



Adoption of Agroforestry in Mai District, Phongsaly Province

A Research Project

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AGROASIE
Lao Organic Products



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Acronyms

AEC	ASEAN Economic Community
ASEAN	Association of Southeast Asian Nations
DAFO	District Agriculture & Forestry Office
EOP	End of Project
GoL	Government of the Lao PDR
HH	Households
INGO	International Non-Government Organisation
MAF	Ministry of Agriculture & Forestry
NAFRI	National Agriculture and Forestry Research Institute
NTFP	Non-Timber Forest Product
NUDP	Northern Uplands Development Programme
PAFO	Provincial Agriculture and Forestry Office
TOR	Terms of Reference
WAC	World Agroforestry Centre (formerly known as the International Centre for Research in Agroforestry, ICRAF)



Figure 1: The distant glow of a secondary forest fire emerges in the evening light on the road to Houay Thong village, Mai District

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Figure 2: Collecting and storing firewood is an essential part of work in Houay Thong village in April, after burning the secondary forest

EXECUTIVE SUMMARY

Factors that influence the adoption of agroforestry were investigated by conducting semi-structured interviews with men, women, and leader groups in eight target villages, Mai District. A total of 194 persons (33% female) were met by the survey team, representing 18 percent of the adult population. Early findings were then presented at a stakeholder's workshop in the District centre to examine these findings and consider how agroforestry could assist with rural development.

The survey team found that seven villages were practicing a form of rotational shifting cultivation. Fallow periods ranged from three to seven years, on average. Most farmers rely on upland rice grown into burned upland fields. One village, only 8 km from the District, has more stringent enforcing of forest protection and consequently a higher proportion of area devoted to perennial crops.

Agroforestry gardens exist in 11 percent of households on average (a range of 3-20%)¹. Agroforestry gardens are mostly forest-based and are usually close to the village with a mix of perennial plants sourced from the forest (such as galangal, cardamom, rattan or indigenous fruit trees) or from outside the village (coffee or fruit trees). Grafting of improved varieties onto wild rootstock, such as with persimmon, is a promising technique being adopted in two Akha villages.

Production results were limited and not always forthcoming, but a household income survey is warranted in HVK village for those that rely on their mature agroforestry gardens. Results from early adopters should also be monitored.

An average of 40 percent of households per village (excluding Houay Vang Kao), who are not currently practicing agroforestry, expressed a desire to adopt. They are motivated to do this: (1) to improve their household income; (2) to provide more food for their families. The approach, to plant multiple crops and trees in a single garden, is often attractive due to its convenience but requires a long-term perspective.

However, various factors have prevented this level of interest from becoming action. These barriers include: (1) a lack of sufficient planting material; (2) a lack of nearby land or labour; (3) a lack of insufficient knowledge, either technical or marketing; (4) women pinpointed the lack of motivation as being a major constraint; (5) a few men highlighted their lack of appropriate tools. Opium addiction is also evident in several villages and may restrict adoption. No single factor seemed to be overwhelmingly important. Obviously many factors affect the decisions to move limited labour from subsistence farming and food-gathering to permanent agroforestry plots.

Poverty was considered to prevent lower-income families from adopting agroforestry due to a lack of resources (i.e. land or planting material) or a lack of labour.

Extension processes directed by Project and District extension agents are helping farmers adopt agroforestry. Study tours, field training, and provision of planting material were all useful ways to encourage adoption. Individuals are beginning to conduct their own on-farm testing. New access roads and basic village infrastructure will build momentum for more widespread adoption of agroforestry.

Village leaders suggested using demonstration plots as a way for interested households to follow the progress of production and profit. Attitudes also need to be addressed to raise motivation; leaders can play a role in urging or convincing families to adopt. Differences exist between the villages in terms of practice and interest. Extension processes and information flows may need to be adjusted to match each village's profile.

¹ Note: Houay Vang Kao village was excluded from this calculation. This village was selected as a contrast to the other villages due to the existence of mature agroforestry plots and close proximity to the District.

