Japan International Cooperation Agency (JICA)

Sustainable Natural Resource Management Project (SNRM)

Case Study

Incorporating Indigenous Species in Smallholders' Acacia Plantations in Thanh Hoi Commune, Tan Lac District, Hoa Binh Province, Vietnam

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List of Abbreviations

JICA	Japan International Cooperation Agency
SNRM	Sustainable Natural Resource Management Project
REDD+	Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries
VMBFMLD	Village Management Board for Forest Management and Livelihood Development

1. Summary

The plantation of *Acacia mangium* for the woodchip production by short rotation is largely spreading out in Central and Northern provinces. Considering the risk of disease and insect attack on monoculture plantation, as well as the low economic benefit of the plantation in the growing economy of Vietnam, the production system does not have good prospect in the future. The business models for longer-term rotation have been developed; however, smallholders continue the monoculture plantation because it is easy and they need short term income. SNRM REDD+ pilot project implemented participatory planting of indigenous species in Acacia plantation in order to improve economic viability of forest plantation as management of the province.

In order to diversify monoculture Acacia plantation and prolong the plantation cycle for the higher product value, eight indigenous species were mixed planted (20-30%) with Acacia in a participatory manner (146.4 ha in total, 123.8 ha 20-30% with mixed and 22.6 ha with only indigenous species, 189 HHs in 13 villages) in Thanh Hoi commune, Hoa Binh province.

After three years of planting, Xoan ta (*Melia azedarach*), Gioi (*Michelia mediocris*, fruit bearing, non-grafted), and Tram trang (*Canarium album,* fruit bearing) showed good growth. The performance of indigenous species varied depending upon the site and maintenance level. Acacia/Michelia model also showed good result by using Acacia as initial shade trees to form Michelia plantation (Acacia was harvested at 3 years). 85.4% of villagers either like (70.8%) or accept (14.6%) planting of indigenous species, showing they understood the economic and environmental merits of native species and open to incorporate them in Acacia plantation.

SNRM concluded that useful indigenous species (e.g. *Melia azedarach*, *Canarium album*, *Michelia mediocris*) can be introduced in some parts of Acacia plantation as clusters but a good plan is needed since they require better soil, more caretaking (including selecting right days for planting) and longer period for timber production. To fulfill the shade requirement of *Michelia mediocris* in the first few years, Acacia can be used as supporting trees to create shade in the first three years. Canarium and Michelia diversity the products with NTFP (Non-Timber Forest Product), rationally more profitable in the long run, and good for environment (water conservation and carbon stock). Forming village management mechanism (village management boards, village regulation and village fund) can be developed to effectively protect the acacia plantations of longer rotation mixed with indigenous species.

2. Background

In the recent years, forest plantations of smallholders have largely been developed in the Central and Northern provinces in Vietnam. In Hoa Binh province, 43% of forest cover (113,132 ha, 22% of entire area) is forest plantations[1]. As occurred in other provinces, these plantations are largely dominated by fast-growing monoculture plantation of Acacia mangium. Acacia is a nitrogen

[1] 2016. FPD.

fixing tree, suitable for rehabilitation of degraded soil after years of agricultural cultivation. Also, the reliable market for woodchip materials in the vicinity makes the smallholders to simply produce the short-term acacia woods.

However, considering the increasing labor cost along with economic growth of Vietnam, the low profitability of acacia woodchip production has limited future potential[2]. Making longer plantation cycle is one of REDD+ strategies to increase carbon stock in the forest. One of the solution packages of Provincial REDD+ Action Plan (PRAP) is to improve economic viability of plantation in production forests[3]. In order to reduce the risk of disease and insect attack while ensuring the economic and environmental performance, prolonging the rotation cycle and diversification of plantation products with high value native species are considered as two principle strategies for enhancing such forest plantation system[2]. Increasing demand of high value timber for local industry has a potential to cope with the problem.

Figure 1: Typical landscape of *Acacia mangium* plantation in Thanh Hoi Commune

How can smallholders prolong the rotation cycle? Long-term rotation of monoculture acacia can be one solution but incorporating certain amount of indigenous species has environmental and economic benefits (reduction of disease, pest and storm damage and product diversification). In order to convince the smallholders to incorporate indigenous species in acacia plantations, social, economic, and technical barriers need to be coped with sensible institutional and political support.

In order to diversify forest tree species, and to improve the long-term economic value, and increase carbon sequestration in planted forests, Sustainable Natural Resources Management Project (SNRM) promoted mixing indigenous species in Acacia plantations managed by smallholders. Beneficiaries are households in the pilot commune who legally possess allocated

[2] Pistorius, T., Hoang, H.D.T. Tennigkeit,T. Merger, E. Wittmann, N. Darragh Conway,D. Business models for the restoration of short-rotation Acacia plantations in Vietnam. German International Climate Initiative. https://www.unique-landuse.de/images/publications/vereinheitlicht/Acacia-Business-Models-Vietnam.pdf.

