Assessment of Forest Rehabilitation and Management in Northern Provinces, Lao PDR

Sustainable Forest Management Project in Northern Provinces of Lao PDR
[Project ID: 2014 P1-ASEM]

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Executive Summary

Forest resources plays important roles for Lao PDR on economic development and local livelihoods. Their degradations and depletions will certainly impact on many aspects, particularly the poor. The country's forest was decreased at alarming rate since 1990 as the annual forest loss rate was around 1.4% (134,000 ha). The forest degradation and loss is not only globally impact – the climate change, but also locally regarding the decline in supplies of forest resources which impact on local livelihoods. The Northern Provinces of Lao PDR having faced with the forest degradation and deforestation annually due to mainly shifting cultivation[1], over-harvest of forest resources and forest fires. The underlying causes of these are the needs of food including rice and incomes. Other underlying causes are due to population growth and commercially cropping promotion policy without readiness preparation and detailed studies. The issues were recognized and aware to necessarily reverse the loss by the Government of Lao PDR since early 1985.

In response to that the government has tried hard to retain the forest loss. Significantly, the National Forest Management Program was launched as the land and forest allocation program began in 1990 and declared first 18 National Biodiversity Conservation Areas in 1993. Then, National Forest Strategy was endowed in 2005 to achieve the country's forest cover at 70% by 2020. Of which, the land and forest allocation program is an important intervention to limit shifting cultivation across the country. However, the strategy has not been well translated and exercised effectively on the ground. Thus far, the forest rehabilitation approach in Lao PDR has not been sustainable and not taken in account of biodiversity aspect. Due to limited budget and technical skills of government made the past land and forest allocation without holistic analysis, customary natural resource uses, monitoring and livelihood development.

Therefore, the Sustainable Forest Management Project of Asia-Pacific Forest (APF) Network would make significant in long run for forest rehabilitation, enhancing forest quality that also benefit local communities. For Lao PDR, it is principally believed that to take effective land use planning to allocate some poor and potential forest to having sufficient time in regenerating is good enough from naturally forest recovering for the northern region. Meanwhile, some livelihood support related to forest resource management are necessary. The project starts with analyzing to designing and demonstrating possibly innovative approaches for sustainable forest management in the region, especially for Lao PDR. The target provinces, Luang Namtha, Oudomxay and Bokeo are located along Lao-China border, and partly to Myanmar and Thailand. As to plan for the forest rehabilitation, restoration and management of the project sites requires to conduct an assessment on the current status, potentials of forest rehabilitation, restoration and management of the pilot villages of Lao PDR in the context of forest ecosystem.

[1] Shifting cultivation that is practiced in long-fallow (15 years old) requires more forest land be converted and resulted to forest degradation, loss of original forests but in short-fallow (<3 years old) resulted to deforestation.

Results of the assessment show that the target provinces have as large area of three forest categories as 1,769,421 ha and potential forests (1,269,460 ha) especially in the Oudomxay Province (see item 5.1). The forests in target villages covering over 50% each and comprising some good forest conditions and some wild animals were reported (see item 5.4.2). Almost all the forests of the pilot villages are semi-evergreen and some mixed deciduous forest. Among those, Ban Nam Pheng has good forest condition being maintained, having been better in cover and quality. The forest resources of Ban Nam Pheng provide substantial benefits to many neighbouring villages in the area including the people from Namo town. Ecosystem service of Ban Nam Pheng is tangible and that shows other villages on the importance of forest protection. Ban Nam Pheng becomes an example village in the area whose forest is well protected from conversion and selling concession of villagers to Chinese investors. Whereas, other villages' forests are fewer today due to converting to rubber tree plantation and other cash crops. Consequently, those villages have suffered with insufficiency of wild foods including fish and wild vegetable after the majority of their forest areas was converted.

Forest degradation and loss are an issue in the north region resulted in local livelihood impacts. A small illegal logging scale, over-harvest of non-timber forest products (NTFPs), forest fires resulted to forest degradation (see item 5.4.3). But the deforestation is mainly by shifting cultivation in short fallows and particularly the boom of cash crop plantation from early 2000 such as rubber tree plantations. Currently, sugar cane plantations are being invested in Ban Houy Hom and bananas plantation in Ban Don Ngeun. The concern is that some part of their agricultural land was sold in concession to Chinese investors made their agricultural land is limited and forest conversion. Some local villagers are hired for planting and weeding the plantations.

Although each pilot village has a forest cover over 50% of the total village area the forest degradation is concern as some number of tree species have declined very much, being rare to find. Also, the village forest use (production forest) is not well productive. The defined agricultural land is intensively cultivated and too short fallows are practiced except Ban Nam Pheng. Agricultural land is ever more limited and so consecutive re-cultivation (Hai Lok) is practiced. Meanwhile, forest resources are under high threats from over-harvest. Due to the over-harvest without proper management made 16 tree species in the pilot villages are fewer today, such as Mai Dengnam, Mai Hian, Mai Sai, Mai Sakoh, Mai Wanam, Mai Dou, Mai Koh deuy, Mai Khaen, Mai Somsieo, Rattan, Kok Tao etc (see item 5.4.4). These tree species were suggested to be recovered in the proposed village rehabilitation areas and outside where appropriate. The villagers were interested to rehabilitate their degradation forests as to enhance water resources, forest supplies and construction materials. But, officials expected to see more forest cover, better water source, biodiversity and forest supplies (see item 5.4.3).

Forest rehabilitation and restoration in the pilot villages will have a similar approach. In general, the proposed village forest rehabilitation areas will be naturally forest rehabilitating through improved land use planning since the proposed area is not severely degraded. At least 90% of all the original plants remain to regenerate in the proposed village rehabilitation areas unless

proper management is in place by preventing forest fires, in particular. Enrichment by replanting some tree species is possible but it needs to do survey properly if we really plant them or not. Most importantly, building local ownership through outreach and participatory approach are needed with training and supervising them consistently and assist in their livelihood development. By the way, effective village regulations for ensuring sustainable forest management are necessary. Some wildlife species present in the pilot village areas will help seed dispersals except some species that are not used by any wildlife which then human's inputs may be needed. In this regard, we need to understand forest ecology, particular tree species as some species is not shade or sun tolerant. Local nursery may be established, collect seeds or seedling from forest to cultivate. Rehabilitation of some NTFPs such as cardamom, bitter bamboo, need to make some space for sunlight. Some other NTFPs such as Kok Tao, Wai (rattan) and Sakhanh may be managed in harvest and prevent forest fires in their existing locations. Also, a home garden may be established within the proposed forest rehabilitation area of Ban Nam Pheng where they wanted to plant all medicinal plants that they can harvest in close by, and this village has most potential.

In order to develop an example of forest rehabilitation in the pilot villages some bare land should be identified and observed as to understand some ability of forest regeneration in the area. As pilot forest plots in different forest degradation conditions to be identified and observed on the grow rate. Such a framework species to make a forest succession "re-colonization" should be tested by planting some fruit trees [e.g *ficus*] to attract birds to help seed dispersal in the defined bare land (see Annex G). Therefore, during further detailed village surveys or new land and forest use planning in the pilot villages may need to identify the plots. In broader scope, forest connectivity is important to consider and be reviewed through new land use planning and work with neighbouring villages how to connect forests from the pilot villages to other main forests.

Forest rehabilitation will be sustainable if right mechanism and good governance is in place. It needs to have local ownership, some mechanism/system of work and interest of decision-makers. Kumban and village institution arrangement to be made as to support this work such as village forest rehabilitation group, village and Kumban advisory committee. Monitoring mechanism is also important activity to ensure the agreements/regulations are well followed as well as trees planted are well monitored. Finally, at provincial and district level, this forest rehabilitation work should be incorporated into relevant provincial and district plans. Considering and incorporating this work as part of the provincial and district's agendas, into policies or strategic plans. This will make possible if only the relevant provincial and district authorities have recognized the forest loss issues and have a common understanding that the forest rehabilitation will be one of securing for long-term local livelihoods.

1. Introduction

Lao PDR is considerable rich in natural resources - forests, water resource, and minerals. As those are significant for environment protection and national economic development. About 80% of the populations live in rural area and rely on nature for agriculture, collecting forest and water resources for household subsistence (Morris et al, 2004), and to the country's economy as a whole. Benefits of the forest products – particularly non-Timber Forest Products (NTFPs) are huge, contributing to local livelihoods, providing substantial household incomes and some food security in times of hardship (ICEM, 2003). Apart from the local consumptions, (NTFPs) contribute 20% of GNP - Gross Net Product of the country (IUCN, 2001). Unfortunately, the forest was decreased from 70% (26.5 million ha) in 1940 to only 40% (9.5 million ha) in 2010 (DoF, 2011[2]), and that impact on local livelihoods. During the 1990s the annual forest loss was around 1.4% (134,000 ha) and annual emission from deforestation and forest degradation was estimated at 51.1 million tCO_2e (DoF, 2011). Fragmentation of forests and a decline in the average growing stock within the residual forests are unavoidable, which have reduced carbon stock capacity, releasing carbon dioxide into the atmosphere and have a negative impact on biodiversity (DoF, 2011). Whereas, across the country there are many large forest blocks were regenerated and reclaimed to a forest. However, the current official figure has not been made yet. This is being discussed on the percent of forest canopy cover[3] is used as whether 20% or 10% to be used. According to the FAO's definition as only 10% of forest canopy cover is used but this is just considered a potential forest in the Lao context. Anyhow, if the forest canopy is lower than 20% the country's forests remain at 71.6% in 2005 (MAF, 2005) and it is believed that the net of the country forest cover would be at least 50% by 2015.

Although recognising that forests sequestrate carbon dioxide (CO_2), when they are destroyed and burned they release CO_2 into the atmosphere. This is really global concern and challenge from the continuously forest degradation and loss world-wide. Therefore, the forest degradation and loss is considered a major issue that makes change in climate. Forest loss varies from country to country but still in high portion in the least and developing countries (Bapna, 2010). The Northern Provinces of Lao PDR having faced with the forest degradation[4] and deforestation[5] annually as key drivers are shifting cultivation, over-harvest of forest resources and forest fires. Yet, other are logging, industrial tree plantation and infrastructure projects etc. Slashing new forests for hill rice cultivation and have recently increased in cash crop plantation as widely reported especially in the areas where have not been had effective in land use planning and law enforcement. Also, repeatedly forest fire is always happened and

[2] Department of Forestry (2011). Lao Investment Plan of World Bank's Forest Investment Program, Vientiane.
[3] A forest with a canopy cover of 20% is used in Lao PRD but FAO uses only 10%.
[4] Forest degradation (degrade): a change with forest that affects forest structure, function, productivity and native species diversity.
[5] Deforestation (forest loss): as forest is converted to some other uses so that it will not be possibly reverted back to a forest within the short to medium term.

that associated with hill rice cultivation. Current studies show that the annually forest loss rate of the country after 2005 is slightly slower compared to that of the past (the loss rate of 1.4%). For example, the landscape of Nam Xam NPA including outside the NPA during 2005-2010 is 0.82% (Forest Carbon, 2014) and in Nam Et-Phou Loey National Protected Area (NPA) during 2004-2013) is 0.37% (1,437 ha) (Hansel et al., 2013).

Key drivers of the deforestation and forest degradation in Northern Provinces such as in Houaphanh Province, are shifting cultivation and over-harvest of forest resources (SNV, 2014) especially NTFPs. The underlying causes of these are the needs of food and incomes, and the other underlying causes are due to population growth and commercially cropping promotion policy without readiness preparation and detailed studies. On the other hand, limited livelihood alternatives including some difficulty in access to credit scheme and market of domestic products, are cumulatively indirect causes. The growth of local population is also considered an importantly indirect driver that makes and will put more pressure on forests in the future.

The forest degradation and loss is not only globally impact – the climate change, but also locally regarding the decline in supplies of forest resources which impact on local livelihoods (food and income sources). The issues were recognized and aware to necessarily reverse the loss by the Government of Lao PDR since early 1985. Significantly, the National Forest management program was initiative as the land and forest allocation program began in 1990 (Gaston, 1995; Fujita and Phanvilay, 2008) as to stabilize shifting cultivation practice. Also, first 18 National Biodiversity Conservation Areas were declared in 1993. Then, the Government had an important initiative by announcing the National Forest Strategy in 2005 to achieve the country's forest cover[6] at 70% by 2020. In response to, and translate this strategy, it has continued implementing the forest management program, shifting cultivation stabilization program and a land and forest allocation program. The land and forest allocation program is an important intervention to limit shifting cultivation across the country. The strategy has not been well translated and exercised on the ground effectively. Thus far, the forest rehabilitation[7] and restoration[8] approach in Lao PDR has not been sustainable and not taken in account of biodiversity aspect. Some forest categories allocated have not been used based on their purposes and agreements made according to the program. For instance, village production forests of almost villages around Nam Xam NPA are now then changed to agricultural land. In addition, promoting tree plantation is another effort of the government to return forest cover.

The Sustainable Forest Management Project of Asia-Pacific Forest (APF) Network would make significant in long run for improving forest growth, enhancing forest quality of the country. For Lao PDR, it is principally believed that to take effective land and forest use planning to allocate some poor and potential forests to having sufficient time in regenerating is good enough from naturally forest recovering for the northern region. Meanwhile, some livelihood support related

[6] Forest canopy cover of 20% is used in the Lao context for definition a forest of Lao PDR.
[7] Rehabilitation is a more about enrichment as to improve naturally forest regeneration to gain a better forest health.
[8] Restoration is a process of recovering from damage or loss e.g replanting some native tree that already lost is back to a forest or from bare land to a forest.

to forest resource management are necessary. The project starts with analyzing to designing and demonstrating innovative approaches for sustainable forest management in the region, especially for Lao PDR. The target provinces (Luang Namtha, Oudomxay and Bokeo) are located along Lao-China border, and partly to Myanmar and Thailand. These provinces have large conservation and potential forests that linked together in the northern forest landscape through various forest corridors (see Figure 1). The pilot villages are Ban Nam Pheng of Namo District, Ban Houy Hom of Luang Namtha District and Ban Don Nguen of Ton Pheung District, in Luang Namtha, Oudomxay and Bokeo Province, respectively.

There are as large area of three forest categories[9] as 1,769,421 ha and also potential forests (1,269,460 ha) in the target provinces especially the Oudomxay Province. Ideally, the initiative of the pilot villages will not only to improve forest cover but also forest quality and connectivity. Success in the pilot villages on this will be replicated in other villages, districts and provinces. Therefore, the northern forest landscape will be healthy, better connected and to provide local people with better forest supplies.

[9] 3 forest categories including protected area, protection forest and production forest.

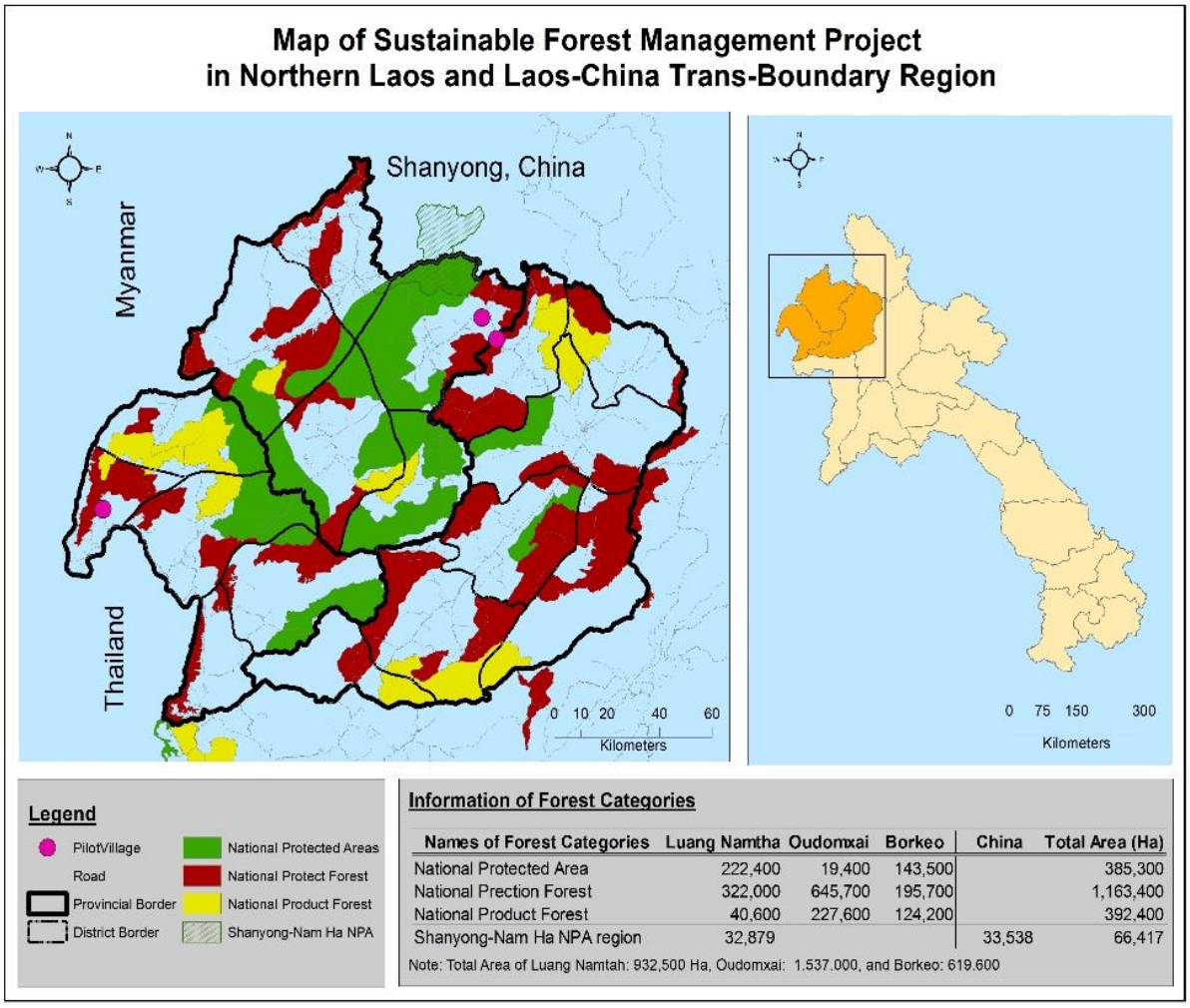

Figure 1. Map of Sustainable Forest Management Project, Northern Laos

The consultations were to identify issues, current status of forest degradation, stakeholders' interest and potentials of forest rehabilitation in the 3 pilot villages (Ban Nam Pheng, Houy Hom and Don Ngeun). The fieldwork was conducted in February, 2015, worked with key stakeholders in the target provinces, districts and pilot villages.

2. Objective

To assess the sustainability[10] of rehabilitation, restoration and management of forests and forest ecosystem in the 3 pilot villages.

[10] Sustainability is the maintenance of positive changes induced by the project afterward. It is the project activities that are used, functioning or moving on afterward. Therefore, in this context requires local ownership and improved system as appropriate mechanism to be in place.

The assessment was to understand perceptions of officials and villagers on and forest rehabilitation and restoration; current status of forests and conditions of the pilot villages, including history of forest in their villages; presence and absence of key species; their livelihood impacts due to forest change; their interest on forest rehabilitation; identify some possible framework species using various factors for screening, also challenge and opportunities, mapping of their visions on forest rehabilitation and enhancing forest management.

3. Methodology

Stakeholder workshops, face-to-face discussions and site visits of each pilot village, were conducted. Taking account of the project objectives below as the scope of fieldwork and principle to conduct the consultations at all levels as to see what potentials and interest of the stakeholders to develop, test and demonstrate effective approaches on forest rehabilitation and management.

The Project Objective

- To explore, test and demonstrate effective approaches on forest restoration and forest management and responding mechanism to generate sustainable flow of benefits to closely related stakeholders.
- To strengthen forest law enforcement and promote cooperation on trans-boundary biodiversity conservation.
- To share information and knowledge of best practices on forest restoration and rehabilitation.

3.1 Consultations with the Project Team/Provincial and District Officials

- Session 1: Started with project orientation and concepts of forest and forest rehabilitation related using slides in pictures to illustrate the points.
  - Counting from the project, background of forest rehabilitation and restoration in Lao PDR; importance of forests and their functions; functions of some species and trees within the forest ecosystem; forest changes, consequent impacts, sustainability of forest rehabilitation and restoration.
  - The concept helped the participants think better how to rehabilitate forests based on the current conditions and to see their expectation from the efforts.
- Session 2: Discussed on the lessons learned on forest rehabilitation. Brainstorming of possible sustainability of forest rehabilitation, restoration and management.
- Session 3: Preparing for pilot village visits with provincial and district officials.

3.1 Consultations with the Pilot Villagers

- Using semi-structure interviews to conduct with three groups for three areas of the work. For the elderly/village authority on village information including history of forests in their villages; for separate man/women groups to

understand their livelihood impacts due to forest changes and their interest on forest rehabilitation, restoration and management.

- Identified the current forests (key tree and wildlife species loss/rare/present), identify some possible framework species using various factors for screening (See Annex F), also challenge and opportunities, mapping of their visions on forest rehabilitation, zoning etc.
- Site visits carried out, took pictures and recorded waypoints of important locations (see the checklist in Annex E).

4. Background

Background on forest rehabilitation, restoration and management related was reviewed and prepared in Annex G additional to this report. This background[11] paper would be important for some readers to capture some relevant information including some practices and lessons learnt that be useful for implementers who have limited knowledge in this regard. Of course, planning for forest rehabilitation, restoration and management needs to have a better understanding of the forest ecosystem, history of forest changes, root causes, key drivers and underlying causes of the changes. Also, principles of and lessons learnt from best practice should be obtained and considered where appropriate (see Annex G).

