	Water surface
Soil formation	5	4		1			2	0
Nutrients cycling	5	3		2			2	0
Biodiversity	5	1		2	1		4	1
Climate and weather regulation	5	4		2	2		1	2
Regulation of water flows	5	4		3	2		2	0
Mitigation of natural disaster	5	4		2	1		1	
Water purification and waste treatment	5	4		3	2		2	
Anti-soil erosion	5	4		2	1		2	
Carbon storage	5	5		2	1		3	

Ecosystem services	Natural forest	Planted forest	Upland annual crops	Perennial plantation	Mixed home garden	Wet rice and flat land annual crops	Fallow	Water surface
Biological control	5	3		2	1		3	3
Pollination	5	4	2	3	2	2	2	
Clean water	5	3		2			2	
Food	3	2	5	3	3	5		3
Fuel	5	3		2			2	
Wood and fiber	4	4		1			2	
Fodder and fertilizer	3		5		3	4	3	
Medicine	3				1		2	
Natural scenery	5	4	3	3	2	2	1	3
Tourism and entertainment	2	3	0	3	1		1	4
Cultural and spiritual values originated or derived from nature/natural resources	3	2	3	2	1	3		2
Total	88	61	18	40	24	16	37	18
Highest possible points	100	100	100	100	100	100	100	100

Legend for table:

Current trend (color code)	Declining significantly	Declining	Declining slightly	Improving slightly	Improving	Improving significantly	not relevant
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Role in providing ES (number code) 5: Vital 4: Important 3: Fairly important 2: Minor 1: Very minor 0: Not relevant

Governance actors and mechanisms

Policies, institutions and legal framework

As a village, Na Noi is not considered a Government administrative unit, and is administered by Na Nhan Commune's People Committee (Na Nhan CPC)---the CPC is thus, a key actor in the governance of Na Noi. The Na Nhan CPC is in charge of law enforcement, public services, and implementation of all government policies in Na Nhan commune, including Na Noi village. The CPC is also responsible for developing annual socio-economic development plans, implementing the plan, and reporting to the next governmental level (district).

Another key actor in the governance of Na Noi is the Department of Forest Protection---forest law enforcement is performed by this Department at both district and commune levels. In some cases, a special task force is formed for forest patrolling which includes forest rangers, police and even the army. However, according to farmer's perceptions, the role of local authorities is not clearly regulated, and the rights of forest rangers are not reflective of their assigned duties. Moreover, the rights and responsibilities of forest owners are not clearly defined in legal documents, which leads to, or exacerbates conversion and degradation of forest lands as some regulations in the law give forest owners more rights over the land than rights over the resources on that land. In general, the enforcement of laws to control illegal logging is considered ineffective.

Payment for forest environmental services (PFES)

Payment for Forest Environmental Services (PFES) is a national policy issued in 2010 that obligates water and electricity users to pay for upstream forest owners through hydropower and water supply companies. PFES is by far, the only governance mechanism that directly internalizes the externalities of natural resource use, and thus help to balance the economic trade-offs between forest extraction and forest protection. According to Le *et al.* (2016), PFES has been implemented in Dien Bien since 2012 with high revenues collected from buyers –about USD 12 million– placing it 5th among the top provinces that generated the highest revenues for PFES. To date, 84% of the forest area in Dien Bien province is entitled for payments. Service providers receiving payments are forest owners such as individuals, households and communities. Up until 2014, these service providers have received about 88% of total payment (USD 5 million). However, according to several authors, including McElwee (2014), PFES should be significantly improved with regards to rights of forest owners, equity in accessing rights to use the forests, transparency in payment mechanisms, and the involvement of relevant parties in the development of the collection and payment mechanism.

In Na Noi village, 33 out of 34 respondents reported to have received ES payments at a flat rate of 200,000 VND/household/year. Accordingly, all households in the village are part of a communal group managing the forest in the form of community forestry. As a group, they conduct forest protection and development activities and receive payment for watershed services (from hydropower plant downstream in Son La province) in return. However, our survey showed that not all respondents participated in these activities. Of the interviewed farmers, only 12% said their households participate in forest patrolling 52% in forest plantation 52% (Table 23). Nevertheless, there is no difference between participating and non-participating households in terms of the amount of PFES received. The amount, being very small (about 2% of average households' annual income) and given unilaterally represents an unfair distribution of PFES revenue, and potentially discourages participation or the positive behavior intended to be triggered by the scheme. This result confirms findings of Le *et al.* (2016) in Dien Bien province where most village heads (69%) and household respondents (82%) reported that the process of setting the payment level was neither transparent nor well understood.