[3] Hoa BinhPPC. 2017. Provincial "reducing emissions from deforestation and forest degradation, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries" action plan of Hoa Binh province for the period from 2017 to 2020 towards 2030.

forest lands, and have completed the harvest in the year the project initiated, thus they were able to plant indigenous species for the next cycle.

3. Land use and forest status of Thanh Hoi commune

Thanh Hoi commune, the pilot commune of SNRM, is a mountainous commune with a total area of 2,633 ha. 61% (1,608 ha) of the entire commune is forest land (45% and 16% for production and protection forests, respectively, Table 1). 88% of forest land is allocated to households and 78% of which (1,108 ha) is production forest (Table 2).

Table 1. Area and structure of land use of Thanh Hoi Commune

No.	Land type	Area (ha)	Percentage (%)
1	**Agriculture land**	**594.6**	**22.6**
	Annual crops	429.9	16.3
	Perennial crops	164.7	6.3
2	**Forest land**	**1,608.7**	**61.1**
	Production forest	1,184.5	45.0
	Protection forest	424.2	16.1
	Special use forest	-	0.0
3	**Aquaculture land**	**11.6**	**0.4**
4	**Non-agriculture land**	**354.2**	**13.5**
6	**Unused land**	**64.3**	**2.4**
	Total	**2,633.3**	**100.0**

Source: Land statistics report of Thanh Hoi commune up to 31/12/2014 of Natural resources and environment department of Tan Lac District

Table 2: Forest land allocation in Thanh Hoi commune

No	Forest manager/ user	By category		Total allocated forest (ha)	%
		Production forest (ha)	Protection Forest (ha)		
1	Economic organizations	20.9		20.9	1.3
2	Households	1,108.5	310.8	1,419.3	88.2
3	Community	38.6	113.4	152.0	9.5
4	Commune People's Committee	16.5		16.5	1.0
Total		**1,184.5**	**424.2**	**1,608.7**	**100.0**

Source: Land statistics report of Thanh Hoi commune up to 31/12/2014 of Natural resources and environment department of Tan Lac District

In Thanh Hoi, protection forest is mostly natural forest, allocated to households and community to manage and protect. The status of households' management and utilization for each forest categories is described in the Table 3.

Table 3: The status of households' management and utilization of forest resources

Forest type	Benefit	Responsibility	Forest status
Protection forest	- Collecting firewood for cooking and daily use - Allowance for forest management and protection activities used to be provided but stopped - No other income from forest management like PFES or REDD+...	- Timely report illegal logging to authorities - Protect forest, water resources and clean environment	- Typical species are castanea, vernicia montana, dracontomelon, canarium. Plants grow slowly. - Located far from residential areas difficult to manage and protect forest, forest quality and quantity has been declined. - Some forest area was converted to plant cassava - Some forest area are abandoned due to damage from cattle and waiting for investment from the

			State - Villagers had no clear idea about the location of allocated forest in some area
Production forest	- Allcoated households are able to invest and decide their own business plan for the forest - Households have rights to receive benefit from investment thorugh legal logging. - Receive support from forest plantation projects (e.g. PAM project seedlings, maintenance allowance, etc.)	- Protect and produce their own forest	- Mostly Acacia with 5-7 year duration. - Average income is 30-50 million VND/ha - Households only do weeding but not fertilize. - Forest quality is average - In the first few years, mixed planting acacia with cassava - Forest has clear border, no dispute, limited grazing damage - Some area was converted to plant pomelo cultivation

Source: Adapted from Hoang L. S., Nguyen G. K., Vu D. H., Pham T. L., Tran V. P., Duong Q. H., Nguyen T. T H., Hoang D. V. Socio-Economic Survey for Thanh Hoi Commune, Tan Lac District, Hoa Binh Province. 2017. SNRM.

In the production forest, forest owners are free to choose any species and spacing[4]. In the protection forest, forest growers are required to plant at least 50% of main trees (long-term trees) with the remaining supporting trees (fast growth, less competitive with main trees like acacia, cinnamon, etc.).

4. Land use and household economy in Thanh Hoi Commune

According to the interview of villagers, one household has 1.3ha of land on average (production forest and agricultural lands account for 63% and 17%, respectively) (Figure 1). The main livelihoods are from agriculture, animal husbandry and others including hired jobs, salaries and allowances, etc.