Forest ecosystem is a community of living forest organisms with their environmental substrates (non-living) that, interacting as a system. The living forest organisms are mainly trees and wild animals but including shrubs, herbs, bacteria, fungi, and people. Whereas, the environmental substrates are air, soil, water, organic debris, and rocks. The forest ecosystem provides a variety of good and services upon which people depend such as food, construction materials, income sources, medicinal plants, hydrology, water cycling, maintaining a local climate etc. Most rural people rely on forest products for good and household income especially during hardship. Globally, forests play an important role in regulating the earth's temperature and weather patterns, storing large quantities of carbon and water (see Annex G).

For long-term forest rehabilitation, restoration and also management as to reverse forest and biodiversity there is a need to understand the current forest types and ecosystem, and in particular locations, forest components including key wildlife species present in the area. Forest changes and impacts are obvious and more severe today. Declining in forest cover, structure, functions and supplies impact on animal, humans and all associated, including soil stability, water source and local climate. The changes, the forest degradation and loss is not only globally impact – the climate change, but also locally when supplies of forest resources decreased that undoubtedly impact on the local livelihoods.

[11] Background paper on forest rehabilitation and restoration related in detail can be found in Annex F.

The habitat degradation and loss is prevalently happened especially in the northern Lao PDR due to shifting cultivation, cash crop plantation which associated with forest fires, and also over-harvest of forest resources. As well as, repeatedly forest fire is always happened that associated with hill rice cultivation. Confirmedly, the key drivers of the deforestation and forest degradation in some northern provinces such as Houaphanh, are shifting cultivation and over-harvest of forest resources (SNV, 2014). The underlying causes of these are the needs of food and incomes but other are due to population growth, commercially cropping promotion policy without readiness preparation and detailed studies, limited livelihood alternatives including some difficulty in access to micro-credit scheme and market of domestic products. Of which, the growth of local population is also considered an importantly indirect driver that makes and will put more pressure on forests in the future. Therefore, address forest degradation and deforestation need to do a holistic approach but detailed situation analysis to be undertaken.

In the past, forest rehabilitation, the tree plantation in Lao PDR was mainly economic tree plantation and often converted natural forest to plantation forest. Anyhow, as only planting trees without any scientific knowledge would not achieve the expectation and long-term sustainability of forest rehabilitation and restoration. Perhaps, it leads to gain some unexpected outcomes such as introduction of invasive species or generate incentives that finally impact on original forest habitats.

Principles of forest rehabilitation and restoration are to promote ecological integrity and enhance human well-being in the forest rehabilitation landscapes (Lamb and Gilmour, 2003). It needs to work on-site level to enhance socio-economic and ecological gains at the landscape level (see Annex G). Much needs to be done to turn the forest restoration landscape from an idea that is implemented in a few pilot areas into mainstream practice that is adopted and promoted by governments and the private sector.

Among many approaches of forest rehabilitation and restoration have been applied (see Annex G). Where the site with some degraded forest requires little inputs and effort but if some habitat that some endangered tree species are lost[12] need to restore that species. In this regard, we cannot plant every single tree from the initiative due to man-power and budget limitation. Therefore, some best practice such as framework species (Goosem and Tucker 1995, Kirby et al. 2000, Lamb, 2000) is interesting approach to be applied where of high habitat loss (deforestation). It is just about to plant some small number of selected tree species such as *ficus* for early succession; making stepping stone; then to gain secondary and target forest succession (see Annex G). This technique is applicable for where some wildlife is present, it uses low costs but takes time to restore the forest loss area to a forest. Whatsoever, any approach it requires to understand the current status of the proposed rehabilitation or restoration area, interest of stakeholders and expectation, also budget capability. Maintenance is needed in the early years to ensure that weeds do not dominate the succession.

[12] Species loss means that species has no longer in the area even seeding is not found.

Thus far, forest rehabilitation and restoration in South-East Asia is much about economic interest rather than biodiversity and maintaining local livelihoods. Lao PDR for instance, forest rehabilitation in planting by promoting and providing some incentive for private sector to plant trees but most about economic trees and that impact on original forests because of being slashed and burned for new exotic tree plantation. The plantation by the government is about protocol except naturally forest rehabilitation approach which is considered better. Consequent impacts of the economic tree plantation by private sector are not only on biodiversity but also much on local livelihoods in long run.

5. Results

5.1 Overviews of the Target Provinces and Districts

Oudomxay Province is mountainous which covers 85% of the province and an area of 1,537,000 ha. It has seven districts, the population of 303,187, of which 158,479 are women (2015); with the density of 20 person/Km^2. Total scattering forest area is 1,186,300 ha (77.2%) of the province, of which the three-forest category[13] is 772,225 ha or 32.1% (see Figure 3). About 693,500 (45.1%) of the province's forest located within this three-forest category and outside is degraded and considered potential forest[14] (MAF, 2005[15]). The forest degradation is mainly found in outside of the three-forest category and protection forest. Therefore, although the province has as large as 772,225 ha, is classified in the three-forest category it is only 493,800 ha or equivalent to 32.1% of the province is considered a forest[16]. This means 283,425 ha in the tree-forest category is degraded forest and that to be rehabilitated.

The province has diverse ethnic groups as 12 ethnic groups but mainly Khmu covers (57.9%), then Hmong (15.2%) and Lao Loum (10.9%), Leu (7.9%), Akha (2.6%) etc. The people rely on agriculture mainly hill rice cultivation and cash crop plantation (rubber tree and bananas plantation). The current plantation area of the province is 33,715 ha, mainly rubber tree plantation covers almost 100% (33,642 ha). Other small areas of plantations are Bananas, Teak (*Tectona grandis*), Agarwood, etc. The poverty remains at 26.4% and expect to eradicate down to 20% by 2020. Gross Domestic Product (GDP) per capital of the province is US$1,020. The province has a strategic plan in agriculture and forest sector development including NTFPs, industry and service sector. Growth rate of socio-economy of the province is at 11.6%.

[13] Conservation forests including national protected area, national protection forest and national production forest.
[14] Potential forests are mostly a fallow land that will be a forest if they is allocated for regeneration.
[15] Forest assessment report of Ministry of Agriculture and Forestry (2005).
[16] The forest is used in Lao PDR as only its canopy cover of ca. or above 20%.

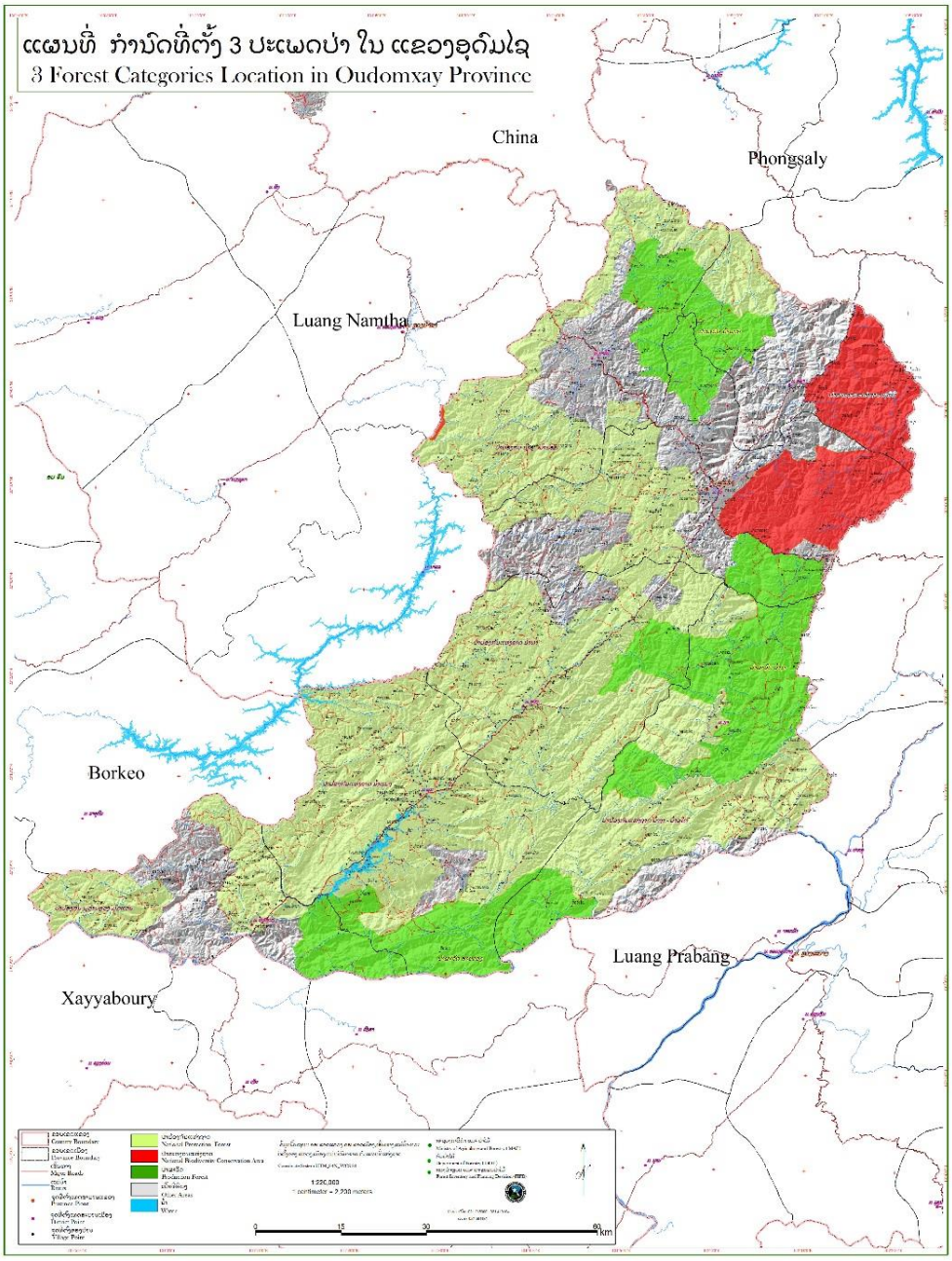

Figure 2. Map of three-forest category in Oudomxay Province

Namo District has the population of 38,760, of which 19,338 are women (2015); consists of 11 ethnic groups - mainly Hmong (33.7), Leu (15.1%), Akha (13.4%), Khmu (10.7%) etc., with the density of 19 person/Km^2. The people rely on agriculture mainly hill rice cultivation and cash crop plantation such rubber tree and bananas plantation. The poverty remains at 28.76%. Gross Domestic Product (GDP) per capital of the district is US$816 (2015). The district has priority in cash crop plantation, rice production and service. Growth rate of socio-economy of the district is at 8%.

Luang Namtha Province is also mountainous which covers similar to that of Oudomxay province and an area of 932,500 ha. It has five districts, the population of 185,436, of which 93,898 are women (2015); with the density of 17 persons/km^2. Total scattering forest area is 589,349 ha (63.20%) of the province, of which the three-forest category is 589,199 ha (60%). About 344,300 ha or 36.92% (see Figure 3) of the province's forest located within this three-forest category and outside of the province is degraded and considered potential forest (MAF, 2005). The forest degradation is mainly found in production forests and some in protection forests. Therefore, although the province has as large as 589,199 ha classified in the three-forest category it is only 343,900 ha (36.82%) of the province is considered a forest. This means 245,299 ha in the tree-forest category is degraded forest and that to be rehabilitated.

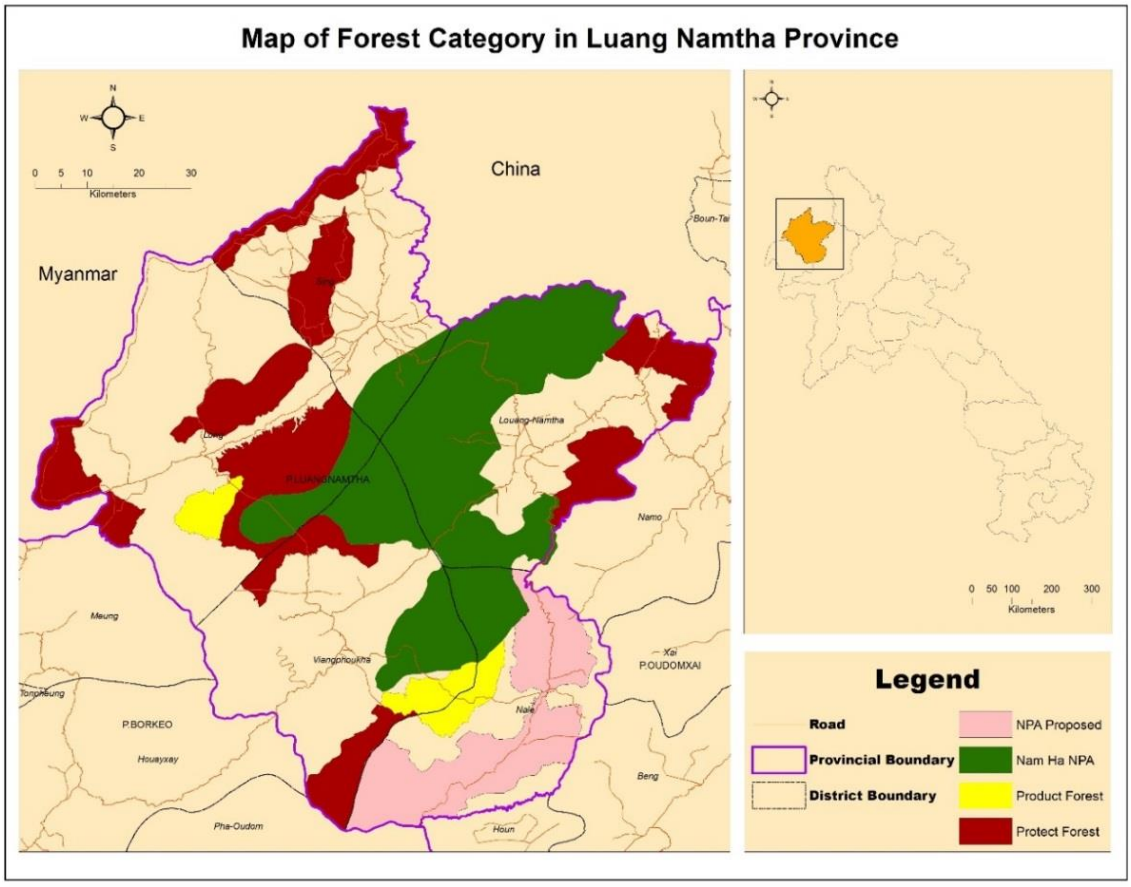

Figure 3. Map of three-forest category in Luang Namtha Province.

The province has diverse ethnic groups as 17 ethnic groups - mainly Tai ethnic group, then Akha, Khmu, Hmong etc. The people rely on agriculture mainly hill rice cultivation and cash crop plantation (rubber tree and bananas plantation). The current plantation area of the province is 31,951 ha, mainly rubber tree plantation covering 86.1% (27,513 ha). Other plantations are Agarwood (2,595 ha), *Eucalyptus*, Teak (*Tectona grandis*), Mak kao, fruit trees etc. The province

has strategic plan in sustainable agricultural development including rice and livestock production, cash crop plantations.

Luang Namtha District has population of 56,705, of which 29,390 are women (2015); mainly Tai ethnic group covers 25%. The people rely on agriculture mainly rice cultivation, cash crop plantation and livestock raising. The cash crops are mainly rubber tree and sugar cane planation. The poverty remains at 5.13% and expect to completely eradicate by 2020. Gross Domestic Product (GDP) per capital of the district is US$1,168. The district has priority in promoting agricultural development especially rice production, vegetables, livestock raising and other cash crop plantation such as water melons.

Bokeo Province is mountainous which covers 70% of the province and an area of 619,600 ha. The province has five districts, the population of 176,743, of which 86,767 are women (2014); with the density of 28 persons/km^2. Total scattering forest area is 500,989 ha (80%) of the province, of which the three-forest category is 407,989[17] ha or 65.84% (see Figure 4). About 286,593 ha (46.25%) of the forest of the province located within this three-forest category and outside of the province is degraded and considered potential forest (MAF, 2005). The forest degradation is mainly found in production forests and some in protection forests. Therefore, although the province has as large as 407,989 ha classified in the three-forest category it is only 263,019 ha (42%) of the province is forest. This means 144,970 ha in the tree-forest category is degraded forest and that to be rehabilitated.

The province has diverse ethnic groups as 15 ethnic groups - mainly Lao Loum, then Khmu and Hmong. The people rely on agriculture mainly hill rice cultivation and cash crop plantation (rubber tree and bananas plantation). The current plantation area of the province is 32,124 ha, mainly rubber tree plantation covers 78.5% (25,222 ha). Other plantations are Teak, Agarwood, Yang Bong (*Palaquium annamensis*), fruit trees, bananas etc. The poverty remains at 13% and expect to eradicate down to at least 10% by 2020. Gross Domestic Product (GDP) per capital of the province is US$ 1,479 in 2010. The province has a strategic plan in agriculture, industry and service. Growth rate of socio-economy of the province is at 9.2% and expect to achieve at 10.9% by 2020.

Ton Pheung District has the population of 28,705, of which 14,047 are women (2008); with the density of 40 persons/km^2. The people rely on agriculture mainly cash crop plantation, rice cultivation and livestock raising. The cash crops are mainly rubber tree, bananas and sugar cane plantations. The poverty remains quite low (1.7% or 94 families) and expect to eradicate down to 0.7% by 2020. Gross Domestic Product (GDP) per capital of the district is US$1,471 and expect to achieve at US$2.057 by 2020. The district has priority in promoting agricultural development especially rice production, livestock raising and cash crop plantation. Growth rate of socio-economy of the district is at 8.9%.

[17] Including district protection forests (12,510 ha).

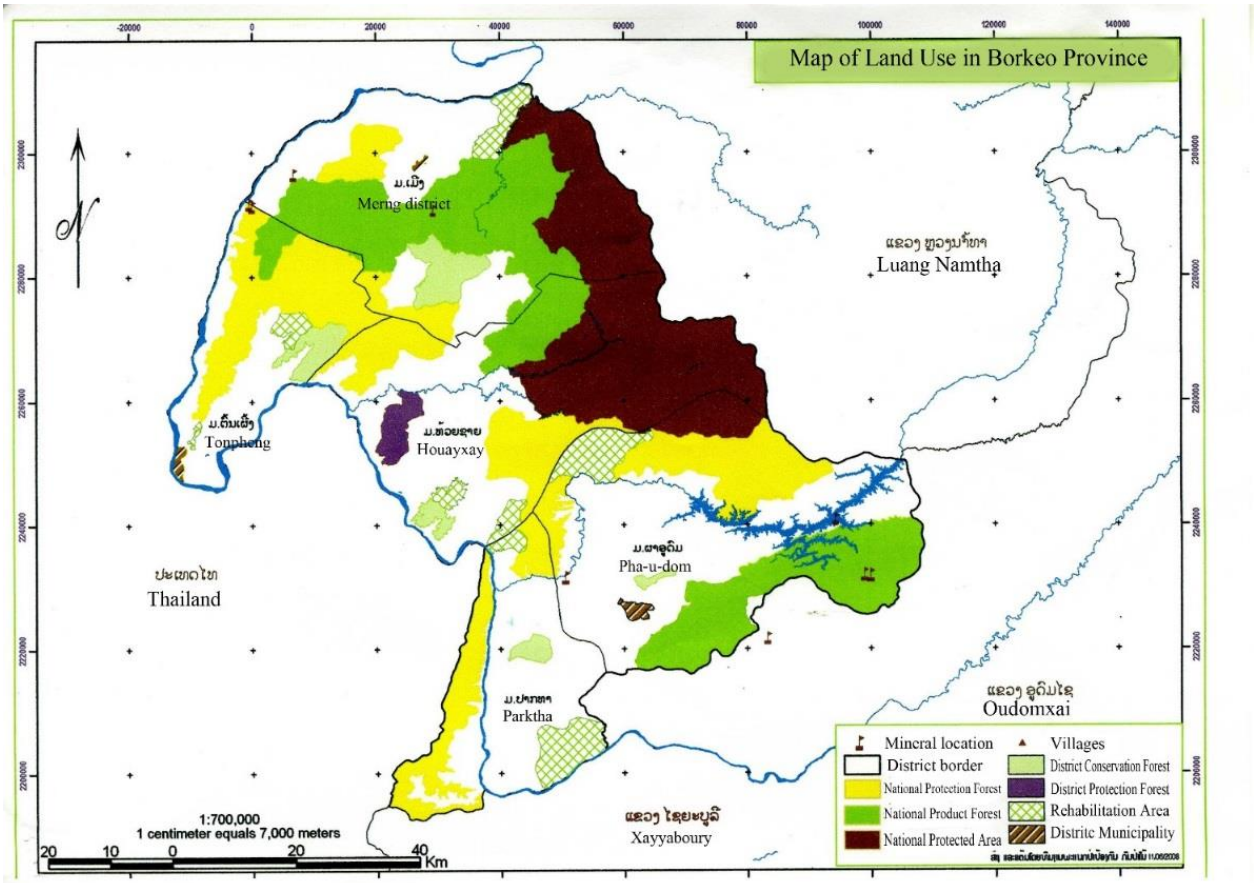

Figure 3. Map of three-forest category in Bokeo Province.

5.2 Understanding, Interest and Expectations of Officials

Understanding of some officers on forest rehabilitation approach in scientific and a sustainable way is likely low. They thought that the forest rehabilitation needs to do proper nursery and to plant some economically important tree species even though they are non-native such as Mai Taekha and Mai Dou Lai were suggested. They are interested in the same previous forest rehabilitation such as collecting seeds, establishing nursery and planting. This is about budget and they were eager to know the cost per tree for planting. However, their thoughts, expectations and possibilities of forest rehabilitation in their pilot villages did change slightly after some orientations on forest ecosystem were given. Forest rehabilitation may not need to do proper nursery garden but locality, practically and adaptively based on site potentials e.g collecting seedling from the forest. In this regard, clear consultation with relevant officials to brainstorm on penitential success of forest rehabilitation and management is needed. They need to have a new thinking, learning from past lessons learnt on failure and success. The officials' expectations of the forest rehabilitation are to achieve a better forest cover, water source, biodiversity and supplies of forest products, such as non-timber forest product (NTFPs). Whereas, local villagers are strongly interested in water source enhancement, supplies of forest products and timbers for house construction.