Table 23. Household participation in PFES activities

Activity	Participant HH	Non-participant HH	% of participation
Forest patrolling	4	29	12%
Forest plantation	17	16	52%
Assisting forest regeneration	11	22	33%

Participation in planning and decision making

It is well-known that the policies and decisions relating to resource management in Vietnam are often imposed from the top down, and lower-level agencies must act within the scope limited by their direct superiors. At the grassroots level, people's actual participation in land and forest management

processes and planning (including land allocation and monitoring) has been disputed, despite the fact that stakeholder consultation at all planning levels is required by law.

We investigated household participation in the land use planning process of Na Noi village (Na Nhan commune), and found that 35% of respondents were not consulted, while 65% have no information about it. Similarly, 32% of respondents said they did not know that their participation in land use planning consultation is regulated by law, while 68% said they have no idea on this matter.

Consequently, 94% of respondents could not tell whether they are satisfied or not, with the existing land use plan. In terms of land use planning implementation, only 3% of respondents said they have been informed about the results of the implementation of land use planning, while 26% said they have not been informed, and 71% said they have no idea. When asked about key benefits of having a land use plan to the commune in general, only 4 out of 34 respondents took at least one choice, while 30 respondents made no choice at all (Table 24).

Table 24. Benefits from having a land use as perceived by respondents

Benefits	Number of respondents	Choice made by respondents	Percentage (%)
Better management of forests	34	4	12%
Better environmental protection	34	3	9%
Proper land allocation for different purposes	34	2	6%
Land conflicts are mitigated	34	2	6%
Traditional and customary cultivation and land use practices are facilitated	34	2	6%
Land use rights are clarified and secured	34	1	3%
People's participation in land resources management is enhanced	34	0	0%
Financial support for better land use management	34	0	0%

From the figures above, there has been an evident lack of people's participation in land use and forest planning process, hence, in decision-making. Additionally, indigenous knowledge and local customary land use practices have been only marginally supported, and this could lead to risks of non-compliance. Finally, in the context of forest governance, there was no evidence in forest planning showing which agencies and parties were involved and their roles in decision-making.

Community forestry

In 2008, a foreign supported project helped the Na Noi village community to build a community forest management (CFM) system on a 220 ha forest. The CFM was well organized with a management board and internal regulations of managing the forest, a benefit sharing scheme, as well as budget management. Since 2013, about 148 ha of this community forest has received payments from the PFES program as part of the government's policy on supporting upland communities surrounding natural forests. Income from PFES has been used for community purposes and shared amongst households contributing to forest patrolling and other protection activities. So far, this is the only income source from community forests that the local community gets. Involvement in community forest activities has not yet brought sufficient economic and cultural benefits to local

people, and their actual participation is low. It was found in the stakeholder workshop that only a third of households in the village participates in assisting natural forest regeneration, while it is significantly lower in community forest patrolling. Furthermore, there is a lack of funding for the organization of meetings and trainings on forest inventories for community forestry members.

Stakeholders recommendations toward sustainable landscape governance

The stakeholder consultation workshop ended with a question to elicit recommendations on how to improve the effectiveness of landscape governance mechanisms so that both ecosystem services and livelihood benefits can be secured. Participants hesitated to provide comments regarding law enforcement, policy and institution, and participation/monitoring in policy making and decision making. With the presence of commune leaders and some officials, this is understandable. However, recommendations were made to clarify land use and resource rights/access, incentive mechanisms, and to develop common goals and plans, and improve capacity to manage forests. Their recommendations concentrated on two land use types, the natural forest and upland annual crops (shifting cultivation) where land use/access rights are still ambivalent (see Table 25). While these recommendations should be considered a priority in any future intervention, further investigation will be needed to elaborate on stakeholders' recommendations.