Acacia mangium is harvested with 5-7 year rotation. Acacia is sold to the woodchip factories located in/near the commune. Chip processing factories undertake the harvest. Average income is 30-50 million VND/ha from the harvest. The income from forest plantation accounts for 6.6% of household income (Figure 2). Households only do weeding and fertilizing for the first two years after planting. Acacia is intercropped with lemongrass in some village. In the first few years, acacia is mixed with cassava which is used for feeding animals (e.g. pig, poultry). Forest has clear border without dispute on land, and limited damage from grazing. Some area was converted to plant pomelo. Villagers are expected to convert the land use status from forestland to agriculture in order to expand pomelo cultivation.

[4] Decision No. 35/2016 / QD-UBND, Regulation on species, density, models, crop structure and investment support level under the Project Protection and development of forests in Hoa Binh province in the period of 2016-2020 and other programs and projects funded by investment support and state budget in Hoa Binh province.

Figure 1: Landuse of a household

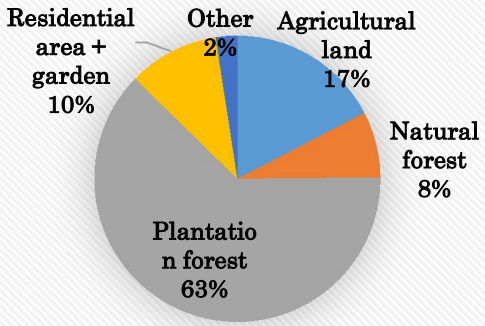
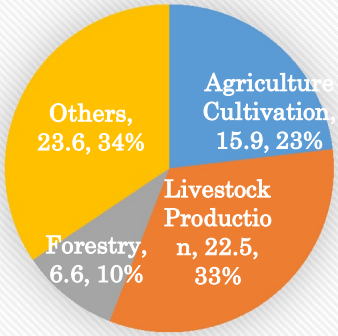


Figure 2: Household income (mil. VND, %)



Remark: Average of 20 households surveyed.

Source: Adapted from Hoang L. S., Nguyen G. K., Vu D. H., Pham T. L., Tran V. P., Duong Q. H., Nguyen T. T H., Hoang D. V. Socio-Economic Survey for Thanh Hoi Commune, Tan Lac District, Hoa Binh Province. 2017. SNRM.

Villagers in Thanh Hoi has access to bank loans from two government operating banks. Vietnam Bank for Social Policies is operating for poor or nearly poor households. The loan is provided by family bases with relatively low interest (0.25% - 0.75%/month) with limit of 100 million VND/household. No collateral is needed and the loan period to 120 months. The contract with CPC or commune unions (youth's, women's, farmer's etc.) is required to monitor the recipient groups. Vietnam Bank for Agriculture can provide loan to higher amount but the collateral is needed (e.g. red book). The interest is higher 0.9 – 1.12 %/month and villager can receive loan up to 70% of the value of collateral. The available bank loan are not suitable for long term forest plantation since they are small amount with short term with high interest rates.

Figure 3: Village meeting at Sung village (2016.10)

5. Project implementation process

Setting up village forest management mechanism

In order to promote village participation for forest management in an organizational manner, the Project facilitated to establish Village Management Board for Forest Management and Livelihood Development (VMBFMLD) in each targeted village [5]. Under the VMBFMLD, Village

[5] REDD+ Action: Promoting village-based forest protection against encroachment. SNRM Success Story: Thanh Hoi commune, Hoa Binh Province

Regulations on Forest Protection and Development was formulated based on the principles and rules the villagers agreed. Village fund was established to promote village forest management practices. All the SNRM activities at village level were carried out through the VMBFMLD.

In order to sensitize and to plan project activities, 32 village meetings and 2 communal meetings were organized in 2017. Villagers were provided with information on the project; the rights and responsibilities of the villagers and the project in the forest tree planting, as well as implementation plans of each stage were clarified. The villagers registered the forest tree planting with the planned sites. All conditions for participation in project forest plantations are institutionalized with a commitment signed by the villagers, the project and CPC.

In principle of project implementation, as an incentive to motivate villagers to participate in the forest plantation, villagers with good performance of forest management are prioritized to receive project support in livelihood development activities such as beekeeping, biogas plant construction, improved cooking stove, vegetable growing, fodder grass cultivation and fruit tree growing[6].

Villagers' contribution to Village Fund

Planting indigenous species with acacia (at least 20% for production and 50% for protection forest) was compulsory to receive the project support. Villagers were provided with acacia and native species seedlings. The project has agreed with villagers on the following conditions.

- Acacia seedlings planted in acacia plantation mixed with indigenous species in production forests: villagers contribute 20% of the value of acacia seedlings to village fund.
- Acacia seedlings planted in protection forests: free of charge
- Seedlings of indigenous species: free of charge

Financial resources for Village Fund are 100% covered by the villagers who received the project's support.