5.3 Forest Degradation and Deforestation

The forest habitat degradation and loss are prevalently happened especially in the northern country due to shifting cultivation, cash crop plantation which associated with forest fires, and also over-harvest of forest resources. Part of the north region the forest degradation and deforestation in the target provinces as well as target districts are mainly shifting cultivation, cash crop plantation and over-harvest of forest products in the past. The forest degradation in the north is because of a small illegal logging scale, collecting non-timber forest products (NTFPs), forest fires but the deforestation is mainly shifting cultivation in short fallows and especially the boom of cash crop plantation from early 2000. Underlying causes of these are the needs of food and incomes. Promoting commercially cropping of the government policy without readiness preparation and detailed studies is considered an importantly indirect driver that impact on the forest land. More double demands of land, forest land for cash crop cultivation in recent years make almost all the villages in the target districts except Ban Nam Pheng, has limited agricultural land. The cash crops planted in the target provinces and districts are rubber trees, corns, sugar cane and bananas plantations. For example, selling land concession to Chinese investors in Namo District for bananas plantation in Ban Houy On, Ban Laoh and Ban Phou Thong, is being debated after facing with some environmental issue. Environmental impacts are obviously observed and reported associated with the bananas plantations due to pesticides used in a great amount and plastic thrashes.

Rubber tree plantations were observed in Ban Houy Hom and that they planted for over 10 years ago. In recent years, sugar cane plantation is increasing in this village and bananas plantation in Ban Don Ngeun. The concern is that some part of their agricultural land was sold in concession to Chinese investors made the agricultural land is limited. Due to the business the village's forest is under high pressure. Local villagers claim new agricultural land from slashing forest and sell in concession to the Chinese investors. The cost of concession is US$100 per Lai[18] per annum. The local villagers are hired for planting and weeding the plantations. It was reported both sugar cane and bananas plantation requires a lot of inputs (chemical fertilizers and pesticides). Consequent impact on health of the local labour and surrounding villagers are highly possible including soil and local livelihoods as well as water sources in long run. The forests and agricultural land in the pilot villages especially in Ban Houy Hom, have been degraded and lost to the economically agricultural expansion. However, due to these pilot villages have quite large area and so their forest areas still remain in at least 50% of their village areas.

5.4 Pilot Villages

These three pilot villages are not really poor and not facing severely forest degradation in the defined forest zones. The villages are considered a medium class status as indicating in their house conditions, livings and village potentials for livelihood development. Perhaps, Ban Houy Hom would be lower status compared to that of other two villages, also regarding their interest

[18] One Lai is 1600m^2 or 1/6 ha.

in and possible sustainability of forest rehabilitation and management. Although each pilot village has a forest cover over 50% of the total village area the forest degradation is concern as some species declined very much, being rare to find. Also, the village forest use (production forest) is not well productive and the defined agricultural land is intensively cultivated as too short fallows. With population growth and selling land concession to Chinese investors except Ban Nam Pheng the agricultural land is even more limited. Local villagers cultivated hill rice and corn in short fallows recently as about 3-5 years for Ban Nam Pheng but lower in other two pilot villages. Consecutive re-cultivation (Hai Lok) that redo immediately in following years by some families was reported. According to the local knowledge they realized there has no any particular land location in the pilot villages that identified as degraded land although some part reported on re-cultivation and appearing of Nya kha (sun grass). This is perhaps the local perspective is that the forest degradation means loss other than declination. With the growth of markets and local populations would put more pressures on the northern forests in the future unless stronger village ownership in their forest protection is built.

Results of the village consultations showed similar causes of forest degradation and deforestation in the pilot villages (see Table 1).

Table 1. Causes of forest degradation and deforestation by the pilot village

FDD type	Ban Nam Pheng	Ban Houy Hom	Ban Don Ngeun
Forest Degradation	Logging	Exploitation of NTFPs	Forest fires
	Exploitation of NTFPs	Logging	Logging
	Forest fires	Forest fires	Cutting firewood for sale
			Exploitation of NTFPs
Deforestation	Shifting cultivation	Cash crop plantation	Shifting cultivation
	Cash crop plantation	Shifting cultivation	Cash crop plantation

The forest degradation in the pilot villages due to over-harvest of forest products, forest fires and small scale of illegal logging activity. Due to the over-harvest without proper management made about 16 tree species in the pilot villages are fewer. The tree species that are fewer available including Mai Dengnam, Mai Hian, Mai Sai, Mai Koh deuy, Mai Sakoh, Mai Wanam, Mai Dou[19], Mai Khaen, Mai Somsieo, Rattan, Kok Tao etc (see Table 2).

Anyway, the forest of each pilot village was large in the past but about 50-60% of the total village area remains today. The forest land was converted to agricultural land and that they used in short fallow when agricultural land is limited. Therefore, forest cannot regenerate where they keeps intensive farming such as for sugar cane plantation. This can means a loss of forest at last from that replacement.

[19] Only Ban Don Nguen used to present of Mai Dou and needs to be rehabilitated.

5.4.1 Village locations and profiles

Ban Nam Pheng established in 1973, located by the Road no. 13 North to Lao-China border and in between Namo town and Na Teoy of Luang Namtha Province. It borders to Ban Nahome on the north, Ban Pangthong on the south, Ban Kielan on the east and Ban Ban Namkae on the west. The village has an area of 2,457 ha and forest area of 1,678 ha, covering 68.64% of the total village area (see Figure 5). Of which, it has protected area (651.3 ha), protection forest (98.4 ha) and production forest (937.3 ha).

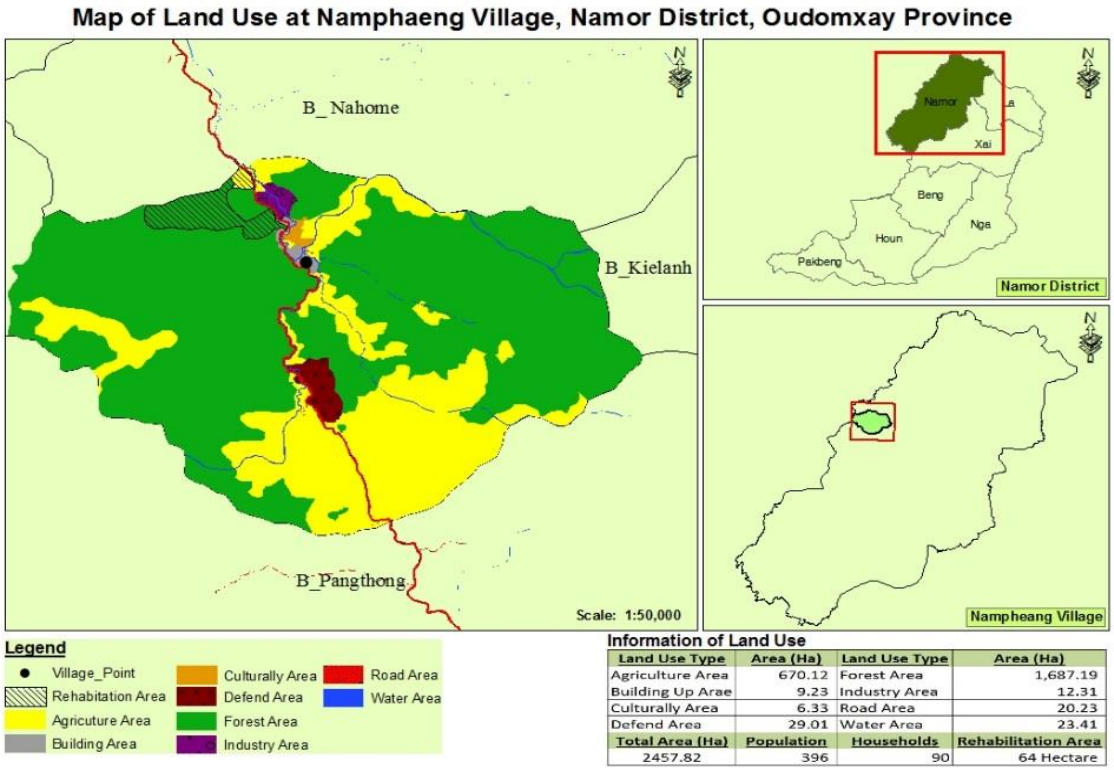

Figure 5. Map of land use of Ban Nam Pheng

The village has 90 households (21 poor households), 396 people, of which 205 are women, all is Khmu ethnic. The villagers rely on hill rice cultivation (679 ha) and collecting forest products for household incomes. They earn incomes from mainly forest products and some cash crop plantation (corn). Of which, the annual income of the village from the forest product is about 400 million KIP, mainly from bitter bamboo shoots and cardamom. However, the income from the bitter bamboo shoots have declined recently because of lower products when forest cover in the bamboo forests is higher density as not allows enough sunlight for the bamboo tree needs to grow.

Ban Nam Pheng was a pilot village of IUCN-NTFP project from 1995 to 2000 on improved sustainable harvest of forest products, focused on sustainable use, management and marketing of bitter bamboo shoots.

Ban Houy Hom established in 1970, located by the Road R3 connecting Houy Sai of Bokeo Province to Boten of Luang Namtha Province. Ban Houy Hom is just about several kilometers after Ban Na Touy of the road section Na Toey-Luang Namtha. It borders to Ban Suanya on the north, Ban Namkae on the south, Ban Tintok and Ban Natoey on the east, and Ban Houy Dam on the west. The village has an area of 1,079.29 ha and forest area of 591.8 ha, covering 54.83% of the total village area (see Figure 6).

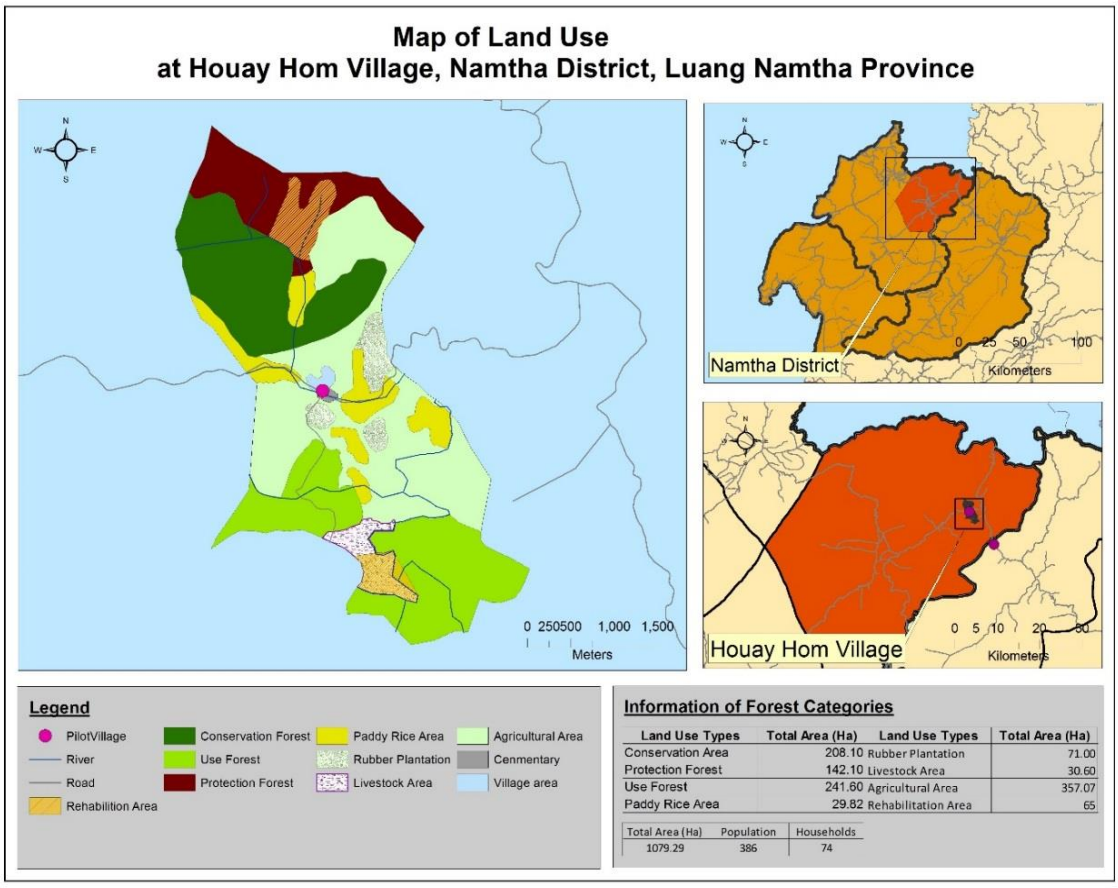

Figure 6. Map of land use of Ban Houy Hom

The village has 74 households, 384 people, of which 205 are women, all is Khmu ethnic. They rely on paddy, hill rice and cash crop cultivation (251 ha), and collecting forest products for household incomes. They earn incomes mainly from agriculture, cash crop plantation (corn, sugar cane), forest products mainly bitter bamboo shoots and cardamom and livestock.

Ban Houy Hom has not received any aid project but they have some capacity and regulations in their forest management following the government's regulations[20]. However, villagers' ownership in the forest management is quite low.

[20] Government's Regulations as translated and propagated by Provincial and relevant District Agriculture and Forestry Office.

Ban Don Ngeun established in 1996, located about 25 km from the Ton Pheung town to the east. It borders to Ban Houy Ome on the north, Ban Nakham on the south, Ban Nam Keung on the east and Ban Mula and Thalat on the west. The village has an area of 1,588.77 ha and forest area of 999.59 ha, covering 62.9% of the total village area (see Figure 7). The village has 119 households, 451 people, of which 227 are women. Eighty percent of the population is Muser, then Thai Dam, Leu and Yeun. They rely on hill rice cultivation (497 ha), small number of paddy field (15 ha) and collecting forest products for household incomes. They earn incomes from mainly agriculture, cash crop plantation (bananas from selling labour to Chinese farms), some forest products mainly from Mak Tao *(Arenga saccharifera*), Dok Kem (broom grass), Rattan and livestock. The village has estimate annual income of US$1,200 per year/head.

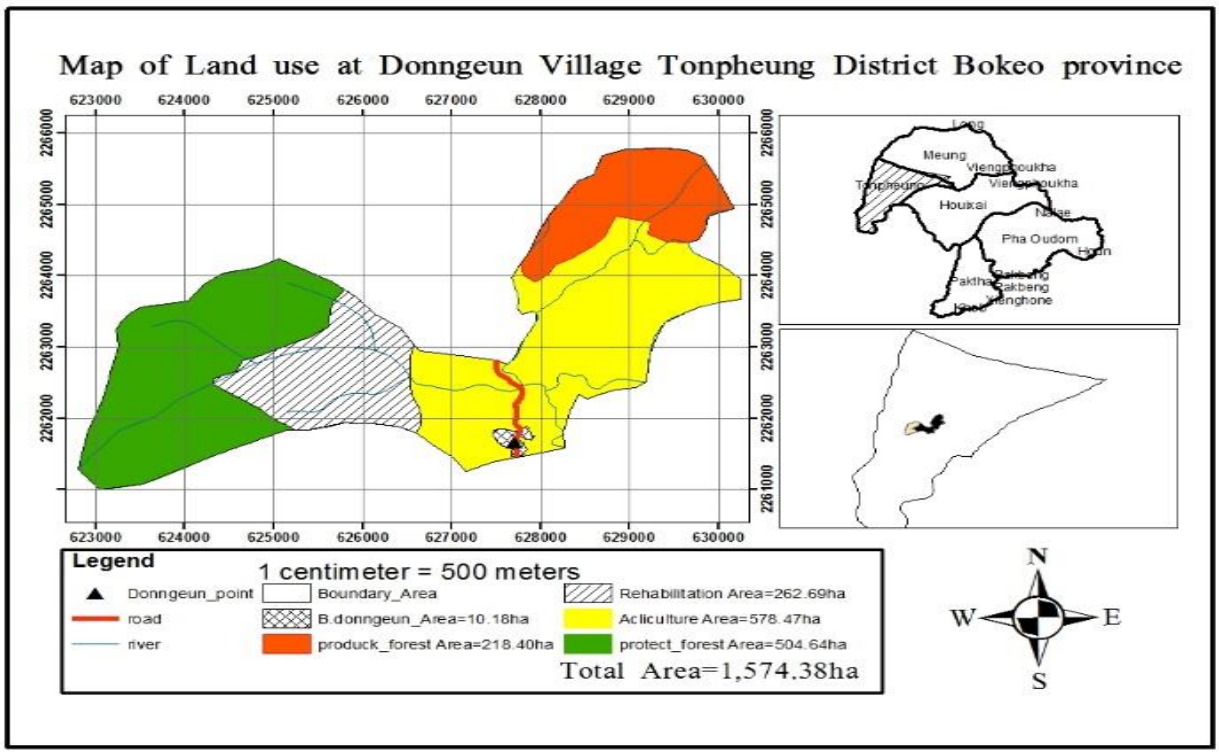

Figure 7. Map of land use of Ban Don Ngeun

Although Ban Don Ngeun has not received any aid project they have some capacity and regulations in their forest management following the government's regulations. However, villagers' ownership in the forest management is not high especially its sub-ethnic group "Yuen" usually disobey the regulations, converting new forest area to claim new agricultural land, over-harvest of forest products and generate forest fires. Claiming new forest all foothill of Phou Bersong was well reported during the survey.

5.4.2 Forest resources, sustainable uses and management

Ban Nam Pheng has still good condition of forest resources (timber trees, wildlife and non-timber forest products). All is semi-evergreen and some mixed deciduous forest. There are present of Mai Kor (*Castanopsis sps.*), Mai Dengnam (*Xylia dolariformis*), Mai Hian (*Melia toosendan*), Mai Sakoh etc. The village forest is quite large and found in both sides of the village makes local climate in this village remains good (fresh and cool). The villagers of Ban Nam Pheng suggested that forests of the village have been better in cover and quality. But, the area where is far from the village is difficult to manage completely as many people from many villages including from the Namo town encroached and poached their forest resources.

With some good status of wildlife species reported in the village area. It looks better status in comparison with other neighbouring villages. The wildlife species reported in the village protected area and some around the village are barking deer, lesser mouse deer, several species of civets (esp. common palm civet), wild pig, squirrel species, porcupine sps., bamboo rat, bengal monitor, python, oriental pied hornbill, peacock, several species of barbets, green pigeon, laughing thrush, jungle fowl etc (see Annex C). The wildlife species present in the proposed rehabilitation of the village is lower but it is connected to the main wildlife area of the village such as village protected area. Therefore, it is possible for some terrestrial wild animals returning to the proposed rehabilitation if the forest is better and fewer disturbed. The species used to present in the area for some 20 years ago but extirpated in the area today were gibbon, langur, sambar, bear, porcupine and pangolin.

Important Non-timber forest products (NTFPs) are bitter bamboo shoot, cardamom, Peuk meuk (bark), variety of mushroom species especially Het deng (red mushroom), Mai hok (large bamboo). Forest supplies of the village have some good level of ability but a quantity of some timber trees and non-timber forest products has declined in recent years. NTFPs are significant contribution to the household incomes of Ban Nam Pheng's villagers. The village annual incomes from NTFPs is 452.8 million KIP, of which 298.6 million KIP from bitter bamboo shoots. Other from agricultural product (corn) and other NTFPs such as mushroom, cardamom and rattan. Nevertheless, the income from the bitter bamboo shoots have declined recently because of lower products when forest cover in the bamboo forests is higher density and that not allows enough sunlight for the bamboo tree needs to grow.

Anyway, ecosystem service is essential and tangible in Ban Nam Pheng and that shows other villages on the importance of forest protection and ecosystem service. Protecting the forest makes the villagers of Ban Nam Pheng proud of it and they do well appreciate the conservation work. The forest supplies provide them with not only daily food sources but also construction materials, herbal medicines and maintaining local climate. The forest resources of the village provide substantial benefits to many villages in the area.

Due to the investment of IUCN project made the villagers of this village understand the needs of forest management and values of the ecosystem service. Ban Nam Pheng is an example village in the area whose forest is well protected from conversion and selling concession to

Chinese investors. Whereas, other neighboring villages did sell almost their forest lands, perhaps due to their weakness of village authorities made them unable to protect their forest from the outside pressures on the demand for cash crop plantation. Their forest land is fewer today, consequently suffered with insufficient wild foods including fish and wild vegetable after the majority of their forest areas was converted. Ban Pangthong for example, as 70% of the village land was converted to rubber tree plantation made the village forest remains less than 15%. This led to totally insufficient forest resources to be harvest for subsistence. They just rely on the forests of Ban Nam Pheng.

The villagers of Ban Nam Pheng know well how to use their forest resources in a sustainable way as to avoid their tree species extirpation and extinction. They have their own regulations on sustainable forest use by zoning and defining harvest techniques and season. Clear and agreed various zones to be implemented such as protected area, protection forest, production forest, agricultural area. The harvest technique is about size, part and age of forest products to be harvested. Also, the harvest season is the date to start and end of the year for harvesting of certain non-timber products such as cardamom and bamboo shoots. Through the practice they have observed and gained experience in the forest management and to be adaptive. For example, managing good products of bitter bamboo shoots and cardamom needs to ensure enough sunlight. These species need to have some forest space for sunlight getting through so where the forest is well growing the products of these species are decreased, smaller in size and possible to be extirpated from location to location (see Annex D). Therefore, in terms of management in the production forest the villagers would like to remove some trees in the bitter bamboo and cardamom production areas as to maximize products and benefits for the local villagers.