Recommendations are made for policymakers to consider how agroforestry might become a national strategy to improve the livelihoods of upland communities:

- (1) The Ministry of Agriculture and Forestry should consider mainstreaming agroforestry farming systems in upland areas by applying the following measures:
 - a. Develop a comprehensive 10-year Agroforestry Master Plan that defines the concepts and benefits of agroforestry, sets out priorities, considers land tenure, builds partnerships, sets investment targets, and seeks to build better markets for agroforestry products.
 - b. Improve coordination between concerned MAF agencies to determine the lead MAF agency for promoting agroforestry.
 - c. Direct NAFRI to build stronger research and development linkages with the World Agroforestry Centre to identify profitable and sustainable combinations of crops suitable for adoption by smallholders in the various upland environments of northern Laos.
- (2) The Ministry of Agriculture and Forestry should consider developing technical criteria to guide in the selection of suitable combinations of annual and perennial species as part of agroforestry farming systems.
- (3) The Ministry of Agriculture and Forestry should consider developing a micro-financing scheme for medium- and long-term credit in support of smallholder farmers interested in establishing agroforestry farming systems in priority upland districts.
- (4) The Ministry of Agriculture and Forestry should consider assigning trained and experienced agroforestry extension technicians to priority upland districts, who are capable of promoting diverse agroforestry systems to smallholder upland farmers.

Finally, recommendations are made for the implementing stakeholders to consider how to consolidate and scale-up agroforestry. The Project can promote adoption in the following ways:

- Continue to use a hands-on approach that brings farmers together and enables them to see the advantages of agroforestry.
- Consider up-skilling lead farmers with core competencies, who can train others in specialty skills (e.g. grafting, pruning, nursery-raising seedlings, transplanting, etc).
- Work with partners to identify more productive combinations of perennial and annual crops. Blend these combinations using various innovations, such as selective regrowth, living fences, relay cropping, or hedgerows. Visit the WAC project in north-west Viet Nam to see novel combinations in the field.

District and Provincial partners can contribute to adoption of agroforestry in the following ways:

- Help expand the market for agroforestry products, including fruits, nuts, and other products.
- District nursery services should be broadened to include fruit trees and fallow shrubs that may be useful for agroforestry.
- Work with MAF on how to support the land tenure needs of smallholder farmers who wish to invest in long-term mixed-farming systems such as agroforestry.

1. BACKGROUND

Since 2008, World Renew has been conducting integrated development activities through its Phongsaly Integrated Development Project based in Mai District, Phongsaly Province (see map in Appendix 1). In partnership with the Ministry of Education & Sports' Department of Non-Formal Education, the Project has focused on improving the livelihoods of poor and remote villages in this rugged and isolated District.

The overall objective of the Project was to improve the livelihoods and living conditions in the 13 target communities by raising the levels of education, achieving sustainable livelihoods with improved incomes, and helping villagers to enjoy better health and nutrition.

The root cause of these problems lies with the poor accessibility of the communities. Consequently, the limited resources of District services are insufficient to deliver quality education or basic health services to the same extent as in the District centre. Marketing and trade are more problematic due to the logistical challenges.

An End of Project (EOP) evaluation was conducted in 2012 to examine the outcomes of the project's activities and to formulate recommendations for the next Phase (Kelly 2012). However, the broad scope of the evaluation meant that several technical aspects were not able to be closely examined. The Project's strategy to alleviate poverty by promoting agroforestry was observed – but time constraints prevented the survey team from fully understanding how useful this approach was or if agroforestry adoption could be improved.

The Northern Uplands Development Programme (NUDP), operating within the Ministry of Agriculture and Forestry (MAF), issued a call for proposals in October 2013. World Renew's concept note was accepted, and a full proposal was then prepared to investigate the adoption of agroforestry in World Renew's target area in Mai District (Appendix 2). The proposal, accepted for funding in April 2014, had the following objectives:

- (1) To determine the farmer-perceived factors that assist or hinder the adoption of agroforestry;
- (2) To encourage field staff, District extension agents and local decision-makers to view agroforestry as a key strategy to raise livelihoods in upland areas of Phongsaly.

The findings of this study are presented here for all stakeholders to better understand how adoption of agroforestry takes place. It is hoped this will help field staff to better target their interventions, and to assist policy makers as they consider policies that can improve food security and livelihoods for upland farming communities.