Technical design

After receiving the registration regarding size and tree species, the Project conducted screening and prepared plantation design for the participants. A qualified consultant was hired to survey and design the plantation to meet the State regulations on forest plantation. The forest plantation designs were approved by FPD. The villagers who planted in protection forest must strictly comply with state regulations on planting protection forests[7].

The selection of species underwent in three steps: 1) introduction of tree species suggested by government decision[8]; 2) selection of villagers at village meetings; and 3) technical surveys on suitability of land conditions by consultants. Two types of Acacia mangium (local and Australian seeds) and eight indigenous species including two types of *Michelia mediocris* (grafted and non grafted for the NTFP models) were selected (Table 4).

[6] The villagers who committed uncontrol grazing or encroachment were eliminated from beneficiaries of SNRM.
[7] The technical design of plantations in production forests does not need approval.
[8] Decision No. 35/2016 / QD-UBND, Regulation on species, density, models, crop structure and investment support level under the Project Protection and development of forests in Hoa Binh province in the period of 2016-2020 and other programs and projects funded by investment support and state budget in Hoa Binh province.

Table 4: Selected species for plantation

No.	Species	Local name	Price (VND/ seedling)	Density (tree/ha)	Harvest age (year)	Products and growth
1	*Acacia mangium* (local seeds)	Keo tai tượng nội	800	1,660	5-7 years	Slow growth, for chip only.
2	*Acacia mangium* (imported seeds)	Keo tai tương nhập khẩu	1,800	1,660	> 7 years	Fast growth Chip and timber
3	*Chukrasia tabularis*	Lat hoa	1,800	700-800	> 15 years	Good timber
4	*Canarium album*	Tram trang	1,800	1,000 – 2,500	> 7 years (Fruit)	Fruit and timber
5	*Canarium tramdeum*	Tram den	2,000	800+ 800 other trees	> 7 years (Fruit)	Fruit and timber
6	*Dracontomelon duperreanum*	Sấu	3,000	830	> 6 years	Fruits
7	*Melia azedarach*	Xoan ta	1,500	1,100	> 10 years	Good wood
8	*Michelia mediocris (non grafted)*	Gioi hat	8,000	300 + other trees	> 7 years (Fruit)	Fruit and timber
9	*Michelia mediocris (grafted)*	Gioi ghep	45,000	300 + other trees	> 5 years (Fruit)	Fruit and timber
10	*Hopea odorata*	Sao den	3,000	1,667	> 15 years	Good timber

Source: seedling suppliers, plantation design, 2017.

All the registered land were reviewed and only the one larger than 0.5ha were selected[9]. Villagers participated in the survey to determine the boundaries of land plots, tree species selection, and mixed planting methods. Villager can plant indigenous species by cluster or mixed with acacia in production forest but required to be mixed with acacia in protection forest.

Demonstration of NTFP model

Apart from the large-scale participatory forest tree planting, the project also attempted NTFP/Acacia mixed model (*Michelia mediocris* + Acacia mangium + Black cardamom (*Amomum longiligulare,* Sa Nhan tim)) as demonstration. Michelia is a high potential NTFP species with valuable fruit production having promising market in the vicinity but initially requires shade to grow. Michelia was planted with Acacia which provides shade to Michelia in a first few years and then is removed. The design of two models (seedlings with grafted and non grafted) are summarized below.

Model 1: Acacia + *Michelia mediocris* grafted seedlings + Black cardamom (0.5ha)

- Acacia: 555 seedlings/ha (space: 6mx3m)
- Michelia: 333 seedlings/ha (space: 6mx5m)

[9] Technical design is not required for lands smaller than 0.5ha.

- Black cardamom: 1.667 seedlings/ha (space: 3mx2m).

Model 2: Acacia + *Michelia mediocris* seedling non grafted + Black cardamom (0.5ha)

- Acacia: 500 seedlings/ha (space: 6mx3m)
- Michelia: 833 seedlings/ha (space: 4mx3m)
- Black cardamom: 1.667 seedlings/ha (space: 3mx2m)

Study tour, technical training on tree planting and maintenance

In order to improve the capacity on af/reforestation techniques, the project has organized study tours and trainings. Two study tours on planting and tending were organized for three models: a model of growing medicinal plants under forest at Ba Vi (Ha Noi); a model for experimental mixed plantations at Forestry University (Xuan Mai - Hanoi); and a model of transforming pure plantation forest into indigenous tree mixed plantation at household scale in Thach Thanh (Thanh Hoa Province). 88 representatives of registered households attended. Three technical training courses on planting and tending were organized with 148 participants. The technical guidance for forest tree planting and tending were designed and distributed to every household.

Figure 4: Study tour at Thach Thanh (Thanh Hoa Province)

The Project provided technical guidance on soil preparation, afforestation and maintenance of planted forests.