Ban Houy Hom has overall forest degradation and only some fairly good condition of the forest resources in the protected area but it is quite far from the village. All is semi-evergreen forest and presence of Mai Dengnam, Mai Wanam, Mai Hian, Mai Sai, Mai Sakoh. The villagers of Ban Houy Hom suggested that forests of the village have been changed and degraded but they can find some wildlife species and NTFPs. Other forest types including production forest are highly degraded. The wildlife species reported in the village protected area are barking deer, several species of civets e.g palm civet mainly, bengal monitor, bamboo rat, wild pig, squirrel species, several species of barbets, green pigeon, laughing thrush, jungle fowl etc (see Annex C). The wildlife species present in the proposed rehabilitation area of the village (Phou Sabor) is lower but it is connected to the main wildlife area of the village such as village protected area and protection forest that link to Ban Suan Ya – as part of the Nam Ha NPA. Therefore, it is possible for some terrestrial wild animals returning to the proposed rehabilitation if the forest is better and fewer disturbed. The species used to present in the area for some 20 years ago but extirpated in the area today were gibbon, langur, sambar, bear, porcupine and pangolin.

Forest supplies of the village have some fair level of ability but a quantity of some timber trees and non-timber forest products has declined since last decade. NTFPs have some significant contribution to the household incomes of Ban Houy Hom especially bitter bamboo shoot,

cardamom, broom grass and Peuk Meuk. The village gains incomes from NTFPs is ca. 100 million KIP per annual as second to agriculture (415 million KIP). Similar to that of Ban Nam Pheng, the income from the bitter bamboo shoots have declined recently because of lower products when forest cover in the bamboo forest is higher density and that not allows enough sunlight for the bamboo tree needs to grow. Anyway, ecosystem service is quite essential in the village but the villagers have not appreciated it as much as Ban Nam Pheng's. It maybe that this village has not been sufficiently educated on the importance of forest conservation since no any conservation project working in there. This village was one of the villages who have grown cash crop plantation for years - started with rubber trees and now then sugar cane plantation. The villagers sold land concession to Chinese investors for sugar cane plantation (10 ha in 2014) and will be more increased to 19 ha by 2016.

The village has some regulations on forest use following the government regulations but not well enforced. The villagers have some knowledge and understand on forest growth and production. They realize as the same as Ban Nam Pheng in managing good products of bitter bamboo shoots and cardamom needs to ensure enough sunlight. These species need to have some open space for sunlight getting through.

Ban Don Ngeun has overall forest degradation and only some fairly good condition of the forest resources in the upper hills of the village – as part of the national protection forest but it is quite far from the village. All is semi-evergreen forest and presence of Mai Dengnam (*Xylia dolariformis*), Mai Khean (*Hopea*), Mai Dou (*Pterocarpus macrocarpus*), Mai Yomhom (*Toona febrifuga*). The villagers of Ban Don Ngeun suggested that forests of the village have been changed and degraded due to over-harvest and forest fires but they can find some wildlife and some NTFPs in the village area. The wildlife species reported in the protection forest which is quite far from the village are barking deer, monkey, several species of civets (palm civet), bengal monitor, bamboo rat, wild pig, squirrel species, peacock, several species of barbets and green pigeon, laughing thrush, jungle fowl etc (see Annex C). The wildlife species present in the proposed rehabilitation of the village (Phou Bersong) is lower but it is connected to the main wildlife area of the village such as national production and protection forests. Therefore, it is possibly for some terrestrial wild animals returning to the proposed rehabilitation if the forest is better and fewer disturbed. The species used to present in the area for some 20 years ago but extirpated in the area today were gibbon, langur, sambar, bear, porcupine and pangolin.

Forest supplies of the village have some fair level of ability but a quantity of some timber trees and non-timber forest products has declined since last decade. NTFPs have some significant contribution to the household incomes of Ban Don Ngeun especially from Mak Tao, cardamom, broom grass etc. The village gains incomes from NTFPs is about 50 million KIP per annual as third important income source after agriculture and livestock. Ecosystem service is quite essential in Ban Don Ngeun and they do some appreciation in the forest ecosystem service. Average annual income of the village per head is US$1,200. This village was one of many villages in the district who sold some land concession to Chinese investors for bananas plantation (200 Lai or 39 ha in 2014) and will be more increased. Selling draft labour to the

Chinese investors for bananas cultivation is becoming important income source of the village today.

The village has some regulations on forest use following the government regulations but not being well enforced. Forest fires, over-harvest forest products as well as illegal logging, were reported. Anyway, the villagers have some knowledge and understand on forest growth and production. They believe that managing good products of some NTFPs needs to manage the harvest technique and prevent forest fires.

5.4.3 Interests, expectations and zoning

Ban Nam Pheng is strongly interested in forest management and rehabilitation. They want to achieve in enhancing the water source and forest supplies for maintaining their household incomes. Some numbers of tree species become fewer stands and necessary to be planted (enrichment). Where appropriate in their forests as not necessarily restrict to the defined forest rehabilitation area. Some NTFPs and in the forest use area, such as cardamom and bitter bamboo shoots to be managed by removing some unnecessary trees as to make some space for sunlight. The proposed village forest rehabilitation area is located in northern village, the upper Houy Heu and Houy Leng (8 ha) were used for hill rice and corn cultivation in the past (see Figure 8). Since the forest in the proposed village forest rehabilitation area has represent of almost all original tree species and that are able to regrow naturally. Therefore, the forest rehabilitation will be mainly in natural growth with some specific tree plantation in their appropriate habitat. The women of the village were most interested in rehabilitating and restoring NTFPs that being useful for their families including herbal medicinal plants but the men group specifically timber tree species. Some tree species that are rare to be replanted is not only the proposed forest rehabilitation area but also other where possible, including Mai Sakoh, Mai Hian, Mai Kuangdeng, Mai Somsieo. The NTFPs are Peuk Meuk, Peuk Bong (incense glue), rattan and cardamom (Kuang Toung). By the way, they agreed to identify a block in the rehabilitation area for replanting all medicinal plants. The village authority and some official are interested to develop this village forest and establish herbal medicinal plant block representing of all medicinal plants in the area for tourism in the future.

The villagers identified four main forest zones according to their traditional knowledge to recognize the differences as *Pa*[21] *Kong khaoxuang*, *Pa Lanten*, *Pa Nampik*, *Pa Houaban* (see Figure 8).

[21] Pa = Forest

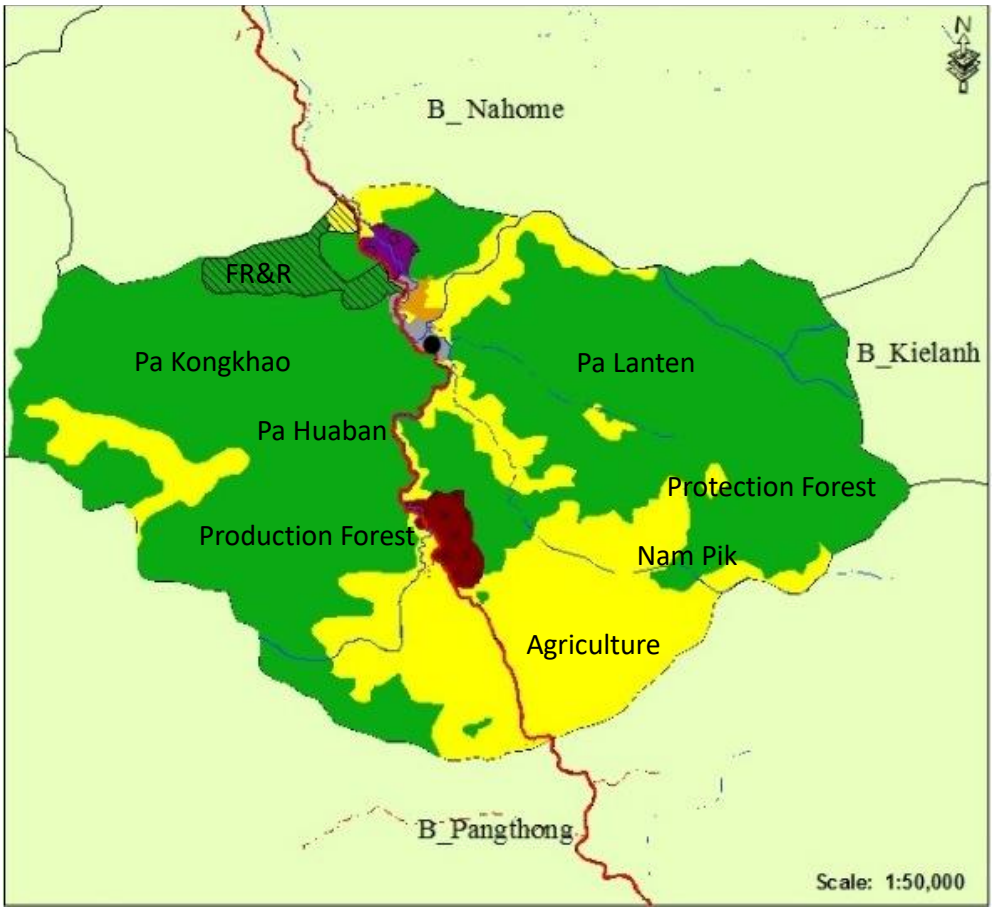

Figure 8. Map of the village land use and vision of Ban Nam Pheng.

The *Pa Kong khaoxuang* is part of the village protected area considered important forest with various NTFPs such as bitter bamboo shoots, khem (broom grass), het deng (red mushroom) and Kok Tao (palm tree). This area is also dominant by Mai Kor (*Castanopsis* sps.), Mai Dengnam, Mai Sakoh and Mai Juang.

Also, this forest is home to some number of wildlife species especially civets, barking deer and birds are important for the forest ecosystem in seed dispersals. It is just located connectively to the proposed village forest rehabilitation area (Houy Heu and Houy Leng). The *Pa Lanten* is also part of the village protected area and agricultural land. It has a similar forest condition to that of *Pa Kong Khaoxuang* but lower in the forest productivity and part of it is paddy field. Wai (rattan) and Mak Neng (cardamom) are found in this zone. Some part of this land is used for corn production. The *Pa Nampik* was used long time for cultivation; it is considered degraded forest land as young fallows with dominance of weeds including Nya kha (sun grass) and Khem (broom grass). This area is abandoned from hill rice cultivation to reforest naturally. The *Pa Houaban* is partly used for hill rice cultivation in recent years and habitat of Wai (rattan). A fallow of 3-5 years is used for hill rice cultivation in the village (see Figure 8).

Ban Houy Hom has some interest in forest management and rehabilitation. They want to achieve in enhancing the water source, forest supplies for maintaining household incomes and timber for house construction. Some numbers of tree species become fewer stands and to be planted (enrichment) where appropriate in their forest especially in the defined forest rehabilitation area. Some NTFPs, such as cardamom and bitter bamboo shoots to be managed by removing some unnecessary trees as to make some space for sunlight. The proposed village forest rehabilitation area (39 ha) is located in northern village. The area is known as Phou Sabor and watershed of Houy Mai Heng which is close to Ban Suan Ya (see Figure 9).

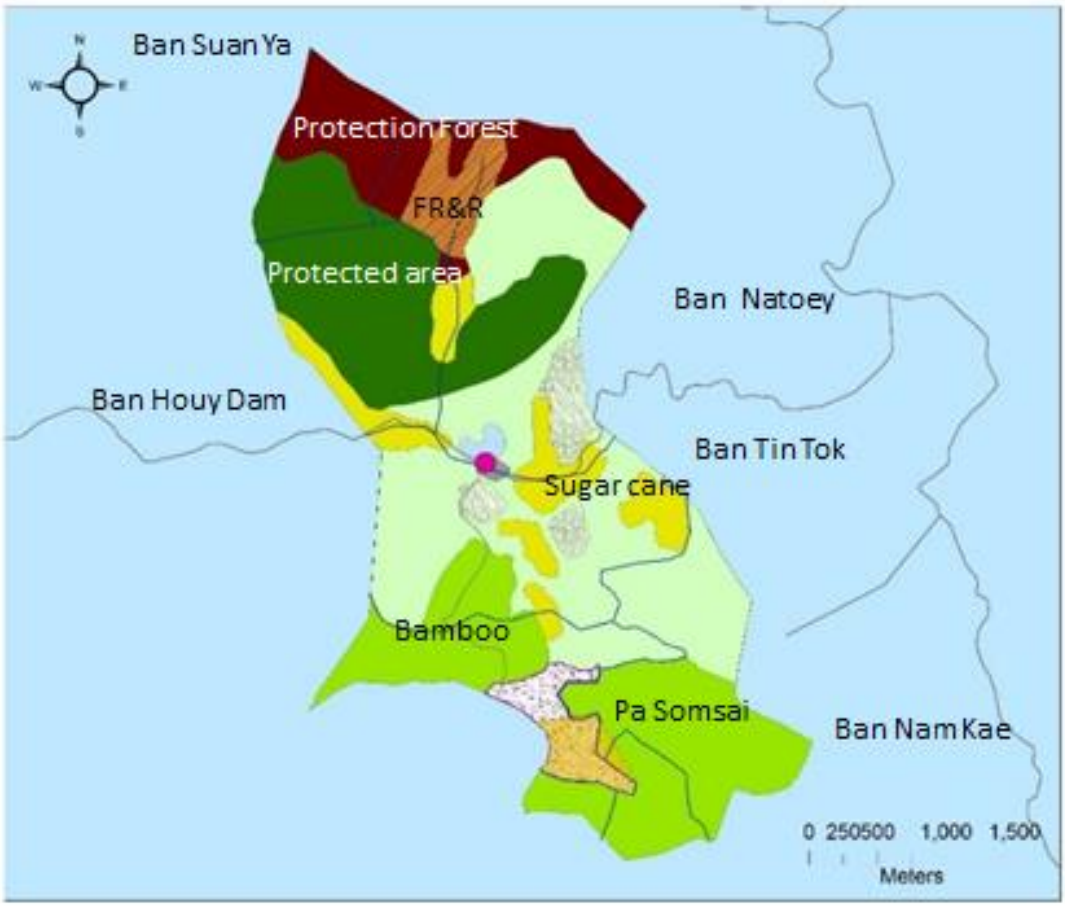

Figure 9. Map of the village land use and vision of Ban Houy Hom

The area was partly used for hill rice cultivation in the past. They realize that it is one important watershed for their agriculture in the area so the forest rehabilitation is essentially needed. Although the forest in the proposed village forest rehabilitation area has represent of almost all the original tree species that are able to regrow naturally it is necessary to plant some rare tree species as to maximize biodiversity of the area. The rare tree species identified to be replanted in the proposed forest rehabilitation area such as Mai Sai, Mai Sor, Mai Dengnam. The NTFPs are Peuk Meuk, Peuk Bong and rattan.

Traditionally, the villagers recognize their various forest types as *Pa Sa Ngouan* (protected area), *Pa Yot Nam* (Protection forest), *Pa Somsai* (forest use), the rest is *Din kasikam* (agricultural land) and *khet liengsat* (grazing area). The *Pa Sa Ngouan* is quite large located in upper village. This forest is home to some number of wildlife species especially civets, barking deer and birds are important for forest ecosystem in seed dispersals. It is just next to the proposed village forest rehabilitation area. The *Pa Yotnam* "watershed" of Houy Mai Hang and part of it was used for hill rice cultivation in the past. Therefore, the villagers proposed this forest area (39 ha) is the village forest rehabilitation area as to enrich the forest and leave it regenerate naturally. The *Pa Somsai* and also *Pa Nokhom* (bitter bamboo forest) are considered degraded forest regarding the amount of annual product supplies. The production of the bitter bamboo shoots is not really productive today due to lower percentage of sunlight getting through when forest is better growth to covering in the bamboo forest area. The *Din Kasikham* is used for plantation and rice production. Whereas, ca. 19 ha was defined as livestock grazing area according to the land and forest use planning carried out in 2005 is now partly converted to sugar cane plantation.

Ban Don Ngeun is similar to that of Ban Houy Hom as the villagers have some interests in forest management and rehabilitation. They want to achieve in enhancing the water source, forest supplies for maintaining household incomes and timber for house construction. Some numbers of tree species become fewer stands and to be planted (enriched) where appropriate in their forest especially in the defined forest rehabilitation area. Some NTFPs, such as Kok Tao, Wai (rattan) and Sakhanh may be managed in harvest and prevent forest fires. The proposed village forest rehabilitation area (20 ha) is located in northern village. The upper mountain, it is known as Phou Bersong and watershed of Houy Bersong (see Figure 10).

They realize that it is one important watershed in the area so the forest rehabilitation is needed. Although the forest in the proposed village forest rehabilitation area has represent of almost all the original tree species that are able to regrow naturally it is necessary to replant some rare plant species. The rare tree species identified to be replanted in the proposed forest rehabilitation area such as Mai Dou, Mai Khaen, Mai Dengnam and Mai Kuangdeng. The NTFPs are Kok Tao, Wai (rattan) and Sakhanh. Similar to that of Ban Houy Hom, the villagers recognize their various forest types as *Pa Pongkan (*protection forest), *Pa Phalit* (Protection forest), the rest is *Din kasikam* (agricultural land). The *Pa Pongkanh* is quite large and located in upper village that connected to other villages. Its part with the village "watershed" of Houy Bersong which is considered likely degraded due to forest fires and over-harvest of product products including timber logging.

However, this forest is still home to some number of wildlife species especially civets, barking deer and birds are important for forest ecosystem in seed dispersals. It is just closed to the proposed village forest rehabilitation area. Also, The *Pa Phalit* is part of National Production Forest as very large that connected to other villages. The village proposed the watershed of Houy Bersong (20 ha) is the village forest rehabilitation area as to enrich the forest and leave it

regenerate naturally. The *Din Kasikham*, located in lowland area and partly converted to bananas plantation of the Chinese investors.

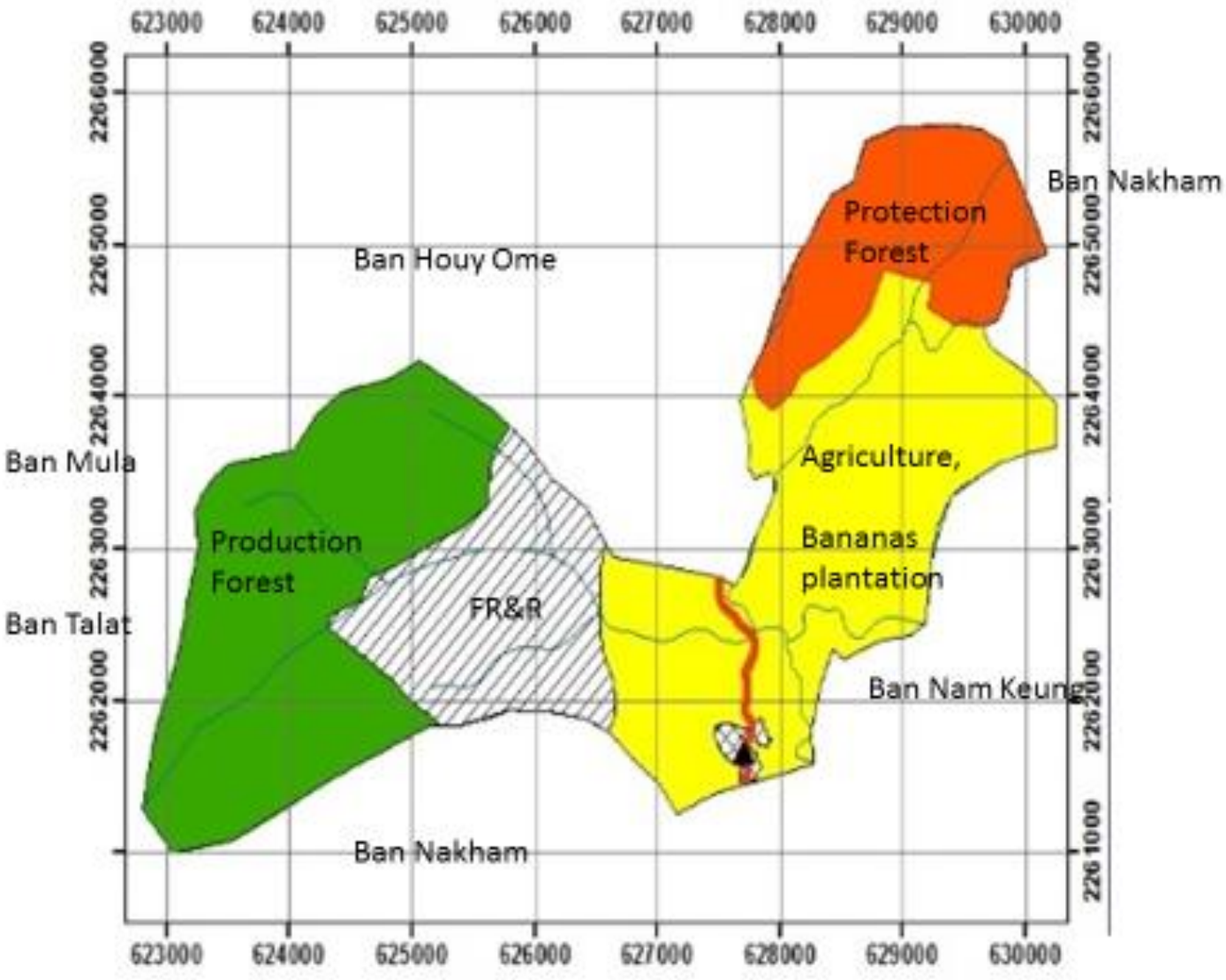

Figure 10. Map of the village land use and vision of Ban Don Ngeun

In summary, due to marginal agricultural land was defined and practiced in short-fallows and in many rounds make the villagers aware of reduction in soil quality today. It indicates that their rice products reduced about 50% in the same piece of land compared to that of the past. Previous decades many villages in the area converted their forest lands to rubber tree plantations but right now a majority of the villages do short-lived cash crop plantation such as sugar cane and bananas that being cultivated in the same plots every year. However, this led to use chemical fertilizer and pesticide to control weeds and pest which consequently impact on environment and the people. Absolutely, soil quality will be much lower, not much productive and lost at last unless land quality management is in place. In this regard, it was observed in

Ban Houy Hom and that their piece of agricultural land is considered poor as appearing of a lot of weeds, some sun grass and only few young tree species.