2. LITERATURE REVIEW

2.1 Upland farming systems in northern Laos

Farmers that rely on the cultivation of rice-based farming systems on rainfed slopes remain one of the poorest and most vulnerable groups within Laos. Their poverty relates to their lack of connectivity to basic services, markets and information. A system of "slash-and-burn" or rotational fallow, with upland rice as the central crop, is practiced by these upland farmers to maximise the returns of labour needed to prepare the fields. Yields are often lower than for lowland (or flooded) rice-based systems, and

exposes the community to higher risks of crop failure should rains arrive late or at a lower amount (Bartlett 2012).

Additional pressure is being felt as population density rises through natural population growth and by reduced accessibility to land. Accessibility has reduced as a result of three factors. Firstly, the government policy of land allocation that began in the mid-1990s was enforced to stop the clearing of virgin forests (Lindquist et al 2006). Secondly, subsequent policies to resettle communities into focal zones or through village consolidation led to a reduced access to land (Baird and Shoemaker 2005; Castella et al 2013). Thirdly, concessions provided to companies (agriculture, hydropower or mining) has placed further pressures on some upland communities and reduced their access to land (Schönweger et al 2012).

Without access to large tracts of land, the rotation cycle is reduced and soil fertility is unable to be restored during the fallow period. Subsequent crop yields suffer. Fallow lengths, up to 40 years during the 1950s, had reduced to only three years in areas near Luang Prabang and Oudomxay (Lindquist et al 2006). Weeds then became a major issue placing hefty labour demands on upland communities (Roder 2001, Ducourtieux 2006). Upland communities, such as in Phongsaly, are more recently experiencing a net outflow of persons moving to more developed urban centres with the attraction of the city livelihood (Ducourtieux et al 2006), placing greater pressure on labour to deliver higher returns.

Two broad strategies are being practiced to intensify production of upland slopes in the Asia-Pacific region, both focusing on management of the fallow phase (Cairns 2007). First, the fallow phase can be made more effective. That is, plants that may accelerate or improve the fallow phase are either introduced or allowed to regrow. Pigeon pea or *Leucaena*, for example, have been shown to accelerate the replenishment of soil fertility during the fallow phase in northern upland (Lindquist et al 2006). Secondly, the fallow phase can be made more productive. In this case, semi-perennial or perennial cash crops (fruit trees, nuts, timber trees, etc; see Figure 3) are introduced into the fallow field, and the fallow period adjusted accordingly, to provide economic benefits.

Agroforestry is one way that farmers can achieve both an effective and a productive fallow. Agroforestry plots can include fast-growing trees that can rapidly replenish soil fertility *and* other kinds of trees or perennial plants as cash crops. In practice, productive agroforestry stands become a form of permanent cultivation, taking this land out of the rotational cycle.



Figure 3: Coffee nurseries at Houay Thong (left) and Moutern (right) villages

2.2 Agroforestry systems

Agroforestry is the integration of woody species into the farming system. An agroforestry plot may be initiated by planting woody species into a previously cleared area (farm-based agroforestry) or by planting new crops, either annual or perennial, into a forested area (forest-based agroforestry).

The core components of an agroforestry garden tend to be: (1) the presence of long-lived or perennial cash crops; (2) a significant diversity of crops, either annual or perennial; (3) a garden that provides harvestable products throughout the year. (See Box 1 for our survey team's definition.)

When designed and implemented correctly, agroforestry combines the best practices of tree-growing and agricultural systems, resulting in more sustainable use of land (FAO 2013).

Agroforestry systems can:

- help protect and sustain agricultural productive capacity;
- ensure food diversity and seasonal nutritional security, such as for children;
- diversify rural incomes;
- strengthen resilience to climatic fluctuations;
- help perpetuate local knowledge and social and cultural values

Box 1: “Agroforestry” as defined by the survey team

“**Agroforestry** is an agricultural farming system that has agricultural crops and trees integrated together in the one area.

It is achieved by planting trees (perennial or semi-perennial species) into a cultivated area OR planting annual crops or grasses into a forested area.”