Tree planting

The quality of the seedlings makes great impacts on plantation performance. In order to provide high quantity seedlings to villagers, the Project signed a seedling supply contract with a reputable and capable seedling center in Hoa Binh province (Hoa Binh Seedling Center under Hoa Binh DARD). In order to ensure quality of seedlings the Project monitored the nursery and inspected them before handling to the villagers[10].

In 2017 and 2018, nine species (including eight native species) were planted in 146.41 ha (17.9 ha of protection forests and 95.5 ha of production forests) by 189 households at 286 sites (0.77ha/household on average, Table 5). Approximately 102,000 seedlings of eight indigenous species (including *Amomum longiligulare,* 42% of all the tree planted) were planted (Table 6). All the plantations were planted with native trees either by cluster or mixed with acacia trees (mixed 20% in 2017 and 30% in 2018, respectively) in production forest and 50% in protection forest.

[10] The contract was signed with seedling providers meeting seedling standards. The seedlings in the nurseries were inspected against the fixed standards before handling them to villagers.

Table 5: Area by method/category and plot size of indigenous species plantation in Thanh Hoi commune

No.	Task	Unit	Quantity		
			2017	2018	Total
1	Planted area by tree species	ha	113.40	33,01	146.41
1.1	Planted area:100% indigenous tree species	ha	18.89	2,72	22.61
1.2	Mixed planting: indigenous species with acacia	ha	94.51	29,29	123.8
2	Planted areas by forest categories	ha	113.4	33,01	146.41
2.1	Production forest	ha	95.5	12.13	107.63
2.2	Protection forest	ha	17.9	20.88	38.78
3	Number of households	HH	148	41	189
4	Number of planted forest plots by plot area	plot	241	45	286
4.1	Number of plots less than 0.5 ha/plot	plot	157	29	186
4.2	Number of plots equal or more than 0.5 ha/plot	plot	84	16	100

Table 6: Number of seedlings planted by species under SNRM in Thanh Hoi commune

Tree species	Local _Name	2017	2018	Total	%
Acacia mangium	Keo	119,064	21,521	140,585	57.9
Melia azedarach	Xoan ta	27,059	5,053	32,122	13.2
*Chukrasia tabularis**	Lat Hoa	16,279	14,549	30,828	12.7
Canarium album	Tram trang	12,038		12,038	5.0
Canarium tramdeum	Tram den	5,861		5,861	2.4
Dracontomelon duperreanum	Sấu	6,491		6,491	2.7
Michelia mediocris (grafted)	Gion ghep	183		183	0.1
Michelia mediocris (non grafted)	Gion hat	458	8,491	8,949	3.7
Hopea odorata	Sao den		3,861	3,861	1.6
Amomum longiligulare	Sa nhan tim	1,834		1,834	0.8
Total		**189,267**	**53,475**	**242,752**	100.0

*Due to high survival rate and value of timber of Chukrasia tabularis, many villagers planted it in 2018.

6. Project output

Survival rate

According to interviews with villagers, survival rate of planted trees are varied. Based on them, survival rate of acacia is very high, above 85%, and those of native species is about 65% in average (Table 7). Among the native species *Melia azedarach* (Xoan ta) and *Michelia mediocris*

showed higher survival rates (>80%), but *Canarium album* (Tram Trang), *Canarium tramdenum* (Tram Den), *Dracontomelon duperreanum* (Sau) showed lower survival rate (about 40-50%).

There is a significant difference in the tree survival rates among the villages where villagers were interviewed. The survival rates were lower at Dong 2, Bao 2 and Tam villages (16.7% of planting area in 2017). It is due to the following reasons: the land conditions are not good, thin soil layers with many rocks, and lack of rain after the planting. It is likely that VMBFMLD has not well instructed the villagers how to plant forest trees. Some villagers did not follow the guideline; they did not plant the trees with suitable weather (cool or rainy days), which might have caused higher initial mortality rates.

Regarding the position of planting, 44% of villagers planted indigenous species mixed with acacia (26% in protection forest) and 35% of villagers planted in cluster. More than 70% of villagers are interested in planting indigenous species (Table 7)[11].