5.4.4 Screening of tree species

The tree species that are fewer, rare to find in their forests but being useful and interested by local villagers to be rehabilitated by any means especially to replanting where the species are rare or has no longer present as to enrich the existing forest community. Through the village consultations we identified a total of 16 plant species in the pilot villages (see Table 2). Also, we examined an ability of those trees in ecosystem, survivor ability, cultivation, ecosystem service and to know which wildlife species to help disperse their seeds.

Table 2. Summary of tree rare species for recovery

No	Tree species	Ecosystem				Survivor ability						Cultivation				Ecosystem Service						Wildlife species use			Pilot village		
		Fruiting	Flowering	Sheltering	Dispersing	Water adapt	Fire tolerant	Deep root	Soil adapt	Sun lover	Shade tolerant	Seed collection	Nursery	Easily grow	Poor soil adapt	Timber	Income	Food	Medicine	Erosion control	Total score	Species 1	Species 2	Species 3	Nam Pheng	Houy Hom	Don Ngeun
1	Mai Dou	1	1	1	1	2	2	2	2	2	1	2	2	2	2	3	0	0	0	2	28						X
2	Mai Sai (champa)	2	1	2	2	1	2	1	2	1	1	2	2	2	1	3	0	0	0	2	27	Squirrel	Barbet		X	X	
3	Mai Hien	2	3	1	3	1	1	1	1	1	1	3	2	2	3	3	0	0	1	1	30	Barking Deer	Mouse Deer	Wild Pig	X	X	
4	Mai Khaen	1	1	2	1	2	1	2	2	2	2	2	2	2	2	3	0	0	0	2	29						X
5	Mai Dengnam	1	1	2	1	1	1	2	1	1	2	2	2	2	1	2	0	0	0	2	24	Squirrel	Wild Pig			X	X
6	Mai Soh	2	2	1	2	1	1	2	1	2	1	2	2	1	1	3	0	0	0	2	26	Barking Deer	Squirrel	Mouse Deer	X		
7	Mai Sako	1	1	1	1	1	2	1	2	1	2	1	1	2	2	2	0	0	0	2	23				X		
8	Mai Kuangdeng	1	1	2	1	1	1	1	1	1	2	1	1	1	1	3	0	0	0	2	21					X	X
9	Mai Wanam	1	2	3	1	1	2	2	1	1	2	1	2	1	1	3	0	0	0	2	26	Bird sp.	Squirrel			X	
10	Mai Somsieo	1	1	1	1	1	3	1	2	2	1	2	2	1	2	0	2	2	0	1	26				X		
11	Mai koh deuay	2	2	1	1	1	1	1	2	2	2	2	2	2	1	1	1	2	0	1	27	Squirrel				X	
12	Peuk Meak	1	1	1	1	2	1	1	1	1	2	1	1	3	2	0	3	0	0	1	23					X	
13	Peuk Bong	1	1	1	1	2	1	1	2	2	1	2	2	2	2	0	3	0	0	1	25					X	
14	Wai (rattan)	1	1	0	1	1	1	0	2	1	2	2	2	2	2	0	3	0	0	0	21	Squirrel			X		X
15	Kok Tao	3	1	1	2	2	1	1	2	2	2	2	2	2	2	0	3	2	0	0	30	Civet	Squirrel				X
16	Sakhanh	0	0	0	0	2	2	1	2	1	3	0	2	3	2	0	2	2	0	0	22						X

Remarks: a score of 3 is the highest

There are some similar tree species identified in the tree pilot villages and score of each species was given by the villagers. Overall values in score of the identified plant species that are high because of their abilities, functioning in ecosystem and providing benefits to the people, including are Mai Hian, Mai Khaen, Mai Sai, Mai Dou, Mai Soh, Mai Wanam and Tao. Specifically, the species with high value in ecosystem as they provide with fruits for wild animals, flowering, sheltering and ability to disperse by itself or animals are Mai Hian, Mai Wanam, Mai Dengnam, Mai Sai and Mai Khaen. Planting these trees are not necessary to plant many trees because they can help themselves easily afterward. Whereas, the species with good ability to survive and be cultivable are Mai Dou, Kok Tao, Sakhanh, Peuk Meuk, Peuk Bong, Mai Hian, Mai Sakoh and Mai Somsieo. Of which, Mai Dou although it can survive it cannot grow if it is planted in under shadow. Anyway, these species are generally not difficult to plant but it needs to plant in high number for Mai Dou in Ban Don Ngeun since it was extirpated and this species is

understood being unlikely used and dispersed by known wild animals in the area. In addition, almost the species listed have good functions in ecosystem service (timber, food, income and soil erosion control).

The wildlife species that were reported in the pilot villages and possibly help dispersal these tree species including barking deer, civet sps., birds (barbet sps.), lesser mouse deer and wild pig (see Annex C). Of which civets and bird species are fairly present in the pilot village and will play important roles in tree species dispersal which possible help enrich the forests. Although squirrel is common species in the area it will not help in seed dispersal because it eats inside seed, not swallow seeds as civets, barking deer and birds do. Therefore, to conserve wild animals will help improve forest rehabilitation in enhancing biodiversity in long run.

5.4.5 SWOT Analysis of potential forest rehabilitation

Three different degrees of forest rehabilitation responsibilities were discussed to obtain Strengths, Weakness, Opportunity and Threat by village, group and family. The pilot villagers realised that the forest rehabilitation by village can obtain a harmony and equality among different ethnics in the village but some families would not be interested and participated in it due to lack of understanding on the importance of conservation. By the group is possible as it is easier to manage, clear tasks and responsibilities but some people are not in the group would not have opportunity to join or difficult to delist someone. By the family is easier for staff and project to manage but lack of labour in case forest land area needs to expand. Therefore, the table 3 below shows results of the consultations on the forest rehabilitation management with the pilot villages using the SWOT analysis.

Table 3. Results of the SWOT Analysis with the pilot villages

Level	Strength	Weakness	Limitation	Opportunity
Village	Harmony Equality	Lack of ownership Someone will not participate, Lack of conservation understanding.	Some villagers will not pay attention, Difficult to bring people for a meeting.	Build a harmony, Knowledge exchange, Help each other, Training assistance by project/GoL
Group	Easy to manage, Clear tasks, Agreement	Not all can participate	Not understand, Lack of training, Hard to eliminate someone out.	Easy to manage and discuss, Training assistance by project/GoL
Family	be easily managed by GoL staff and project.	Lack of labour	Insufficient training and understanding	Training assistance by project/GoL

In this regard, as to manage and ensure success of the forest rehabilitation by village may need to assign to a group who is interested to be part of the village responsible for managing and enhancing the village forest rehabilitation area. It is a group or unit of the village that be

established and selected by the village in consultation with the relevant government offices. This, the assigned group to be clear on roles and responsibilities and some sort of agreements to be made, with a code of conduct of the group to be made and followed.

5.4.6 Forest connectivity

Ban Nam Pheng the large forest landscape in the area is Nam Ha National Protected Area (NPA) and that also connectivity of Nam Tha National Protection Forest (NPF). However, due to many portions of forests were converted to cash crop plantation in its surrounding villages since last decade made the forest of this village is quite isolated from other main forest landscapes. To the south of Ban Nam Pheng is Ban Pangthong as ca. 70% of the village become rubber tree plantation. To the west is Ban Nam Kae then Ban Houy Hom (the pilot village) but the forest is not connected further from Ban Houy Hom's protected area. To the north is Ban Na Home where another possible forest connection with Nam Tha National Protection Forest but also the forest of Ban Na Home itself remains fewer (see Figure 1).

Anyway, if we work on landscape forest planning and dealing with all neighbouring villages there is a need to start from review all forest and land use planning and to provide them some livelihood assistance. It is likely possible to re-connect the forest of Ban Nam Pheng to the main forest of the Nam Ha NPA through Ban Pang Thong on the south, Ban Na Home to the north, Ban Namkae and Houy Hom to the west.

Ban Houy Hom the large forest landscape in the area is Nam Ha National Protected Area (NPA) and that is connected to Ban Houy Hom's protected area. The upper hill (Phou Sabor), where some wildlife species were reported and the forest is connected to Ban Seun Ya's forest and then to known Nam Kong forest area. The Nam Kong forest is part of Nam Ha NPA and that connect to Xieng Yong Reserve in China. But the forest of Houy Hom is not connected down south further to Ban Nam Kae (see Figure 1). Anyway, forest connectivity of this village has no problem if only the village authority has improved forest management because it has already some connection with the main forest landscape of Nam Ha NPA.

Ban Don Ngeun the large forest landscape in the area is Nam Kan National Protected Area (NPA) and that also connectivity of Sam Chae Muang National Production Forest and National Protection Forest. These forests are in upper hill and present of some important wildlife species that is important for the forest ecosystem. Due to high disturbance these forests are degraded and impact on the species. However, when the village forests are well protected some species that are now believed to be extirpated in the area may return such as gibbon, langur, sambar and bear. To the south as Ban Nakham and it has some forest patch be connected to the village (see Figure 1). Anyway, forest connectivity of this village has no problem if only the village authority has improved their effective forest management.

5.4.7 Preliminary baseline data

Baseline data is important for monitoring and project evaluation to certify a success or failure of a project. One single set of data is insufficient to make a conclusion but it needs several

parameters “indicators” to be measured. Due to just one day visit in each pilot village is not enough time to collect some necessary quantitative data. As the table 3 below presents a preliminary baseline data which can be used for some qualitative and quantitative evaluation by the end of the project.

Table 3. Preliminary baseline data of the pilot villages

Data type	Nam Pheng	Houy Hom	Don Nguen	Measuring of Success
Forest cover (%)	68.64	54.83	62.9	Higher percent
Rehabilitation area (condition) Data 2010	Mainly young fallow and degraded forest as some species are rare[22] to find. No or a few is found from a day-walk.	As half of the rehabilitation area is young fallow and degraded forest as some species are rare to find.	Degraded forest as some species are rare to find.	Recovering from young to pre-mature, more frequency of given rare species is found
Tree species (status) see in item 5.4.4, in table 2 above.	About 5 species are considered in very low distribution, rare to find and in smaller size.	About 8 species are considered in very low distribution, rare to find and in smaller size.	About 7 species are considered in very low distribution, rare to find and in smaller size.	These rare species are better to find and mature trees can be found with more frequency per unit (km).
Wildlife species (status)	Barking Deer is present in the area but not many. Only a flock of 6 pied hornbills.	Barking Deer is present in the area but quite rare and it lives in being far from the village.	Barking Deer is present in the area but quite rare and it lives in being far from the village.	Tracks of Barking Deer are found close to the village with more frequency per unit (km). Also, represent of the extirpated species.
NTFPs (defined species)	Smaller size and quantity,	Smaller size and quantity	Smaller size and quantity e.g Tao	Large size and higher quantity.
Water level in February (cm)	Houy Heu (15 cm)	Houy Mai hang (12 cm)	Houy Bersong (15 cm)	Dec 2014

However, detailed specific data may be collected during the first year of the project as to develop a better set of baseline data of each pilot village for future reference. Some transect walk or plots to be established in the village rehabilitation areas as to gain better quantitative baseline data.

[22] Rare in this context is that even though pre-mature tree cannot be found or a few from a day walk.

5.4.8 Potentials of forest rehabilitations and restoration

Forest rehabilitation and restoration in the pilot villages will be through naturally forest rehabilitation and necessity to replant some trees to re-establish and improved quality of the existing forests. Enriching and connecting forest zones to make a largest forest landscape together with better management. In reality, the forest rehabilitation and restoration in the pilot villages has a similar approach. The proposed village forest rehabilitation areas will be naturally forest growing since the proposed areas are not severely degraded. As to retain and enhance the rehabilitation areas it needs proper management by preventing forest fires. Also, effective village regulations for ensuring sustainable forest management are necessary. Some wildlife species present in the pilot village areas will help seed dispersals except some species that are not used by any wildlife which then human's inputs may be needed such as Mai Dou[23] (see Table 2).

Nevertheless, leaving for natural growth will take time so some human's inputs would need and help enrich the forest faster. Once, to regenerate forest to maximize biodiversity needs to replant some trees that are fewer or rare in the village area. It is not only in the proposed village rehabilitation area to be replanted but also in other forest zones where appropriate. Seeds of the proposed tree species for rehabilitation can be collected in the area and seeding in the pilot villages as to build a village-based reforestation. Ban Nam Pheng is not necessary to invest a lot but it needs for Ban Houy Hom and some in Ban Don Nguen.

Ban Nam Pheng has good forest conditions and the villagers are strongly interested in forest rehabilitation and management. Therefore, it is highly potential to facilitate this village to do this work successfully. This is to only improve and refresh land and forest use planning with improved the village regulations. Appropriate training and monitoring to be in place but that be consistently supporting by relevant government. The proposed village forest rehabilitation area is in Houy Heu and Houy Leng but enrichment of other forest types as some tree species that are fewer or rare to be replanted in the village protected area and production forest was proposed. For example, *Pa Kong Khaoxuang* will be used for rattan and Kok Tao rehabilitation. *Pa Lanten* will be used for cardamom rehabilitation by opening some forest space for the existing cardamom community and replant another cardamom type (Kuang Toung) as it can grow and provide good production under tree shadows. Also, in the area a home garden will be established within the proposed forest rehabilitation area where they wanted to plant all medicinal plants that they can harvest in close by. As a whole, the forest and NTFPs management needs to improve the village regulations.

Ban Houy Hom is necessary to invest quite a lot due to the villagers' ownership in forest management is low. Conservation awareness raising and necessary training for the villagers are needed. The proposed village forest rehabilitation area will be conducted through naturally forest regeneration and some forest enrichment in the proposed village forest rehabilitation area as it is quite large enough (39 ha). However, if villagers are interested in enriching other

[23] Mai Dou can disperse itself by wind as its wings available it can fly away from the mother tree for some distance.

forest types as some specific tree species that are fewer or rare may be replanted in the village protected area and forest uses (87.5 ha), was proposed. Similar to that of Ban Nam Pheng, removal of some trees in the bitter bamboo forest (20 ha) as to improve the production of bamboo products was also proposed. Anyway, the reforestation of Ban Houy Hom is possible to succeed if their regulation enforcement is strong enough and also their cooperation with neighboring villages.

Ban Don Nguen is also necessary for some investment due to the villagers' ownership in forest management is fairly low. Conservation awareness raising and necessary training for the villagers are needed. The proposed village forest rehabilitation area will be conducted as naturally-based regeneration and some forest enrichment will be in the proposed village forest rehabilitation area as it is quite large (20 ha). However, if the villagers are interested in enriching other forest types as some specific tree species that are fewer or rare may be replanted in the production and protection forests is possible. Anyway, the reforestation of Ban Don Nguen is possible to succeed if their village regulation enforcement is strong enough and also their cooperation with neighboring villages.

These two last pilot villages need more close support from the districts, on technical assistance, monitoring and to ensure effective village regulations.

6. Some Lessons Learnt of Forest Rehabilitation in the Target Provinces

Forest rehabilitation and restoration is not new to the Lao PDR as well as the target provinces. Recognizing the forest loss there was to the need of slower the loss rate was initiative in early 1985. A tropical forest action plan was formulated in the country prior to any law and policy on forest related was declared. The first Lao Forest Law was enacted in 1996 and National Forest Strategy for the year 2020 was endorsed by the government in 2005 to guiding the development of the forestry sector in line with overall national plans on increase forest cover to 70 percent of the total land area (16.5 million hectares) by 2020 through apart of management of existing forest it to restore more forest to meet 6 million ha. The ground practice of the strategy including forest management program; shifting cultivation stabilization program; land and forest allocation program; forest law enforcement and forest governance. While promoting public especially private sector in forest rehabilitation – tree plantation. Through the work of the forest rehabilitation related to in the target provinces they have learnt some good points, week points and adaptive management shown in the table 4 as following:

Table 4. Some lessons learnt of forest and land and forest use planning

Topics	Good points	Weak points	Adaptive Management
Land and forest use planning	Defined boundaries, potential forest was increased	No extension afterward, not sustainable and the land allocated was not	Alternatives for local villagers are necessary, ensure appropriate and to ensure the agricultural

		enough later on made disobey the regulations.	land not be degraded as monitoring to be conducted from time to time.
Tree plantation	Planting mainly economic trees and the holders get better household incomes.	Some natural forest was lost and impact on local livelihoods especially where land concession was made. Some conflicts within the communities were reported.	It to be clear where to be naturally regenerated or restored from planting. It is dependent on the purpose [ecosystem or economic] which then be native or economic trees to be planted but to ensure fewer impact on natural forests.
Mapping and ground forest and land allocation	Map produced is faster	Mistakes and conflicts with neighbouring villages raised afterward when map produced without good judgment, lack of customary consideration, lack of principles. Sometime, it was not fully consulted and checked properly with relevant villages.	Forest and land allocation before the village zoning map is made should be in ground check, and based on many factors such as traditional practice, geography, calculate the area with current population and growth rate.
Coordination	Good coordination can make everyone content in the first place, first pilot village.	Poor coordination afterward, did faster but made mistakes and generated some conflicts.	Inform each other on any relevant respective and ensure everyone is well participated so an agreement is made will be effective.
Land title	Villagers has land ownership and able to protect legally.	Land tile is pros and cons for rural people. Often, villagers sell their legal land plots in concession to other people e.g Chinese, then to claim new land from new slashed and burned cultivation.	Land title should be carefully considered and granted as to ensure of protecting from selling the legal land property to other people and to claim new one.
Data management	Good for planning and monitoring	Data was not stored systematically so data loss was often.	Mechanism for data storage and management to be in place. Although change in person to in-charge the system should be functioned.

7. Training and Equipment Needs

According to the consultations with relevant officials and villagers on the training needs and equipment needs for forest rehabilitation, restoration and management apart from known equipment purchased by the project there are summarized in the table 5 as below:

Table 5. Summary of training needs proposed by officials and villagers

Training	Target Districts			Pilot villages		
	Namo District	Luang Namtha	Ton Pheung	Nam Pheng	Houy Hom	Don Ngeun
Mapping, GIS, ArcMap, GPS	X	X	X			
Forest management	X	X	X	X	X	X
Forest rehabilitation		X	X		X	
Monitoring			X	X		X
Forest survey			X			
Forest fire protection and management						X
Equipment and facility						
Computer				X		
Camera				X	X	X
Village Forest fire fund						X
Village speakers						X
Binocular						X
Forest fire observation post						X

8. Recommendations

Forest rehabilitation and restoration in the country has to have a better practical approach and in a sustainable way. Not only quantity by forest cover is expected but also quality of the forests, biodiversity values and a need of improved local livelihoods and ownership in relation to forest management. Some principles, approaches and sustainable mechanisms in this regard to be demonstrated and replicated.

8.1 Forest Rehabilitation and Restoration

As mentioned in the item 5.4.8, the potentials of forest rehabilitation and restoration in the pilot villages - the proposed village forest rehabilitation areas are not severely degraded so naturally forest rehabilitation from just young fallows and existing degraded forest is highly possible as long as local ownership is built, clear land and forest use planning and effective law enforcement is in place. This, forest rehabilitation group of the village to be formed and that they have to have an agreement as clear on roles, responsibility and benefits.

By the way, as to develop an example of forest rehabilitation in the pilot villages some bare land should be identified and exercised as to understand some ability of forest regeneration. Also, pilot forest plots in different conditions to be established and observed the grow rate. The

fallows that we can observe only weed growing due to many short or no rotations for cultivation on that piece of land. Interestingly, such the condition is considered bare land as likely no longer or few tree species present should be piloted by means of a framework species as to make a forest succession "re-colonization". Because of direct planting tree requires high costs so such the framework species should be tested by planting some fruit trees [e.g *ficus*] to attract birds to help seed dispersal in the defined bare land. This is probably part of action research to understand forest regeneration from various stages. Therefore, during further detailed village surveys or new land and forest use planning in the pilot villages may need to identify several possible plots of at least 40mx40m sq each for this or or in straight corridor. This needs to really do survey what tree species seeding/sapling and if any tree seedling available, how many of those rare tree species remains in the pilot plot. Also, where necessary a forest connectivity should be restored from degraded or bare land especially the stretch between Ban Houy Hom and Nam Pheng through Ban Nam Kae.

In principle, the forest rehabilitation we should replant only the native species that are absent or rare today other than non-native tree species such as Mai Taekha, Mai Kha Nyoung and Mai Dou[24]. It is because the main aim of the forest restoration is to enhance water resource and improve forest supplies e.g NTFPs, in particular. Considering the framework species approach needs to think about forest ecosystem as how those trees be dispersed by whether animal (which animal) or wind (see Annex G). It is to plan for first or later succession to gain the needed species be recolonized. As some species cannot be planted in bare land with intensive sunlight so shade trees to be planted first, and then fruit trees. Specific suggestions for each pilot village as below:

Ban Nam Pheng is more in naturally forest rehabilitation in the proposed village forest rehabilitation area and managing their existing forests. The proposed village forest rehabilitation area is in Houy Sua but enrichment in other forest types as some tree species that are rare to be replanted such as in the village protected area and production forest. Wildlife species conservation has been conducted well by the village indicates some species such as squirrel can be observed just close to the village. The presence of wildlife around the village is important not only for ecotourism but also ecosystem purpose in the future. Take the advantage of their forests to generate incomes from tourism and home gardens is well possible.

Ban Houy Hom is also naturally forest rehabilitation in the proposed village forest rehabilitation area and managing their existing forests. The southern block was previously allocated as grazing area has severely degraded land and majority of this part changed to sugar cane plantation requires intensified chemical fertilization for the cultivation. This zone is interesting to identify certain plots for testing how forest is regenerated naturally. Although natural forest regeneration is somehow possible in the degraded land there are not all trees[25] can come back until replanting them. The *Ficus* tree would be important tree species for stepping stone that

[24] Except Ban Don Nguen because Mai Dou was originally present in the village area.
[25] Especially the tree that its fruits are not used by any animals and it cannot disperse itself.

can attract some birds to disperse in the pilot block. Therefore, wildlife species is important to be protected to help the forest ecosystem functions in the future.