The combination of trees, crops and/or livestock helps create a permanent soil cover against erosion and enhances water storage, thus benefitting crops. Leguminous trees can fix nitrogen and provide leaf litter as a fertiliser to boost yields.

Agroforestry also improves the resilience of farmers and increases their household income through the harvesting of diverse products at different times of the year (Figure 4). Products may be collected for household consumption or sold for cash, helping the farmer diversify and spread risks. Woody plants can provide nuts, fruits, resin, oil, natural medicines, natural insecticides, and natural fertiliser. Labour is made efficient since many products are found in a single area.

Agroforestry is not a new system to northern Laos. Studies in Houaphanh (Armitage 2004) identified a number of NTFP that could be grown in an agroforestry system; system designs were based on the collection of benzoin resin. In this case, the *Styrax* tree could form the overstory while cardamom or a yam species could be grown as the understory.

Agroforestry offers clear advantages to farmers and communities when compared with monoculture. Teak woodlots have been planted to a large extent in the north of Laos during the last decade. However, Newby et al (2012) recommended that a more diversified agroforestry system, such as under-planting the teak plantation with rattan or intercropping with paper mulberry, would enable poorer landowners to hold onto their teak woodlot until maturity.

Agroforestry could also reduce pressure on those secondary forests that are being used for collection of their NTFPs. Thanichanon et al (2013) showed that improved accessibility to villages strengthened the influence of government and markets and generally improved



Figure 4: Agroforestry garden of Ms Ping, Saluang village (Photo: Sarah Whittaker)

livelihoods – but was associated with a decline in forest condition due to the in-migration and ongoing reliance on NTFP.

However, adopting perennial (or woody) species is not simplistic. A number of factors can act as barriers of adoption (Reijntjes et al 1992). These include: (1) actual or perceived negative aspects, e.g. compete for light; (2) additional risks, e.g. buffalo eating the young plants; (3) trees require a long period before returns may be observed; (4) there may be ownership issues of the land; (5) restrictions may exist on cutting and transporting timber; (6) markets may not yet exist or transportation may be too cumbersome.

2.3 Objectives of this study

Phongsaly Province has a population made up of 28 ethnic groups, perhaps the richest diversity of people groups of any province in Laos. The rugged terrain and low population density has helped preserve vast tracts of forest from the clearing experienced across the border in Viet Nam and China. However, villages in the upland areas remain isolated with little access to basic services and markets.

Mai District is one of the poorest Districts in the country (GoL 2003). The District faces a number of immediate challenges including how to better link villages with services and markets, dealing with opium production and addiction, the issues of communicating with non-Lao speakers, and pressure by external interests to utilise the natural resources. World Renew's project in Mai District is working with remote communities to find solutions to these complex livelihood needs. One process has been to help communities increase their food security by raising cash crops such as growing perennial crops in an agroforestry system.

After five years of delivery, World Renew wished to better understand what affects the adoption of agroforestry systems. This research was conducted for two main reasons: (1) to determine the farmer-perceived factors that assist or hinder the adoption of agroforestry; (2) to encourage field staff, District extension agents and local decision-makers to view agroforestry as a key strategy to raise livelihoods in upland areas of Phongsaly.

3. METHODS

3.1 Field survey

Farmer perceptions and views were determined by a focus group survey. The survey team received one day's training on how to conduct semi-structured discussions with focus groups and to collect case studies. The survey team then split into two, each group visiting several target villages in a separate area from 25-29 April 2014 (see Appendix 3.) Target villages were selected in consultation with the Project Manager and bearing in mind factors such as logistics, time frame, and travel conditions. Consideration was also given to identify contrasts between villages in their adoption rate, ethnicity, and distance from the District centre.

The survey team visited eight villages made up of three ethnic groups. A group of households was interviewed in each village, including selected agroforestry practitioners (Table 1, Figure 5).