Table 7: Forest plantation status

No.	Monitoring indicators	Unit	Quantity
1	Survival rate*		
	Acacia mangium	%	90-98
	Acacia mangium (Australian seeds)	%	83
	Melia azedarach	%	69
	Chukrasia tabularis	%	40-50
	Canarium album	%	40-50
	Canarium tramdeum	%	71
	Dracontomelon duperreanum	%	40-50
	Michelia mediocris (grafted)	%	95
	Michelia mediocris (non grafted)	%	95
	Hopea odorata	%	59
	Amomum longiligulare	%	NA
2	**Planting position of indigenous trees****		
	Row by row, or tree by tree	%	*43.8*
	By cluster on the bottoms of hills	%	*16.7*
	By cluster on the tops of hills	%	*18.8*
	By plot boundaries	%	*20.8*
3	**Acceptance to indigenous species of the villagers ****		
	Interested in planting native tree species	%	*70.8*
	No interest but no objection	%	*14.6*
	Encouraged by the Project	%	*14.6*

Source: *Physical measurement of 10% of trees. Le X. T., Le T. S. 2nd assessment report on indigenous tree species planting in Thanh Hoi commune, Tan Lac district, Hoa Binh province. SNRM 2020. ** Households interview in 2017. Active Assessment Report. Sub- Component of Pilot REDD+ Activities in Hoa Binh Province. Monitoring data in 2017. SNRM.

Growth of indigenous trees

After three years of the plantation, the planted species were measured. Among nine indigenous species introduced, six species were investigated by tree measurement (Table 8).

[11] *Chukrasia tabularis* was removed since it was not growing well in the plantation.

For indigenous trees, *Melia azedarach* has the best growth in both diameter at breast height (DBH) and height. The quality is also good (2.9/5). *Michelia mediocris* (non grafted) is the second. The DBH and height growth increments are high and the growth quality also good (3.1/5) then this tree has higher potential growth in future. Meanwhile, *Michelia mediocris* (grafted) has low DBH and height growth increment and the quality is relatively low (only 1.9/5). *Canarium tramdenum* is the slowest growth with the lowest diameter (at 0.2m) and height growth increment, and the growth quality is bad (2.1). The diameter of *Canarium tramdenum* increases proportionally with the canopy of the Acacia, suggesting that young *Canarium tramdenum* tree does not have high light demand. *Hopea odorata* has the second lowest diameter (at 0.2m) and height growth increment, and worst growth quality (1.7/5).

Table 8: Growth status of indigenous species in Thanh Hoi commune, Hoa Binh

Species	DBH *(cm)*	Average growth (cm /year)	Height (m)	Average growth (m / year)	Growth quality (1:very bad-5 very good)
Acacia mangium (Local)	6.2	2.0	8.0	2.7	3.6
Acacia mangium (Australian)	9.1	3.0	10.9	3.6	3.6
Melia azedarach	4.9	1.6	5.3	1.8	2.9
Canarium album	3.7	1.3	2.9	1.0	2.9
Canarium tramdenum	***2.0***	***0.7***	1.7	0.6	2.1
Michelia mediocris (grafted)	1.9	0.7	2.5	0.8	1.9
Michelia mediocris (non grafted)	3.8	1.3	3.9	1.3	3.1
Hopea odorata (2 years old)	***1.8***	***0.9***	1.6	0.8	1.7

Remark: Tree measurement of 100 trees in 2020. Source: Le X. T., Le T. S. 2nd assessment report on indigenous tree species planting in Thanh Hoi commune, Tan Lac district, Hoa Binh province. SNRM March 2020.

Figure 5: 36 months years old Gioi (*Michelia mediocris*) plantation (DBH 3.8cm 3.9m height on average) after removal of shade of *Acacia mangium* (2020.3)

NTFP model

Gioi (*Michelia mediocris*) /acacia model was undertaken in order to grow Michelia as understory of fast growing acacia in the first few years and then establish Michelia plantation. Although non grafted Michelia from natural seeds grow much better than grafted one, this is only limited case and the management of villagers were very different. Therefore, it can be suggested that Michelia plantation from natural seeds can be established using acacia as a mediator to provide the shade in the first few year[12]. Black cardamom was planted in

[12] Villager received 4 million VND/ha for acacia harvest of three years.

understory but it did not show the good result probably because cardamom requires more rich soil like natural forests and the condition of acacia plantation is not suitable.

Awareness raising among villagers

Through the trainings by SNRM and planting indigenous species villagers raised awareness of forest plantation business and environment and are willing to accept indigenous species plantation. 85.4% of villagers see the growth of plantation better and accept to plant indigenous species (Table 7). The villagers' awareness can be summarized as following three points.

Figure 6: *Tram trang* grow very well under the partial shade of acacia plantation (Appx. 2.5m in 16 months) (2018.11)

1) villagers became aware of the return of forest plantation in the structure of household economic income; thus more attention should be paid to intensive plantation, selection of tree species, and the products.

2) villagers became to see the importance of forests, and the role of indigenous trees, for maintaining the living environment in general and water sources for daily life and agricultural production in particular.

3) villagers are willing to plant a certain percentage of indigenous trees for economic and environmental values, and want to continuous support from the project for another rotations.