Ban Don Ngeun is similar to that of Ban Houy Hom but forest conversion to bananas plantation would impact on exiting protection forest unless effective law enforcement is in place. Forest rehabilitation in this village (Phou Sabor) would also think of enriching to maximize biodiversity. It is about forest quality improvement as not only tree species to be managed but also wildlife species to be protected to help seed dispersal in the future.

8.2 Approach of Forest Rehabilitation and Restoration

There are two main approaches to be conducted as one for forest rehabilitation in the identified village forest rehabilitation areas and second for enrichment as necessary rare tree species to be replanted not only in the rehabilitation area but also other forest zones where appropriate. There are 12 possible steps to be conducted as following:

- Conduct conservation awareness raising for especially Ban Houy Hom and Don Ngeun to get a better understanding and know long-term benefit for local communities from the forest rehabilitation. It needs to build a common understanding among the villagers.
- Provide training for village how to conduct tree surveys, conservation principles and management. Some basic field survey will be included and this training may be conducted together with officials. Their participation is part of building their ownership.
- To confirm the tree species those preliminarily identified in table 2 to be replanted in each village. Check carefully if any particular species need for survival in which factors such as sunlight - an open forest to grow or shade to survive. These are important to be assessed for tree replanting business because different species has different needs.
- Survey in the proposed village rehabilitation area and other forest types to identify important tree species and NTFPs including the species of interest to be replanted, recording density, quantity of those species found in the samplings. For each village it would have ca. 10 plots (40x40m) or 5 line transect walks (2 km each). Unless these are established properly with waypoints can be baseline data. Seedling of the defined rare species to be recorded and also wildlife observation in the quadrats or transects to be made accordingly. If some area has young fallow it needs to identify which tree species is present.
- Reconfirm the tree species after the field surveys with the village authority as to finalize the list. The species is rare, very low density needs to be replanted in some numbers. But, the tree species that its fruits are not used and dispersed by any animals such as Mai Dou in Ban Don Nguen, to be replanted in larger number.
- Conduct more consultations with local villagers as to understanding on the interested tree species' ecology and an ability of growth. It needs to work on species by species following the same approach focusing on how to plant particular species successfully.
- Survey the possible location for particular tree species need based on its habitat of uniqueness such as Mai Dengnam will be replanted in low valleys, foothill or river banks.

- Refresh forest and land allocation planning, conduct socio-economic surveys for land and forest use planning as all necessary supporting data to be conducted. Zoning appropriately based on its potentials and support data. Village regulations to be improved and agreed by its neighbouring villages.
- Establish village forest rehabilitation group or unit and discuss on best possibility of forest rehabilitation and management in each pilot village. Agreements to be made for each pilot village. The work includes seed or seedling collection for nursery, replanting leading to weeding and monitoring. For some case, such as in bare land watering is needed. Village-based approach is necessary and that for groups/even families for certain planted trees to be taken care. Detailed workplan of this to be prepared including forest fired and threat prevention. In rotation basis responsible for this to be arranged as to avoid abandoning the work of responsibility to someone.
- Specific training on nursery, relocating and replanting is necessary. This is more about on-the-job training including forest monitoring, fire protection etc.
- To develop a mechanism for ensuring sustainability of the village forest rehabilitation. Kumban committee, village committee and village development fund to be arranged. For example, Ban Don Nguen needs to have an emergency fund or fund for forest fire management.
- Training in jobs and help the local villagers in livelihood development but ensure it is sustained as be based on its potentials, interest and possible to succeed.

8.3 Sustainability of Forest Rehabilitation, Restoration and Management

Forest rehabilitation will be sustainable if right mechanism and good governance is in place. It needs to have local ownership, some mechanism/system of work and interest of decision-makers. Monitoring mechanism is also important activity to ensure the village agreements/regulations are well followed as well as trees planted are well monitored. As a whole, ownership of official in this work to be built first. This needs to avoid self-fish of assigned official for this work and do everything by themselves for the villagers.

Ban Nam Pheng is not necessary to invest a lot but Ban Houy Hom and some in Ban Don Nguen. Building ownership of the villagers through awareness raising is forefront and along with their capacity to be built. Absolutely, the sustainability also requires consistent support from relevant government offices and some appropriate mechanism for coordination in maintaining the interest and also relationship to be developed. Replacement of staff is also some issue in the past that led to failure. This is often happened so not one person assigned to. More staff to be trained and able to deliver when one is absent. Also, if replacement is happened hand-over the work to be well arranged. Data to be stored, managed and retrieved systematically. It needs to avoid to having a set of data is stored in one personal computer and one person knows.

Finally, at provincial and district level, this forest rehabilitation work should be incorporated into other relevant provincial and district plans. Considering and incorporating this work as part of the provincial and district's agendas, into policies or strategic plans. This will make possible if

only the relevant provincial and district authorities have recognized that forest loss is an issue that highly possible impact on anyone's lives. The relevant authorities should have a common understanding that the forest rehabilitation will be one of securing for long-term livelihoods.

9. Summary

Talking of the forest rehabilitation and restoration some official think about planting and planning economic trees other than original or native tree species to reverse back the forest. Whereas, local villagers' interest was about enhancement of water source, forest supplies and housing materials. The forest rehabilitation in the pilot villages is possible but most is about natural forest regeneration where there is already a potential forest. Enrichment by replanting some tree species is possible but it needs to do survey properly whether they are really a need to plant or not. In this regard, we need to understand a forest ecology, particular tree species. Building local ownership, capacity as well as ensure all planting trees are monitored.

The pilot villages have similar conditions and existing forest cover is considered high (above 50% of the total village area). Some numbers of wildlife species were reported in the pilot villages so they will be helpful in seed dispersal. Agricultural land limitation is observed in Ban Houy Hom and Ban Don Ngeun as they do intensive cultivation in sugar cane and bananas plantation respectively. Forest rehabilitation in the pilot villages is possible but most is about naturally forest regeneration where there is already a forest. Building local ownership, important to communicate to them to perceive potential benefits from naturally forest rehabilitation. Ban Nam Pheng is not necessary to invest a lot but Ban Houy Hom and some in Ban Don Nguen.

There are a lot of benefits from ecosystem service to be gained when forest is rich enough. Watershed is the first for local villagers but also forest products for foods and house construction materials will be gained. Of which, household income can be gained accordingly. The interest of officials focused on forest cover, water source and incomes. Anyway, focusing only forest cover would not help much for long-term forest rehabilitation unless forest quality is met and more forest connectivity is established in the area as to strengthen the forest ecosystem. Perhaps, it needs to develop example of forest rehabilitation in the pilot villages as some bare land should be identified and exercised. Meanwhile, training is needed for staff and local villagers. Long-term sustainability is necessary to think and plan for. All is to ensure planting trees are monitored.

As a whole, this will make possible if only the relevant provincial and district authorities have recognized that forest loss is an issue, they should also have a common understanding that the forest rehabilitation will be one of securing for long-term local livelihoods.

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Annexes

Annex A. Field Schedule

Day 1. February 1, 2015
Travel VTE-Oudomxay

Day 2. February 2, 2015
Workshop in Namo District, Oudomxay Province

Day 3. February 3, 2015
Workshop in Ban Nam Pheng and site visits

Day 4. February 4, 2015
Workshop in Ban Houy Hom, Luang Namtha and site visit

Day 5. February 5, 2015
Workshop in Luang Namtha, and travel to Bokeo Province

Day 6. February 6, 2015
Workshop in Ton Pheung and then to held a workshop in Ban Don Ngeun with site visit

Day 7. February 7, 2015

Wrap up with the team and check all data and understanding to make a common understanding.

Day 8. February 8, 2015
Travel (Bokeo-Luang Prabang)

Day 9. February 9, 2015
Travel (Luang Prabang – Vientiane)

Annex B. List of Participants and Key Informants

No	Name and family name	Organisation	Contact
1	Mr. Khamkhoun Phomsavanh	NAFRI, Vientiane	22240041
2	Mr. Phonephan Luang Aphay	Community forest, DoF, Vientiane	55311559
3	Mr. Kaensy Philavong	Forestry Section, PAFO ODX (Committee)	55782148
4	Mr. Khamphou Orlavong	DAFO, Namno, ODX	22376536
5	Mr. Khamsao Souksavanh	DoNRE, Namno, ODX	59904026
6	Mr. Vilert Chanthavongkham	DAFO, Namno, ODX (Coordinator)	96741611
7	Mr. Thongsay Lorkanya	PAFO, ODX	59875559
8	Mr. Somkou Singlormany	Forestry Section, PAFO, LNT (Committee)	55363619
9	Mr. Khamphay Sihalard	DAFO, Luang Namtha District	22390572
10	Mr. Lithphone Lethana	DoNRE, LNT	54310222
11	Mr. Vongkeo Sivilay	PAFO, LNT	99722076
12	Mr. Hom Hakvannapheng	DAFO, Luang Namtha District	55886670
13	Mr. Sounphone Inthaphanh	DoNRE, Ton Pheung, BK	55185400
14	Mr. Phongsavanh Vienglasy	PAFO, BK	55554214
15	Mr. Siphanh Komousinh	DAFO, Ton Pheung, BK	55891964
16	Mr. Khampheng Chayasak	Forestry Section, PAFO, BK (Committee)	55684128
17	Mr. Alounsavath	DAFO, Ton Pheung, BK	56183123
18	Mr. Soukphavanh Sawathvong	SFM/APF Net Project (Technical)	27125273
19	Mme Latsamay Sylavong	SFM/APF Net Project (CTA)	58664422
20	Mr. Airyai Vongsa	REDD Office/APF Net Project (Technical)	99781968
21	Mr. Loun Sorlakham	Ban Nam Pheng, Namo, ODX	96139613

22	Mr. Khamla Bounsavanh	Ban Nam Pheng, Namo, ODX	928x5219
23	Mr. Kham	Ban Nam Pheng, Namo, ODX	98378771
24	Mrs. Onsy	Ban Nam Pheng, Namo, ODX	
25	Mr. Nor heu Yang	Ban Pangthong, Namo, ODX	95631175
26	Mr. Khamsavanh	Ban Houy Hom, LNT	98804356
27	Mr. Air	Ban Houy Hom, LNT	54824262
28	Mrs. Sy	Ban Houy Hom, LNT	99701557
29	Mr. Sene Khampheng	Ban Houy Dam, LNT	96138967
30	Mr. Savanthong	Kumban, Houy Dam, LNT	99692101
31	Mr. Noy Heun Chanthakeo	Ban Don Ngeun (Deputy Chief), BK	59505792
32	Mr. Nan Leng	Ban Don Ngeun, BK	58043981
33	Mr. Nandy Sengthongkham	Ban Don Ngeun, BK	54247016
34	Mrs. Phim Chanthakeo	Ban Don Ngeun, BK	58413823
35	Mr. Sopha Inpanya	Kumban Nakham, BK	55984476
36	Mr. Pong Luangmany	Kumban Nakham, BK	54770722
37	Dr. Phaivanh Phiapalath	SFM/APF Net Project (Consultant)	55620681

Remarks: due to many participants in each pilot village so their representatives who have detailed contacts were listed here.

Annex C. List of Wildlife Species Reports in the Pilot Villages

1. Birds

No	Lao spelling	Common name	Scientific name	IUCN Redlist Lao Law	Nam Pheng	Houy Hom	Don Nguen
1	Kai pa	Red jangle fowl	*Gallus gallus*		X	X	X
2	Nok kang kot	Grey peacock Pheasant	*Rheinardia ocellata*	LC, LI	X		X
3	Nok sai	Woodpecker (several sps)	*Dendrocopos sps*		X	X	X
4	Nok khon dok	Barbet sps (several sps)	*Megaliama sps*		X	X	X
5	Nok keang	Oriental Pied Hornbill	*Anthracoceros albirostris*	LC	X	X	X
6	Nok katen	Common Kingfisher	*Alcedo atthis*		X		X
7	Nok kot peu	Greater Coucal	*Centropus sinensis*	LC, LI	X	X	X
8	Nok kot kha	Lesser Coucal	*Centropus bengalensis*	LC, LI	X	X	X
9	Nok khao	Barn Owl (several sps)	*Tyto alba*	LC	X	X	X
10	Nok khao duea	Spotted Dove	*Streptopelia chinensis*	LC	X	X	X
11	Nok pao	green Pigeon	*Treron sps*		X		X
12	Nok salika	Hill Myna	*Gracula religiosa*	LC	X	X	X
13	Khouk lai	Striped Bulbul	*Pycnonotus striatus*		X	X	X
14	Khouk houa dam	Black headed Bulbul	*Pycnonotus atriceps*		X	X	X
15	Nok kon deng	Red-whiskered Bulbul	*Pycnonotus jocosus*		X	X	X

2. Mammals

No	Lao spelling	Common name	Scientific name	IUCN Redlist	Nam Pheng	Houy Hom	Don Nguen
1	Toon	Bamboo Rat	*Rhizomys sp.*	LC, LII	X	X	X
2	Oon ynai	Large bamboo Rat	*Rhizomys sumatrensis*	LC, LII	X	X	X

3	Ka nai	Tree squirrel	*Callosciurus notatus*	LIII	X	X	X
4	Ka hok	Inornate squirrel	*Callosciurus inornatus*	LC, LII	X	X	X
5	Ka hok Thongdeng	Pillas's Squirrel	*Callosciurus erythraeus*	LII	X	X	X
6	Ka hok	Squirrel sps	*Callosciurus sps.*	LIII	X	X	X
7	Chia	Bamboo Bat	*Tylonycteris robustula*		X	X	X
8	Ling lom noy	Pigmy Loris	*Nycticebus pygmaeus*	VU, LI	X	X	X
9	Ling lom ynai	Slow Loris	*Nycticebus bengalensis*	VU, LI	X		X
10	Ling kang	Assamese Macaque	Macaca assamensis	NT, LII			
11	Mou pa	Wild Pig	*Sus scrofa*	LC	X	X	X
12	Mou liung	Hog badger	*Arctonyx collaris*	NT, LII	X	X	X
13	Ma liung	Ferret-badger	*Melogale spp.*	LC, LII			
14	Ngen om	Common palm Civet	*Parodxurus hermaphroditus*	LC, LIII	X	X	X
15	Ngen Hangkan	Large Spotted Civet	*Viverra megaspila*	NT, LI	X	X	X
16	Ngen hangkho	Binturong	*Arctictis binturong*	VU, LII	X	X	X
17	Ngen Doklao	Masked palm civet	*Paguma larvata*				X
18	Chonphon	Mongoose spp.	*Herpestes*	LII	X	X	X
19	Sua meo	Leopard Cat	*Prionailurus Bengalensis*	LC, LI	X	X	X
20	Fan	Red Muntjac	*Muntiacus Muntjak*	LII	X	X	X
21	Bang	Flying Squirrel	*Petaurista spp.*		X	X	X
22	Bang loua	Giant Flying Squirrel	*Petaurista philippensis*	NT, LI	X	X	X
23	Katai sps						X

3. Reptiles

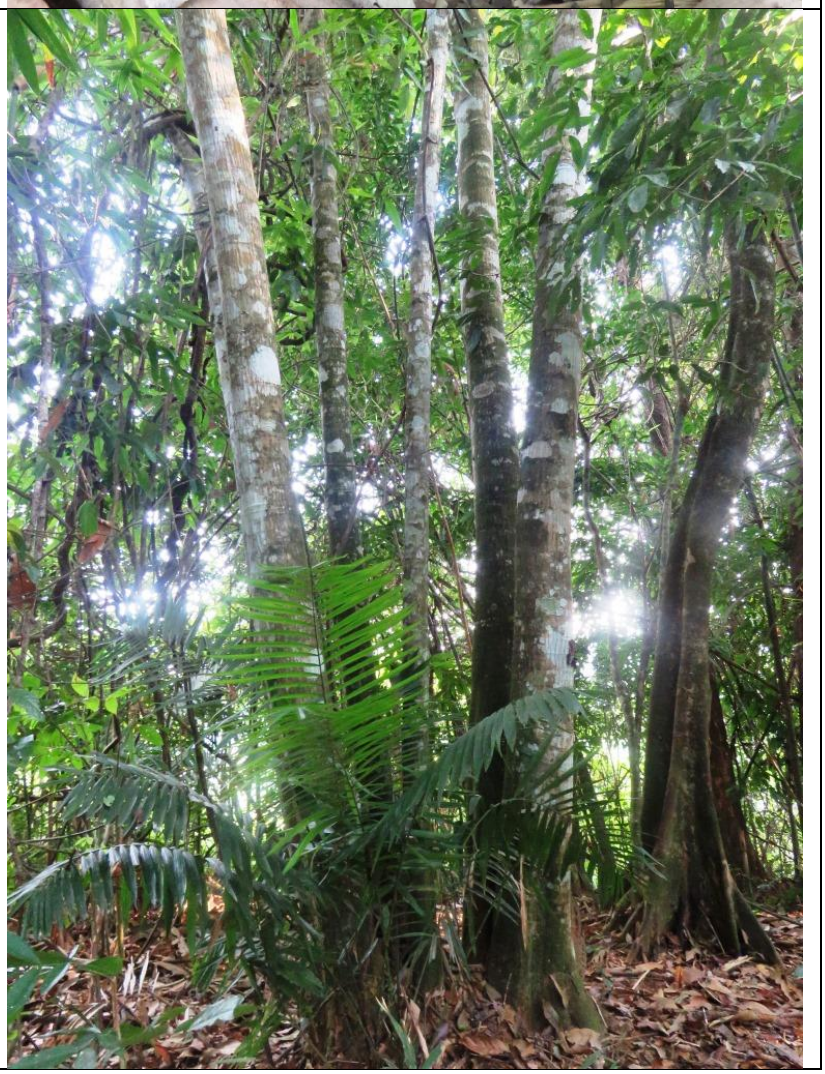
No	Lao spelling	Common name	Scientific name	IUCN Redlist	Nam Pheng	Houy Hom	Don Nguen
1	Ngou Lieum	Reticulated Python	*Reticulated Python*	LC, LI	X		X
2	Ngou kieo	Bamboo pit viper	*Trimeresurus sps.*	LIII	X	X	X
3	Ngou hao hom	Manocellate Cobra	*Naja kaouthia*	LII	X		X
4	Ngou sa	Copperhead Racer	*Elaphe radiata*		X	X	X
5	Ngou	Indochinese Rat snake	*Ptyas mucosus*		X	X	X
6	Lan	Bengal Monitor	*Varanus bengalensis*	LC, LII	X	X	X
7	Tao phueng	Impressed tortoise	*Manouria impressa*	VU, LI	X		
8	Tao sps.				X		X

Remarks: data from village interviews but just for some specific species and some observation in nearby the pilot villages. IUCN Redlist: EN = Endangered, VU = Vulnerable, NT = Near Threatened, LC = Least Concern. Lao Wildlife Law (2007): LI = Prohibited Species, LII = Managed Species, LIII = Common Species

Annex D. Key locations, waypoints and referent photos

Locations	Referent Photos
Village: Ban Nam Pheng, on the south-west (Village production forest) **Name:** Degraded bamboo forest **Waypoint:** N: 21˚00'./ E: 101˚39'.54 **Descriptions:** bamboo forest but small size and low production when forest is better growing in the bamboo forest. It needs to be managed for better products by opening a forest space in the bamboo forest area to get better sunlight.	

Village: Ban Nam Pheng, on the south-west **Name:** Mai Hok (large bamboo) **Waypoint:** N: 21˚00./ E: 101˚39.'43 **Descriptions:** This large bamboo was intensively collected in last two years made lower products so the villagers want to harvest every two year.	
Village: Ban Nam Pheng, on the south-west **Name:** Mai Jong hom **Waypoint:** N:21˚59'.96/E:101˚39.43 **Descriptions:** Mai Jonghom is quite rare due to some demanded by Chinese market, but still being available in this village. Local villagers used its roots as herbal medicine by putting in boiling water for drinking.	

Village: Ban Nam Pheng, on the south-west **Name:** Mai Hat **Waypoint:** N:21˚59’.92/E:101˚39’.39 **Descriptions:** Mai Hat, its leaves are used by local villagers for chewing and its fruits are used by animals.	
Village: Ban Nam Pheng, on the south-west **Name:** Mai Kok sum (*Castanopsis sps* **Waypoint:** N:21˚59’.91/E:101˚39’.29’’ **Descriptions:** Mai Kor sum (*Castanopsis sps*) where Het Deng (red mushroom) grow every year. This tree is rare in many places but plenty in this village.	

Village: Ban Nam Pheng, on the south-west **Name:** Het Deng site **Waypoint:** N:21˚59’.69/E: 101˚39’.67 **Descriptions:** Importance of Het Deng location where a plenty of Het Deng (red mushroom) shooting from August to October of every year.	
Ban Houy Hom, LNT	
Village: Ban Houy Hom, on the south **Name:** Severely degraded as grazing and cultivated land (weeds with fewer threes) **Waypoint:** N: 21˚02’.48/ E: 101˚37’.30 **Descriptions:** over and long period of slashed and burned activity and considered as grazing land but now sugar cane plantation is being expanded toward the south.	

Village: Ban Houy Hom, on the south **Name:** Severely degraded as grazing and cultivated land (weeds with fewer threes) **Waypoint:** N: 21˚02’.26/ E: 101˚37’.28 **Descriptions:** at the transmission line post to the south.	
Village: Ban Houy Hom, on the south **Name:** Severely degraded as grazing and cultivated land (weeds with fewer threes) **Waypoint:** N: 21˚02’.26/ E: 101˚37’.28 **Descriptions:** at the transmission line post to the southeast.	
Village: Ban Houy Hom, on the southwest **Name:** Severely degraded as grazing and cultivated land (weeds with fewer threes) **Waypoint:** N: 21˚01’.98/ E: 101˚37’.22 **Descriptions:** at the transmission line post to the west.	

Village: Ban Houy Hom, on the south **Name:** Severely degraded as grazing and cultivated land (weeds with fewer threes) **Waypoint:** N: 21˚01'.98/ E: 101˚37'.22 **Descriptions:** at the transmission line post to the west.	
Village: Ban Don Ngeun, on the east **Name:** at stream, next to the bananas plantation of Chinese **Waypoint:** **Descriptions:** the bananas plantation of Chinese.	