Table 25. Stakeholders' recommendations on landscape governance towards securing ecosystem services and other livelihood benefits

Category	Targeted land use type	Current state of management	Specification
Clarify and enhance land use rights	Upland annual crops (shifting cultivation)	<ul style="list-style-type: none"> - There is no plan or guideline for management and use of this type of land - Interchangeable use of lands between farmers - Land use rights certificate is issued for this land as "forest land" 	<ul style="list-style-type: none"> - There is a need for land delineation with clear borders, maps, and a detailed land use plan/guideline
Develop/enhance incentive mechanisms that encourage good behaviors	Upland annual crops (shifting cultivation)	There has been no guideline or support for sustainable cultivation methods for upland land farming (shifting cultivation), thus farmers end up with unsustainable practices	Technical support and demonstration pilots, upfront support for seedlings to households who wish to plant more trees on their shifting cultivation land
Develop and obtain consensus on a common management goal	Natural forest	The current forest management plan is made at commune level and is ineffective in encouraging local communities' engagement. The plan focuses on forest protection objectives without due consideration of sustainable economic and livelihood development	Support for developing a community forest management plan based on specific economic and ecological goals, with a strong focus on securing ecosystem services
Develop business plan/model	Natural forest	No business plan/model exists	Develop a business plan for natural forest restoration
Capacity development	Upland annual crops (shifting cultivation)	No governmental program/project aimed at capacity building for shifting cultivators	Training, sharing lessons learnt, and knowledge sharing

Summary and recommendations

Na Noi village is one of 22 villages of Na Nhan commune, in Dien Bien province. The village is a mosaic landscape comprised of natural forest on hill tops, very degraded forest and grassland mixed with shifting cultivation plots mid-hill, and wet rice cultivation and settlement areas in the low lands. Outside forests, trees are hardly planted on farm lands due to limited lands and lack of inputs. Timber tree plantation is not common, while fruit tree orchards exist mainly for household consumption only. The village has a total population of 281 people, all of whom belong to the Thai ethnic group native to the site.

Agricultural production is insufficient even for subsistence purposes—for example, rice production is only good for a 9-month supply in a year; hence, households rely on non-farm and off-farm income to address food shortage. In terms of economic status, poor and near-poor households account for about half of total households in the village (and also Na Nhan commune), and they own significantly less cultivated land, and also have less non and off-farm incomes than non-poor households. The majority of households established home gardens but are generally in poor condition. Amongst agricultural products, arrowroot appears to be the dominant income source, while rice and cassava production are only used for household consumption.

Most households generate additional income from the PFES program, but this only contributed to about 2% of household income. Meanwhile, only about half of households in the village participated in PFES activities. Soil and water conservation technologies are rarely practiced by farmers, resulting in moderate to severe soil erosion on farmlands. Ownership is clear for residential and agricultural lands with some households possessing red books, but it is uncertain in protected forest where rights are interpreted differently. Although natural forest exploitation is restricted, agricultural expansion is ensuing furtively to expand livelihoods, and illegal logging is still considered the most significant cause of forest degradation in the area.

The decline of forest quality in some other agro-ecosystems in the landscape led to declining provision of most ecosystem services and agricultural production in the landscape, and is well understood by local stakeholders. Meanwhile, current governance mechanisms, including legal framework and policies, land use and forest planning, PFES, and community forestry, have either not been well enforced and implemented, or lack engagement by local communities. Consequently, the landscape's capacity to provide ecosystem benefits and well-being has been continuously degrading.

The forest-landscape in Na Noi and Na Nhan will continue to decline for as long as the profitability of agricultural pursuits on cleared land is greater than that of traditional forest extraction, assuming the regulatory environment remains unchanged, thus sustainable intensification of agriculture without continued deforestation must be investigated. However this requires real economic and policy incentives as well as the necessary technological base and marketing infrastructure to support such a development path.

Stakeholders provided useful recommendations for improving landscape governance towards sustainable development, particularly on improving rights and access to natural forest and shifting cultivation lands (which is classified as forest land by law).

In addition, we recommend further studies to address latent issues, as well as knowledge and policy gaps:

- Integration of trees on Na Noi and Na Nhan landscapes is obviously required to improve ES and income for local people. A wider range of tree-based ‘best bet’ alternatives for smallholders (both agroforestry and silvopastoral) should be examined for their environmental, agronomic and economic characteristics, and for the feasibility of their adoption.
- Although there has been an improved understanding of the links between environmental services and the ways in which people exploit them, which could serve as a basis for developing new economic and environmental policies, existing legal regulations, policies, and incentives must first be adjusted to allow for flexible implementation of legal regulations.
- PFES, or PES in general, may provide a mechanism to fund and secure the desired change in ecosystem services. A more flexible mechanism for PFES should also be considered to create a business case for private sector’s buy-in.
- There is a lack of tangible knowledge on ES flows and its links to land use practices and land cover changes. It is necessary to build effective multidisciplinary teams for the study of complex land use issues, but sufficient resources (time, funds, etc.) are required for the teams to remain effective.

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