7. Lesson-learned

Growth of indigenous species

As of three years after the planting, among indigenous species, *Melia azedarach* shows the highest adaptability (the diameter at breast height and the tree height), followed by the *Michelia mediocris* (non grafted) and *Canarium album*. However, this is only a preliminary assessment of three years old because for most indigenous species, the early years often do not fully express growth ability. In the near future when *Michelia mediocris*, *Canarium tramdenum*, and *Canarium album* produce fruits and seeds, these will be good prospects for developing indigenous tree plantations.

Many indigenous trees were planted on very poor soil conditions, very thin/dry topsoil layer with a thick component of rock and poor nutrition due to years of Acacia plantation and improper cultivation in the past. Most of the indigenous trees intercropped in the Acacia forest lack light because after 2-3 years Acacia has closed the canopy while the light demand of indigenous trees is increasing, except for *Canarium tramdenum*, which grow better under the shade in the first few years.

In general, people are more persuasive when seeing the economic values of indigenous plants on their own eyes. *Canarium tramdenum* and *Canarium album* species are easily accepted by households because they produce fruits and timber with high value. *Melia azedarach* is also

selected by many households. However, the plantation site needs to be well selected because *Melia azedarach* does not grow well in bad soil.

Plantation design

In the past, in the pilot commune, there were a number of projects implemented to support villagers to plant indigenous species mixed with acacia. However, the mixed planting method in the same row revealed many difficulties in the process of tending, harvesting and reforestation. The results also showed that after the acacia harvested no indigenous plants were surviving[13].

In SNRM the mixing methods for the plantation was selected by each villager based on their convenience or interests (35.5% was planted by cluster in production forest) (Table 7)[14]. According to the household interviews, 85% of villagers either like or accept the plantation with indigenous species, suggesting that the participatory selection of mixing method was well accepted. Villagers assessed that there would be no difficulty in harvesting forests and reforesting in mixed planting the indigenous species in a cluster. In fact, the project experience shows that villagers can fully learn and apply the techniques of planting and tending of new species.

Economic feasibility of villagers and project approach

In order to incorporate indigenous species in acacia plantation, villagers need to give up the proportion of acacia harvest (which is allocated to indigenous species) in five years. According to a villager, five year old acacia mangium is sold with approximately 40 million VND/ha, suggesting about 8 million VND/ha the reduction of income in five years (in 20% mixed plantation).

The project provided seedlings free of charge for both acacia and native species, but required the 20-30% contribution to village fund for acacia seedlings[15]. This mechanism ensured the responsibility of villagers and create fund source for the VMBFMLD. The project prioritized villagers who participate in indigenous species plantation to receive benefit of livelihood activities. For instance villagers earn significant amount from beekeeping activities (VND 18-20 million/year) which was supported by SNRM[16]. Villagers saw the difference between income loss from Acacia and the seedling cost supplied by the project[17] plus other livelihood benefits received from the project, and decided to plant 20% indigenous species.

The expectation of livelihood benefit from the project was probably large. The condition of the project (the proportion of indigenous trees planted in the plantation plots (20-30%), the 20% contribution to village fund and priority to participate in livelihood activities) is reasonably balanced in accordance with the business model of acacia with short term rotation, the area of

[13] Thanh Hoi received support from the mangrove plantation project (2004) of Vietnam Red cross to carry out mixed plantation between fast-growing trees and local trees (*chukrasia tabularis*, canarium, acacia, seedlings/fertilizer/planting and maintenance cost supported) but now only acacia is growing. The local species were weak and removed. Source: Hoang L. S. et al. Socio-Economic Survey for Thanh Hoi Commune, Tan Lac District, Hoa Binh Province 2016.

[14] In protection forest indigenous species and acacia need to be mixed by row. The cluster planting of acacia is not allowed.

[15] The contribution rate is based on an agreement certified by CPC.

[16] SNRM REDD+ Action Success Story: Creating Sustainable Short-term Income from Beekeeping Promotion in Thanh Hoi Commune, Hoa Binh Province -

[17] About 1.5 million VND/ha for seedling cost. Acacia mangium is planted 1667trees/ha. 800 VND/seedling for domestic acacia and 1500 VND/seedling for Xoan ta seeds.

forest land managed by households, and the level of willingness to plant indigenous species. The mechanisms need to be elaborated to encourage people to continue planting, tending and protecting indigenous trees, combining technical assistance, awareness raising, financial incentives, and livelihood development options (e.g. intercropping of non-timber forest products, medicinal plants under the forest canopy). A democratic discussion must be made to reach consensus in the community, to avoid oppression from the outside and to maintain the will.

Economic analysis of NTFP model

Michelia /Acacia model was specially tried as NTFP model and showed a good result. *Michelia* can be harvested at 5 years from grafted seedlings and 10 years from non-grafted seedlings. The villager got income from removing acacia in three years (VND 4 million for 0.5ha). If villagers can give up a part of short-term income from acacia plantation and convert it to *Michelia* plantation, it will generate income in the future. Although it was not tried in SNRM, *Canarium tramdenum,* non high light demand trees when they are young, may also incorporate this design to develop plantations.