Village: Ban Don Ngeun, on the east **Name:** at stream, next to the bananas plantation of Chinese **Waypoint:** **Descriptions:** Looking to the northwest toward the proposed village rehabilitation area (Phou Bersong) as around the foothills are converted to bananas plantation.	
Village: Ban Don Ngeun, on the east **Name:** at stream, next to the bananas plantation of Chinese **Waypoint:** **Descriptions:** Looking to the south where some part of the forest land is being converted to bananas plantations, sold in concession to the Chinese.	

Annex E. Checklist for forest rehabilitation assessment

Discussion with provincial and district staff

General

1. Populations of the participating province and district, growth rate?
2. Socio-economic development plan of the participating province and district, growth rate?
3. Any data on degradation and deforestation of the participating province? portion of each type especially the deforestation area and extreme forest degradation?
4. Which rationales (direct and indirect) of natural forest deduction?
5. Which impact have happened with local communities due to forest degradation and deforestation? - may provide some qualitative data such as household income?
6. Which village or kumban has most problem of impacts on their livelihoods that made more difficult to live due to forest degradation and deforestation?
7. Which reforestation approach that is considered successful and sustainable?
8. Good and weak points of reforestation in the past?
9. Please provide example of best practice in the past reforestation (maybe in and other countries) that you might know.
10. Which constraints that had failed to the past reforestation?, how to address it?
11. What are there the expectation of the reforestation (ranking 5 expectations)?
12. Sum up, which reforestation approach will be sustainable and effective?

Target village (although a set of info is not completed but get some idea for further working with villagers during village consultation)

13. Village population, ethnic and land use planning status
14. Draw the landscape of target village (including its neighboring villages)
15. Where is still good forest surrounding the target village?
16. What is the status of forest degradation, level of the degradation and portion?
17. What is the current conditions of the forest degradation that need to be rehabilitated in the target village?
18. What was the history of that forest (list of the tree and wildlife species used to live in the area but have gone today?
19. What are potential, opportunities and limitation of the forest rehabilitation in the area?
20. What are the practical techniques of forest rehabilitation be dependent on the degradation level?
21. What capacity of staff and villagers to be trained in the forest rehabilitation?
22. What equipment is needed for the forest rehabilitation?

Ecosystem based approach for forest rehabilitation

23. Which is a need to establish a stepping stone to help forest rehabilitation by forest succession??
24. Is it possible to reforest by forest succession in our province and village?
25. Please select the stepping stone tree species of the forest success? (see species screen table)
26. Please select the wildlife species that has important role for the forest success? (summarize from the item 25)
27. How we can establish this pilot to be best example of forest rehabilitation? Who to do what?
28. What capacity of staff and villagers to be trained in the forest rehabilitation by forest succession?
29. What equipment is needed for the forest rehabilitation by forest succession?

Management

30. Is it possible to succeed in forest rehabilitation in one village, how the neighboring villages to cooperate?
31. How to establish and improve the implementation of regulations at each level as to achieve long-term forest rehabilitation in the province? Is there any specific provincial and district strategy to be in place?
32. How will the implementation of regulations be effective, especially forest fire protection?

Consultation with villagers (check to verify some info, break up for two groups (men and women group) but to finally meet and agree)

Elderly and village authority

1. Illustrate the current village landscape (include neighboring villages) and show various forest zones?
2. Do they have rich forest adjacent to the village?
3. History of forests in the village (list of tree and wildlife species that are gone or about to being gone?
4. Forest degradation status that to be rehabilitated in the target village (soil quality) and possibility of soil replenishment, if necessary.

Group (Men and Women)

5. Have any impact on village livelihoods due to forest degradation (please give an example and indicator of the change)?
6. Which plant species that are important for local livelihoods and that need to be rehabilitated?
7. What are the expectation from forest rehabilitation? (ranking of 5 expectations)
8. Please illustrate the vision of the village forest rehabilitation and management?
9. What are potential, opportunity and limitation of forest rehabilitation in the village? …including soil quality and local climate.

10. Which zone of the village to how rehabilitate and how long it will take?
11. Select which plant species to be a stepping stone for forest rehabilitation by forest succession (see the species screen sheet).
12. Select which wildlife species that has roles on forest rehabilitation by forest succession? (summarize from item 11).
13. How to improve soil in barely land, which tree species to be planted?
14. How to establish the pilot village to be successful and being example for other villages? Who to do what? roles of villages? adjacent villages and the government?

Management (by village perspective)

15. Is it possible to succeed in forest rehabilitation in one village, how the neighboring villages to cooperate?
16. How to establish and improve the implementation of regulations at each level as to achieve long-term forest rehabilitation in the province? Is there any specific provincial and district strategy to be in place?
17. How will the implementation of regulations be effective, especially forest fire protection?

Site visits (the area of interest for forest rehabilitation and not far from the village)

- Check and confirm some info received from the village consultations
- Observe surrounding environment including forest that may take a picture and GPS coordinates.

Annex F. Screening sheet form of tree species

No	Tree species	Ecosystem				Survivor ability						Cultivation				Ecosystem Service						Wildlife species use			Pilot village		
	Local name	Fruiting	Flowering	Sheltering	Dispersing	Water adapt	Fire tolerant	Deep root	Soil adapt	Sun lover	Shade tolerant	Seed collection	Nursery	Easily grow	Poor soil adapt	Timber	Incoe	Food	Medicine	Erosion control	Total score	Species 1	Species 2	Species 3	Nam Pheng	Houy Hom	Don Ngeun

Remarks: please score in appropriate box (3 = highest and 1 = lowest)

Annex G. Background

BACKGROUND PAPER ON FOREST REHABILITATION AND RESTORATION

This paper is prepared as supporting materials to the report and conservation awareness raising in the future. It contents some important concepts, principles and lessons learnt for who have limited conservation biology background. Planning for forest rehabilitation, restoration and management needs to have a better understanding of forest ecosystem, forest changes, key drivers and underlying causes of the forest changes. Also, principles of and lessons learnt from best practice in this regard should be considered where appropriate.

1. Forest Ecosystems and Functions

Forest ecosystem is a community of living forest organisms with their environmental substrates (non-living) that, interacting as a system. The living forest organisms are mainly trees and wild animals but including shrubs, herbs, bacteria, fungi, and people. Whereas, the environmental substrates are air, soil, water, organic debris, and rocks. There are many of these present in a healthy forest (see Figure 1).

Figure 1. Healthy Forest Landscape

Energy that flows through ecosystems is obtained primarily from the sun. It generally enters the system through photosynthesis a process that also captures carbon from the atmosphere. By feeding on plants and on one-another, animals play an important role in the movement of matter and energy through the system. By breaking down dead organic matter, decomposers

release carbon back to the atmosphere and facilitate nutrient cycling by converting nutrients stored in dead biomass back to a form that can be readily used by plants and other microbes (see Figure 2).

However, to communicate on the forest ecosystem concept regarding forest rehabilitation and management for non-scientific audience needs to use some general terms. Basically, good forest is understood and observed regarding forest canopies, forest structures, numbers of habitats and species. An area of high or low biodiversity is usually understood and measured by a number of species especially wild animals. Where is recorded on high number of wildlife species it must have various micro-habitats.

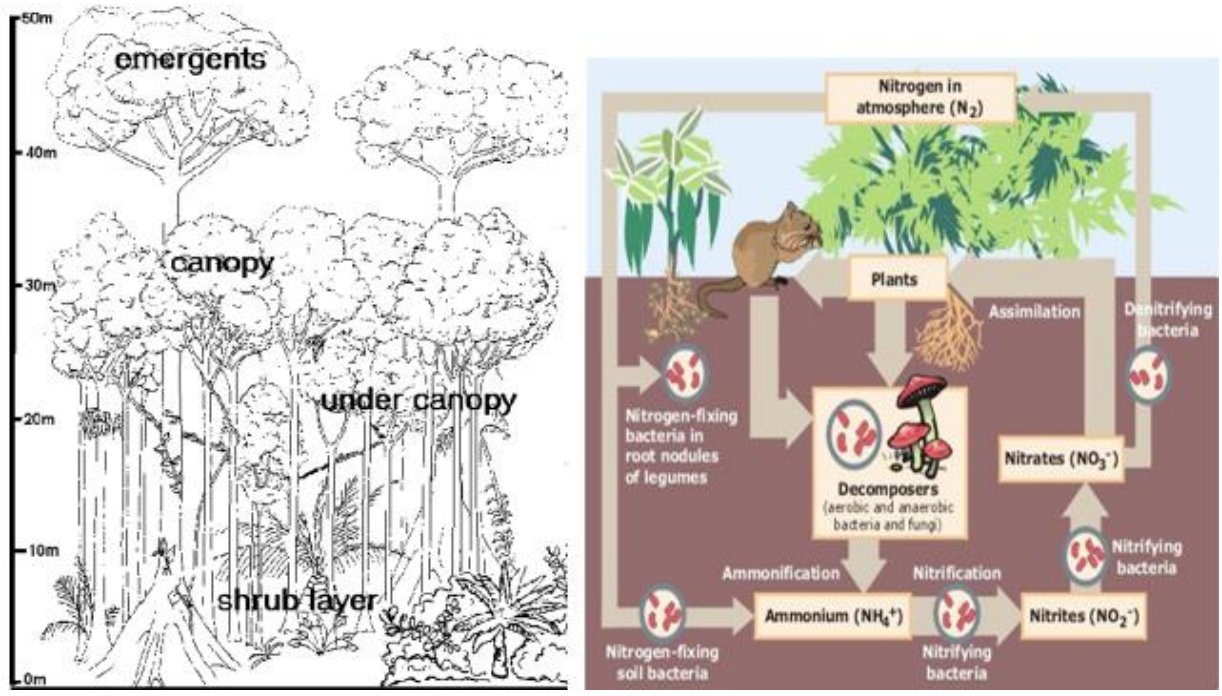


Figure 2. Forest ecosystem and energy flows

They have each functions, inter-dependent, interchangeable on each other within a given ecosystem through a process of food web. Forest is the main component of the forest ecosystem to host "home" and provides with food sources and other ecosystem service (Aerts and Honnay, 2011). Animal is also the main component of the forest ecosystem to maintain the functions. The animal is considered a tree planter "seed disperser" who carries seeds by eating fruits with seeds from one place to drop in other places. Many groups of animals have many different roles and functions in given forest landscape and system as some species live in certain habitat unit, many habitats and altitudes of the certain landscape and also cross-habitats and altitudes of many landscapes. Within one forest each group of wild animals live in different forest canopy layers as some live in top canopy, medium canopy, low canopy, and on the ground. Whereas, some species live in a few canopy layers.

Species boost ecosystem productivity where each species, no matter how small, all have an important role to play. Certain animal species even small insect has its own functions in a given forest ecosystem especially in pollination (see Figure 3). Medium and large animals play an important role in the forest ecosystem as some species can be indicator of forest health. Gibbon and Hornbill species are quite a sensitive animal and they are critically important indicator species of conservation measurement. Changing in forest structure will change in composition of these species accordingly. Therefore, the tropical forest such as Lao PDR the absence of these species is considered declined in forest quality, biodiversity – the number of associated species.

Figure 3. Wild animals and their functions

Other important things of forest ecosystem are soil, water and air. Plant growth requires a compatible relationship between the plant, the air, and the soil. The soil will provide a location, support, foundation, and nutrients for plant growth. Plants need from soil mainly are nitrogen (N), phosphorus (P), potassium (K), but the others important elements are calcium (Ca), iron (Fe), magnesium (Mg), manganese (Mn) etc. These elements are in a compound form that plants can uptake such as ***N*** from NH_3, NH_4, NO_3; ***P*** from H_2PO_4; ***S*** from SO_2. Of which, Nitrogen is the most critical element for plants.

Different types of soil or water will have different portions of chemical compounds. A standard of soil or water composition is important reference for monitoring. A change much in portion of some element in soil or water means a change in quality. Also, water as Bio-chemical Oxygen Demand (BOD) is used for measuring a water quality. In this connection, water and soil are also playing when changing in forest ecosystem (forest cover, forest structure and species composition).

Forest ecosystem provides a variety of good and services upon which people depend such as food, construction materials, income sources, medicinal plants, hydrology, water cycling, maintaining a local climate etc. Most rural people rely on forest products for good and household income especially during hardship (see Figure 4).

Figure 4. Rattan and bamboo made products

Globally, forests play an important role in regulating the earth's temperature and weather patterns by storing large quantities of carbon and water. Up to 15 percent of annual global emissions are a result of the deforestation and forest degradation (Bapna, 2010). As concerns intensify over global climate change as a result of man-made activities, so does the debate over the importance of forests as carbon sinks.

2. Forest Changes and Impacts

For long-term forest rehabilitation, restoration and management as to reverse forest and biodiversity back needs to understand the current forest type, and in particular locations, forest components including key wildlife species. Forest changes and impacts are obvious and more

severe today. The changes, the forest degradation and loss is not only globally impact – the climate change, but also locally regarding the decline in supplies of forest resources which are impact on local livelihoods. Humans depend on a sustainable and healthy environment, and yet we have damaged the environment in numerous ways. Specifically, forests including biodiversity, animal, food sources etc., to be changed in quantity and quality. Declining in forest cover, structure, functions and supplies impact on animal, humans and all associated, including soil stability, water source and local climate.

In Lao PDR, nationally there are nine sources of forest degradation and deforestation identified namely: forest fire, unsustainable wood extraction, pioneering shifting cultivation, agricultural expansion, industrial tree plantation, mining, hydropower, infrastructure development, and urban expansion (DoF, 2011). Deforestation is mainly the result from: (i) expansion of agricultural and industrial tree plantation development, (ii) inundation by hydropower projects, and (iii) clearing of the sites of mining, infrastructure development, and urban expansion. Whereas, forest degradation is mainly the result of unsustainable wood extraction and shifting cultivation.

However, some specific site has specific rationales of the forest degradation and deforestation. The habitat degradation and loss is prevalently happened especially in the northern country due to shifting cultivation, cash crop plantation which associated with forest fire, and also over-harvest of forest resources. Therefore, most highlanders do hill rice cultivation and that they do in usual rotation of 5-7 year fallow where land and forest use planning is complete. However, conversion of new plots from forest land is happened when their plots are insufficient or not good crop production due poor soil and that the case of insufficient law enforcement. Slashing new forest is widely reported especially in the areas where ineffectively land and forest use planning and law enforcement (see Figure 5).

Figure 5. Forest degradation and deforestation

Also, repeatedly forest fire is always happened that associated with hill rice cultivation. The key drivers of the deforestation and forest degradation in some northern provinces such as Houaphanh, are shifting cultivation and over-harvest of forest resources (SNV, 2014). The underlying causes of these are the needs of food and incomes but other are due to population growth, commercially cropping promotion policy without readiness preparation, limited livelihood alternatives including some difficulty in access to credit scheme and market of domestic products. The growth of local population is also considered an importantly indirect driver that makes and will put more pressures on forests in the future. Therefore, address forest degradation and deforestation need to do a holistic approach but detailed situation analysis to be undertaken.

Where settlement is in place forest conversion is observed around the village, from small to larger plots, expanded further to then make a new hamlet. Starting from small settlement but become permanent when bigger population (see Figure 6). Road access is usually constructed to a remote community, village cluster which makes habitat fragmented and disturbed largely from hunting and collecting forest resources by also outsiders.

Figure 6. Settlement and forest conversion

It is really changing, impact on forest land and local livelihoods in long-run. Changes in forest ecosystem begin from the changes in forest structure and habitat connectivity after certain timber species logged, open plots by slashing for agricultural purposes and road access connecting communities.

Usually, forest is slashed and it to regrow naturally if time is allowed enough. The traditional system of shifting cultivation was that farmers do rotate about 10-15 years when forest and land allocation is not undertaken but they often cut new forests. The system is good in keep modified forest and soil but original forest has been widely slashed. About a period of 10-15 year-fallows is considered fairly good forest in Lao PDR because forest is naturally forest regrowing well but agricultural land is not enough for many villages. Also, by the long fallow is likely no any tree species is lost except some wildlife species due to disturbance and hunting. However, if some conservation forest is defined and demarcated through forest and land allocation planning, agricultural land and other land types of each village are defined with local farmers. They have to rotate within the given agricultural land and fallow as firstly about 5-7 years but lower to 2-3 years after 10 years when they have insufficiency of cultivated land. Repeatedly cultivation in the same plots will impact on forest regeneration and also soil replenishment. Mixed deciduous forest, which fallow that wild bananas trees are observed indicating only a first few times of slashed and burned cultivation is undertaken. But more rotations undertaken we can observe dominance of bamboo tree[27]. Furthermore, more plenty

[27] This bamboo tree is considered a succession stage.

of weeds are observed when more rotations of shorter-fallow are cultivated and then appearance of sun grass (see Figure 7).

Figure 7. Forest change from healthy to de-forest

Understanding the forest changes is important and possible to identify from the main tree species that support the forest structure, food sources and roosting sites. The decline and extinction of certain species is due to hunting, habitat destruction and disturbances. Commercial scale harvesting by selecting certain species of trees and wildlife species will lead to a rapid decline and extinction of those species[28]. Forest fire that occurs annually has impact on many species that are not tolerant to fires. Only fire tolerant trees remain in scatter and likely sensitive to mixed deciduous forest. Slashed and burned cultivation varies which is dependent on interventions. More rotations and as short fallow as less than 2-3 years will be problem in long-run. Soil erosion and landslides will be also issue in steep slope mountains. In conclusion, highly degraded sites are easy to recognize. Repeated disturbances or over-exploitation have removed much of the original vegetative cover, some of which may have been replaced by exotic weeds (Lamb and Gilmour, 2003). Wildlife has been lost and pest

[28] Specially for rare and endangered wildlife species

species may have been introduced. Erosion is often widespread, perhaps with landslips and gullies forming on steeper slopes.

In this connection, there are five cases described in summary with some indicators of forest pattern change that are possibly observed in Lao PDR and understood from history of different cases of the forest impacts (see Table 1).

Table 1. Changes of forest and indicators of various fallow stages

Case 1. Forest changes due to logging	**Case 2. Forest changes due to forest fires**	**Case 3. Forest changes due to cultivation (long fallow cycle)**	**Case 4. Forest change due to re-cultivate in short or young fallow**	**Case 5. Forest change due to cultivation in young fallow + chemical inputs**
Previous logging activities in Phou Khaya over harvested the trees, (including harvesting of breeding trees). This disturbed the forest structure and had an impact on wildlife species. However, soil condition has not changed due to the logging activities.	Continuing forest fires for years will restrict the growth of some tree species that are not tolerant to fires (especially the tinny bark trees). Only thick bark trees can survive and adapt to the fires. Therefore, most under-story species are often destroyed (including bushes and even bamboo trees). After fires few stand trees remain. However, if fires are not recurrent, it is possible for some bamboo to regenerate.	Usually, the slashed and burned practices which farmers practice is over a long enough cycle for soil replenishment and if they do not use any herbicides, this will allow trees to regrow naturally to at least a fallow of 5 years. Following traditional practices that has a fallow interval of 7 years or more is good for soil replenishment but shortage of cultivated land would be an issue. Mixed deciduous forest can be indicated by the presence of bananas, bamboo and timber trees.	Re-cultivation in young fallow for 2-3 years consecutively does restrict the growth of some trees and is a possible cause for the loss of tree species. The practice could be responsible for the loss of ca. 60% of the original tree species. Soil nutrients have decreased significantly and now only certain trees can grow (such as Nad, Kheam, Lao, Nya kha). Therefore, this fallow type is considered bush and is quite hard to regenerate unless a long time (20-30 years) is provided for some bamboo trees to appear once again.	Re-cultivation in young fallows for 1-2 years consecutively, and also using herbicide and chemical fertilizers, would degrade the quality of the land. The herbicide will kill certain plant species and the fertilizer will extract soil nutrients for the plants. Many other plants may not be tolerant to these conditions. Therefore, ca. 90% of the original tree species could be lost while some weeds may over grow. The soil will become harder. Indicators of this particular fallow type include small bush and dominant weeds (Nya kha and Lao) and other grasses. This fallow type becomes bare land and is unable to regenerate.

Remarks: the case 5 is often happened in the area with limited agricultural land and cultivation is for commercial purpose as chemical inputs are unavoidable.

3. Forest Succession

Forest succession is a natural pattern of change that takes place over time in a forest (Palmer et al. 1997). Planting late-successional tree species under early-successional shrubs can be an effective means of restoring forests (Lamb, 2000). Tree planting under facilitating *nurse shrubs* is a typical example of the community approach to forest restoration. First tree occurs then second and third to begin, adapt and well grow there (see Figure 8).

Broadly, ecological [forest] succession is the phenomenon or process by which an ecological community undergoes more or less orderly and predictable changes following disturbance or initial colonization of new habitat (Palmer et al. 1997). Succession may be initiated either by formation of new, unoccupied habitat (*e.g.*, fire, severe landslide or logging). Succession that begins in new habitats, uninfluenced by pre-existing communities is called “primary success”. Whereas, a succession that follows and dependent on the primary success is called “secondary success”. In principle, succession is an important guiding principle in the community approach to ecological restoration (Palmer et al. 1997; Aerts and Honnay, 2011). The restoring forest is a dynamic ecosystem, with changing species composition and forest structure, but interventions and management steer the forest towards a desired climax or pre-disturbance community structure. These interventions are usually designed to accelerate natural succession or to bypass intermediate successional phases. This is important to understand what the target tree species to be rehabilitated and so understand its ability and optimum for growth. Planting some tree to shade out some sun-lover species or make shadow for planting target tree is successful practiced in some country.