Potential of indigenous species with long term Acacia plantation

The models of acacia plantation for timber with long-term rotation replacing from local Acacia trees for woodchips are gradually showing the superior result. Acacia will be harvested in ten years as small timber[18].

Many people have seen the benefits of large timber forest plantation, but a very few plant indigenous trees. The project trial confirms the advantage of using new varieties of acacia from Australian seeds. Transforming to intensive cultivation from local Acacia to new Acacia of quality seedlings, timber production with longer term rotation becomes more profitable. Diversification of plantation with indigenous tree species becomes easier with 10 year rotation since the damage of short term acacia harvest can be avoided.

Some households contracted other households to work in afforestation due to lack of available human resources. This is a sign that the short term acacia plantation is becoming more vulnerable in the near future because its economic viability depends upon the low labor cost using their own hands.

Figure 7: Growth measurement of two years old Xoan ta (2019.3)

Financial access and risk abatement for native species plantation

Regarding access to credit, it is difficult to use for long term plantation since the bank loan without collaterals (e.g. bank of social policy) are small (up to VND 30 million) for

[18] 10 year acacia manguim is sold VND 100 million /ha.

short period (3-5 years) for the forest plantation. These loans are mostly used for agriculture and livestock activities. Interest rates are also high due to the short term loan. In order to support native species plantation of long-term rotation, the credit period needs to be longer, the amount larger, and interest lower.

In order to introduce longer rotation for timber, villagers need to take risks including fire, disease, insect attack, robbery, etc. Risk abatement is probably one very important aspect to change villagers' attitude. According to a villager, robbery is the main obstacle to plant indigenous species.

The mechanism to protect their plantation by a villagers' group formulated with the project support (village management boards, village forest regulation and village fund) probably helps reduce these risks and promote longer rotation.[19]

Awareness raising for the local people

Taking acceptance of planting indigenous species by smallholders was not easy process. SNRM undertook a series of awareness raising activities on the long-term benefits of planting indigenous trees through experience sharing, analysis, persuasion, promotion and support. When villagers understood the benefit they voluntarily participated without imposition. Villagers have initially learned the effects of planting indigenous species, techniques of planting and tending trees, sustainable use of forests, and their environmental services. The project result showed that the SNRM's approach was appropriate and initially effective and therefore well accepted by most of the villagers. It is important to work with enthusiastic villagers who can develop a good model for disseminating indigenous species.

8. Conclusions

The mixed plantation of indigenous species in Acacia plantation in the pilot commune of Hoa Binh province has been implemented for three years and showed initial achievements. It is expected that these plantations will be maintained encouraging other households to plant indigenous species for longer term rotation in the future.

The mixed plantation of indigenous species has been carried out for only three years. The effects and effectiveness need to take a long time to show. It is necessary to continue monitoring the growth of the plantation and support the people and localities in planting, tending and protecting indigenous tree planting models, since planting for timber production requires analysis, as well as persuasion and promotion to villagers to help them see the long-term benefits.

The project showed that most of participated villagers have conditions to develop the indigenous plantation, having desire, and obtaining a good awareness of the value and basic techniques of indigenous tree planting. Some issues such as planting on improper sites and timing, and lack of proper care were found to be addressed in order to ensure high survival rates and good growth.

[19] REDD+ Action: Promoting village-based forest protection against encroachment. SNRM Success Story: Thanh Hoi commune, Hoa Binh Province.

Although Acacia particularly ones from Australian seeds showed excellent result, the indigenous species such as *Melia azedarach*, *Michelia mediocris* and *Canarium album* showed good growth. It is needed to replicate the selected models and, communicate with local people to create trust and motivation.

Recommendations

- Continue monitoring and evaluating indigenous tree planting activities for a longer period (5-10 years) to get clear results on the adaptability and effectiveness of tree species
- Strengthen technical knowledge of field staff to supervise and guide the people on indigenous species plantation
- Local authorities to communicate and guide local people on indigenous tree plantation regarding the value, plantation techniques, and demonstration of successful local models
- Support to establish village management board to develop and implement village regulations on forest protection, cattle grazing with appropriate sanctions
- Support local household groups for indigenous tree planting.
- Promote planting indigenous species (up to 20%) mixed with *Acacia mangium* as clusters under good soil conditions in order to ensure high economic values of the species
- Develop *Michelia mediocris* (and *Canarium tramdenum)* plantations using Acacia as supporting trees in the first few years
- Promote planting *Acacia mangium* with seedlings of Australian seeds for timber production