When forest condition changes or having succession it will change in organic matter in litter, alteration of soil nutrients, change in pH of soil by plants growing there. The structure of the plants themselves can also alter the community. For example, when larger species like trees mature, they produce shade on to the developing forest floor that tends to exclude light-requiring species. Shade-tolerant species will invade the area. Some succession is made due to external environmental influences. For example, soil changes due to erosion, leaching or the deposition of silt and clays can alter the nutrient content and water relationships in the ecosystems. Animals also play an important role in positive forest changes as they are pollinators, seed dispersers and herbivores. They can also increase nutrient content of the soil in certain areas, or shift soil about (as termites and ants do) creating patches in the habitat. This may create regeneration sites that favor certain species.

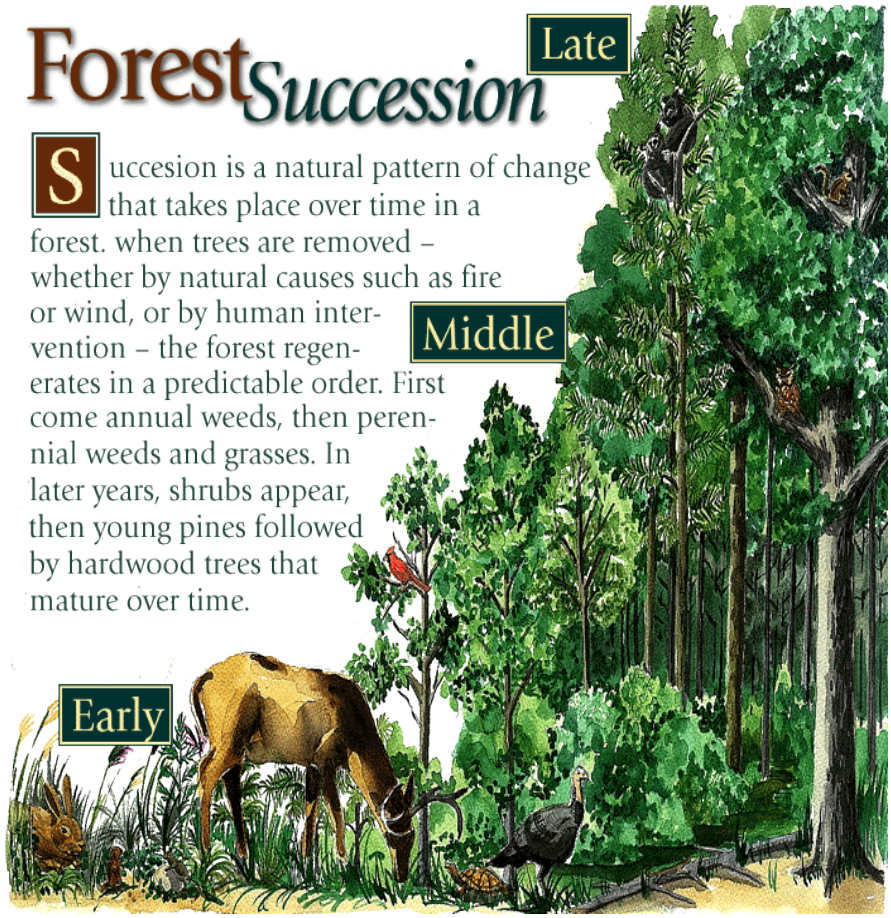


Figure 8. Patterns of forest succession

In addition, climatic factors may be very important, but on a much longer time-scale than any other. Changes in temperature and rainfall patterns will promote changes in communities. In this connection, the forest rehabilitation and restoration in the country has to have a better design and in a sustainable way.

4. Principles and Practices of Forest Rehabilitation and Restoration

4.1 Principles and Approaches

Principles of forest rehabilitation and restoration are to promote ecological integrity and enhance human well-being in deforested or degraded forest landscapes (Lamb and Gilmour, 2003). It needs to work on-site level to enhance socio-economy and ecological gains at the landscape level. The ecosystem approach is based on the realization that:

- Land management has on-site and off-site impacts on ecosystems and people.
- Viable species populations and healthy ecosystem processes cannot be contained within small units so a need to design in landscape.
- Conservation planning and action must take place across whole landscapes and involve multiple interest groups.

The ecosystem approach can help (i) restore forest in a sustainable way that includes improving rural livelihoods; (ii) producing a wide range of goods and services, rather than simply planting trees; (iii) linking forest restoration and rehabilitation activities at the site level with the environmental, social and economic needs at the landscape and ecoregional level; (iv) recognizing and attempting to balance land-use trade-offs; and (v) providing a multi-sector approach that ensures the participation of interest groups in decision-making.

Much needs to be done to turn Forest Landscape Restoration from an idea that is implemented in a few pilot areas into mainstream practice that is adopted and promoted by governments and the private sector.

Since forest degradation and deforestation is major issues and global concern. The Rio Declaration and Forest Principles, the definition of Sustainable Forest Management (SFM) to be applied by CBD signatory party country (UNCED, 1992). Later on, it was globally estimated that, in the decade between 1990 and 2000, the gross annual deforestation rate was 12.3 million ha per annum (FAO, 2001), especially in developing countries. Therefore, every country is called to response for the deforestation strategically and effectively. Apart from management existing forests, sustainable forest use including timber harvest the forest rehabilitation and restoration is also necessary to slow down the net loss. So far, many countries in South-East Asia have tried hard in managing and enhancing forests.

Series of approaches of forest rehabilitation and restoration

There are five approaches as below should be considered and applied as dependent on site conditions, stakeholders' interest/expectation and financial ability.

Passive rehabilitation: simply protecting the site from further disturbances and allowing natural colonisation and successional processes to restore ecosystem biodiversity and structure (Watkins, 1993; Berger, 1993; Aide et al., 2000). Presence of some number of wildlife species and some forest patch will help the forest restoration by this approach faster. This approach is best suited to situations where degradation is not extensive and residual forest patches remain or some advanced forest regrowth is already present.

Enrichment planting: to supplement biological diversity by reintroducing certain key species to hasten the process of natural recovery (Ashton et al., 1997). This approach is for the case that not all regrowth or secondary forests have high levels of biological diversity. Many have been disturbed so many times in the past especially endangered species that only a small number of the species present or no longer. Also, plants with large seeds that are poorly dispersed or plants needed by a particular wildlife species.

Direct seeding: to accelerate such successions is to deliberately reintroduce the seeds by hand or aircraft especially for bare soil that they can establish quickly in weed-free conditions so

perhaps necessitate complete weed eradication (Mergen et al.,1981; Allen, 1997). This approach is for deforested area such as bare land, grassland and old mining sites. The advantage of this approach is considered low cost, no need to raise seedlings in nurseries.

Scattered tree plantings: to accelerate successions is to foster the structural complexity that attracts seed- or fruit-dispersing fauna into the degraded. Just planting small numbers of scattered, single trees or clumps or rows of trees, which form perches for birds. This approach is for abandoned farmland with only plain of weeds and grasses and for plants with low dispersed ability by neither wind nor animals (large seeds). This is to establish new forest clump (stepping stone) but some plant would be slow if newly germinated seedlings be compete with grasses and weeds (Lamb, 2000).

Framework species: plantings consists mainly of a small number of early successional species that grow fast, attract seed dispersing animals and are preferably fire tolerant and nitrogen fixing, thus facilitating and catalysing the spread of other species from nearby forest (Goosem and Tucker 1995, Kirby et al. 2000, Lamb, 2000). One option is to plant species from early successional stages, which will create the conditions for the later arrival of a more diverse community.

All interested species for rehabilitation should be screened with certain parameters and ability (see Annex F). The advantage of the framework species approach is that once the trees are established, they soon out-compete grass and weeds, making it easier for the species brought in by seed-dispersing animals to become established. The approach is especially suited to areas close to intact forest that can act as a source of seeds (and wildlife); this allows additional species to be recruited quickly.

Maximum diversity: all species naturally occurring at the site are planted at close spacing. A major benefit of this expensive method is that colonization from surrounding forests is not required (Lamb, 2006; Haase and Camphausen, 2007).

All approaches above required to understand the current status of the proposed rehabilitation or restoration area, interest of stakeholders and expectation, also budget ability. Maintenance is needed in the early years to ensure that weeds do not dominate the succession.

Consideration of approaches and species selection should take account of advice by Lamb (2000) as following.

1. *The future state of any restored forest is dependent on the current state and initiative (i.e. the species initially present, sown or planted at the site).*
2. *The more plant species that can be initially reintroduced the faster the subsequent succession.*
3. *Some plant species combinations are unlikely to be successful.* Fast-growing species with dense crowns may exclude some slower growing species unless the latter are especially shade-tolerant or canopy gaps are either present or frequently created.

4. *An initial (planted) community of pioneer for shadow and plan for survival of secondary species succession.*
5. *The rate at which restoration occurs depends on the extent of the existing environmental stresses.*
6. *Animals are important seed dispersers, particularly in many tropical regions, and thus have an especially important role to play in restoration ecology.*
7. *The rate at which additional plant species enter at site once restoration has been initiated depends on the distance from sizable intact forest remnants.*
8. *The attractiveness of a site to animal seed dispersers affects the rate at which they bring seeds of new species.*
9. *Species colonising a restored site after canopy closure must have some degree of shade tolerance that either enables them to grow and join the canopy or allows them to persist in the understory until a canopy gap is created.*
10. *Weeding and monitoring for managing the planted trees from early ages of pre-existing colony is necessary.*

Incentives and policy: Obtaining knowledge in principles is basic and just technical aspect but driver enforcement to succeed in forest rehabilitation and restoration need to make some mechanism and supporting policy in place. There will be direct and indirect incentives that decision-makers should consider and apply where appropriate as below:

Direct incentives include the following:

- direct subsidy payments for planting and establishment;
- tax exemption or reduction freedom from income and/or low land tax;
- cheap loans.

Indirect incentives include the following:

- market and technical assistance (training, provision of nursery seedlings etc.);
- land tenure system, local right and benefit sharing;
- concessions in forest rehabilitation and restoration.

Monitoring for Success

Measuring of success is important for any project but to measure whether it is successful or not needs to have baseline data. There are 3 components of measuring related to forest rehabilitation and restoration project as below:

First, to measure plant cover or tree density, the heights of plants and the extent to which the community is developing both an under and over-storeys;

Second, to study composition of the forest community such as numbers, identity and abundance of various plant and animal species, including weeds and pest species. Determining the presence or absence of particular life forms;

Third, to examine some indications that the new plant community has developed appropriate functional responses and has stabilised the soils or improved the quality of water in streams draining the catchment.

4.2 Practices of forest rehabilitation and restoration in SEA.

Most countries in Southeast Asia have tried to rehabilitate their forests by various methods. The practical approach, field-oriented project is working at model sites in Cambodia, Indonesia, Lao PDR and Thailand to demonstrate effective low-cost natural regeneration approaches for restoring forest landscapes. The aim is to contribute to the further recognition of ANR as a less expensive alternative to conventional reforestation and demonstrate how to apply ANR successfully to enhance biodiversity and to restore ecological functions in different regions of Southeast Asia. In addition, project officers will develop best practices case studies and policy briefs to support further expansion and mainstreaming of ANR within national forestry policies.

Table 2. Summary of practice in forest rehabilitation and restoration in SEA

Country	Approach	Lessons Learnt
China	Used a lot of efforts and inputs started from scientific research, understanding historical, ecology and success, then to pilot projects and real practice. Use various methods for various forest types.	Although FR&R in China is considered success there are many limitations such as impact from natural disaster, loss of some traditional knowledge, loss of seed bank. Talking of succession – seeds and seedlings are the most vulnerable in the life cycle of plants.
Cambodia	Promote on community-based natural resource management and formulation of policy and legislation. Enhancing community-based forest rehabilitation and management as well as utilization for the improvement of rural livelihoods.	Land use planning and land tenure are important for the forest rehabilitation program but ineffective, lack of monitoring and law enforcement.
Indonesia	Three forest rehabilitation system as (1) activities induced by incentives, (2) the full cost type and (3) model development. The first system is adopted by communities outside forest areas to get their participation in rehabilitation activities by providing high quality seeds and funds by the government. The second system is used for forest under the management of the Ministry of Forestry – conservation,	The forest rehabilitation is not really successful but to increase its future success needs to consider the following options: 1. Optimizing the National Movement by creating multiyear contracts, incorporating state and private forestry companies especially in forest and land rehabilitation; 2. Utilizing global tools for rehabilitation such as the CDM and REDD; 3. Providing credit for communities that create plantations inside forest areas; 4. Direct

	protection and production forest areas. The third system is a movement to increase forest productivity and participation of the community. It is basically an endeavour to find techniques for land management and community participation. This is fully funded by the government.	investment in industrial forest plantation; 5. Developing partnerships between the private sector and communities; 6. Rehabilitation by expanding community forest activities.
Malaysia	Forest restoration was firstly sold in long concession (50-100 years) to private companies as about (200,000 ha) of forest being degraded or poorly-stocked. Only economic trees were planted Then, the country has promoted to restore forests for conservation purposes by planting native trees, native fruit trees and in critical wildlife habitats.	Security of land tenure is imperative with certification of permanent land use. Also, there must be a firm government resolve to recognize forestry as a legitimate and permanent use of land, strict forest policies, thereby removing the option for conversion.
Myanmar	Forest rehabilitation in the country started since 1980 mainly for commercial, watershed and supplies. Later, land use planning was carried out mainly in the area adjacent to the conservation.	Agreement and land use planning carried out but due to insufficient budget made lack of follow up process and monitoring.
Lao PDR	Shifting cultivation stabilization program is a key intervention to limit shifting cultivation as to leave degraded forests be regenerated while replanting trees by promoting private sector resulted in many private companies have invested in cash crop plantations.	Forest and land allocation is considered important intervention to make clear zone for forest use, protection and regeneration but lack of monitoring, weak in law enforcement as well as lack of livelihood supports. Local villagers faced with livelihood hardship from poor rice products and soil erosion. Consequently, reclaiming forests for new agriculture is often reported. Also, promoting private sector on tree plantation does not contribute to increase forest cover permanently. Moreover, some plantation to replace original forests.
Philippines	The country has a long tradition and rich experience in forest rehabilitation since 1970 and that	Although some successful pilot projects there are not really sustainable. About 12 of 28 projects were failed. The main

	different stakeholders involved and many approach including land leasing to private sector, community-based management using public fund (93%) including loans. This has been gained through programs of various sizes and forms that were implemented all throughout a century of forest rehabilitation in the country. Many policies and laws were reformed, formulated to support this work. Public awareness on the needs of forest rehabilitation and restoration was fully conducted and then land use planning.	issue is that the capacity and ownership were not well built especially the government funded project. It was because of lack of technical guidance, monitoring and support for law enforcement. Also, unstable timber price for the plantations, insufficient financing, economic benefits and unstable government policy impact on the forest rehabilitation.
Thailand	Participation of tree plantation farmers in sustainable forest management commenced in late 2009. The project strives to diversify livelihoods, improve environmental sustainability. There were many methods used in the country such as sowing, enriching, direct seeding, replanting but the framework species conducted in Doi Inthanon is considered effective one. The 'framework species' method involves planting a minimum number of indigenous forest tree species for maximum ecological benefit. Potential species should accelerate biodiversity recovery and enhance natural regeneration, creating a self-sustaining forest ecosystem for wildlife to function.	Low cost and acceptable but take some time to understand its phenology (seasonal patterns of fruiting and a seed collection schedule) will be developed for planning of nursery and planting work. For long-term success it needs to work with local communities, school kids, tourism operation, private sector, through educational program. This can help sideway and up-way scale.
Vietnam	Allocation of forest-planting land to organizations, individuals, households and communities in the form of leasing the forest and forest land over a long-term period to make good profits from forestry production. It is a top-down policy, provide subsidies for families and	The plantation is about economic benefits (60%) and short-term gains, use fast-growing exotic species. Poor quality in seeds, seedlings and implementation work with lack of knowledge on species selection. Therefore, plantation in Vietnam used exotic species, for economic gains only

	financing in interest-free loan to plantation projects.	other than recovery natural/ biodiversity aspects.

5. Forest Rehabilitation and Restoration in Lao PDR

The issues of forest loss are recognized by the Government of Lao PDR since early 1985 and had tried to reverse back the losses. The National Forest management program was initiative around 1993 to delineate conservation forest areas and implemented shifting cultivation stabilization program. Then, the Government had an important initiative by announcing the National Forest Strategy in 2005 to achieve forest cover at 70% by 2020. In response to this strategy, it has continued implementing the forest management program, shifting cultivation stabilization, and land and forest use planning program. The land and forest use planning program is important mechanism to limit shifting cultivation cross the country and then promoting tree plantation. Nonetheless, the strategy has not been well translated and exercised on the ground. So far, the forest rehabilitation and restoration approach in Lao PDR has not been sustainable and not take account of biodiversity aspect. Some forest categories allocated have not been used based on their purposes. For instance, village production forest is used for cultivation when agricultural land is insufficient.

The Forest Strategy 2020, which is endorsed by the government, is the official document guiding the development of the forestry sector in line with overall national plans and strategies for socio-economic development and environmental conservation, including the National Growth and Poverty Eradication Strategy. In practice, most forest rehabilitation was conducted through natural means, then supplementary planting. The natural means is successful and low cost as just about zoning through land and forest use planning. The supplementary planting was not well met with the original expectations – increased forest cover but more about economics of interest. The principle of the supplementary planting especially in areas with low tree density where natural distribution of various tree species is scattered and irregular, or some of the original species are close to extinction or disappearing. So far, tree planting species are eucalyptus, acacia, rubber tree etc., mostly in mono-crops. In addition, seed planting as planting of quality seeds in barren forest lands but this is far to even no try.

The Lao Government has attempted to address deforestation with policy initiatives including limitation of annual logging quotas among other thrusts. These initiatives have, however, had poor results on the ground. The Government implemented the national program on stabilizing shifting cultivation practice which forest and land allocation program was conducted at household level as about 3 plots per family was permitted. However, it has not been successful owing to incomplete process of land use as no extension service. Local villagers kept cultivation in the given plots as up to 3 years of fallow rotation which made their poor crop products. It was the soil replenishment is insufficient and that had problem with soil erosion. Insufficient rice in following years is an issue so local villagers could not follow the agreement made under the program. Thus, they claim more plots and increased longer year rotation but impact on forest area. Some reserve forests are finally converted.

Lack of clarity in procedures, including those related to plantation establishment, together with limited financial resources and human capacity and weak law enforcement are major obstacles (Phothisat, 2013). The direct impacts of economic development on forests in Lao PDR include deforestation and land conversion as well as forest depletion due to poorly regulated legal and illegal logging. The implementation of natural forest rehabilitation in Lao PDR has not gone according to plan because government funding is limited and operational costs are not sufficient to implement activities at local levels. In this context, natural forest rehabilitation and reforestation need support from international organizations, especially with regard to protection forest management. A forest regeneration policy shall be promoted for individual households and organizations via incentives to regenerate degraded natural forest and young fallow forest areas through supplementary tree planting to increase forest density.

The government is also promoting collaboration with domestic and international players in several focal areas including plantation development, wood processing, NTFPs, forest resource conservation and ecotourism

6. Some Lessons learnt of Forest Rehabilitation and Restoration

- Often, much of the regenerated forest consists of a few species designed to yield one or two products rather than seeking to produce a broader range of forest goods and services that will also contribute to the well-being of local communities (Lamb and Gilmour, 2003).
- Reforestation has been carried out at a fraction of the deforestation rate and the new forests, some part of buffer zones of protected areas, are not converted to plantation such as eucalyptus in Lao PDR.
- Provide only some of the goods and services provided by the original forests (Lamb and Gilmour, 2003). Most new [plantation] forests, for example, are established simply to provide industrial timber; they benefit governments or large corporations rather than local communities.

- Many large areas of land became degraded because previous agricultural practices were unsustainable. Production was lost as fertility declined, salinity developed or weeds, diseases or pests became established.
- New agricultural systems are needed to replace these unproductive areas; more diverse landscapes are likely to be a necessary component of such systems (Hobbs and Morton 1999, Lefroy et al. 1999).
- Incomplete land-use planning including forest zoning and village-level land-use planning and land titling and insufficient resources for management of each land area or forest zone.
- Unclear resource and land tenure with weak coordination between sectors, law enforcement and governance.
- Lack of alternative livelihood or production systems to replace shifting cultivation in remote areas and access to markets together with lack of social services such as education and health care.
- Land title issues in some villages around the skirt of the town provide advantage for some families to sell the land for concession and claim new forest land for new agriculture practice.
- Insufficient understanding or ignorance of existing laws, traditional practice and regulations by entrepreneurs and local people.
- Limited human resources and limited financial support. Some government policy such as economy orientation (promoting cash crop plantation), contracts to and made more forest conversion.
- Often, forest rehabilitation and restoration has lack of understand on the species of interest, forest ecosystem etc because lack of research.

7. Conclusion

Planting trees without any scientific knowledge would not achieve the expectation and long-term sustainability of forest rehabilitation and restoration. As not much research was carried out in the first initiative as many countries used similar approach on forest rehabilitation and restoration. The forest rehabilitation is to increase forest cover by planting mainly for commercial purpose. Leasing land to private sector was happened in every country. The reforestation by enhancing to maximizing biodiversity is rare but such the framework species is recently considered new approach and effective one. In reality, the principles of forest rehabilitation and restoration are to promote ecological integrity and enhance human well-being in deforested or degraded forest landscapes (Lamb and Gilmour, 2003). Accelerated natural regeneration methods have been developed such as ‘umbrella’ natural regeneration, ‘side-effect’ natural regeneration and forest patch improvement; these are closely related with assisted natural regeneration (FAO-RAP 2003). It needs to work on-site level to enhance socio-economic and ecological gains at the landscape level (see Annex G). Much needs to be done to turn Forest Landscape Restoration from an idea that is implemented in a few pilot areas into mainstream practice that is adopted and promoted by governments and the private sector.

Anyhow, as long as current status of forest that is planned for rehabilitation and restoration is understood it is highly possible to develop and succeed in forest rehabilitation and restoration. Different stakeholders would have different perspectives, interest and expectations that may require some different inputs and approaches. Common understanding is important to put forward as to achieve the sustainability of forest rehabilitation and management.