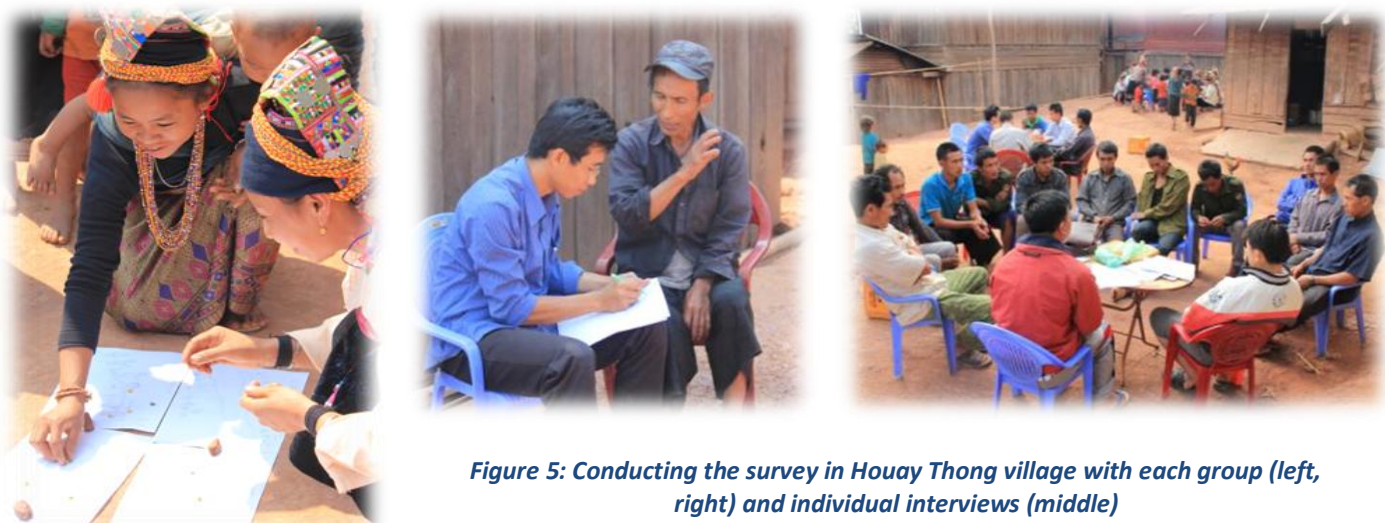


Figure 5: Conducting the survey in Houay Thong village with each group (left, right) and individual interviews (middle)

Two non-Project villages, Houay Thong and Houay Vang Kao, were included to give a contrasting perspective from outside the project's influence. Three survey forms were used (see Appendix 4):

- (1) Village leaders' focus group form inquired about current land use, innovations related to agroforestry, barriers to adoption, and a poverty analysis (Figure 5);
- (2) Men's and women's focus group form inquired about the factors that affect adoption of agroforestry, including voting on these factors (Figure 5);
- (3) Key informant forms were used to gather stories or case studies from individuals in each village who are already conducting agroforestry (Figure 6).

Table 1: Summary of those interviewed in the target villages¹

Village name (code)	Ethnic group	Total population in 2012 (% female)	Total number of households		Total number of adults interviewed (% female)	Total adults in village (% female)	% adults interviewed
			2012	2014			
Houay Thong (HOT)	Akha	-	-	57	27 (37%)	300	9%
Sao Yae (SOY)	Akha	258 (53%)	44	46	23 (17%)	157 (51%)	15%
Phia Lor Kao (PLK)	Akha	470 (50%)	66	72	18 (33%)	275 (52%)	7%
Moutern (MTN)	Akha	225 (49%)	39	35	19 (32%)	122 (49%)	16%
Houay Vang Kao (HVK)	Tai Dam	-	-	44	18 (44%)	215	8%
Sompoy (SOP)	Lao Saeng	176 (45%)	30	29	22 (18%)	91 (48%)	24%
Nong Hiew (NHW)	Lao Saeng	186 (45%)	30	30	32 (41%)	106 (45%)	31%
Saluang (SLG)	Tai Dam	166 (46%)	25	34	35 (43%)	99 (46%)	35%
TOTAL / Average					194 (33%)	1,365 (48%)	18%

¹ Data from 2012 was collected in the End of Project Evaluation (Kelly 2012)

3.2 Stakeholder's workshop

After returning from the survey, each team prepared summary statements for each village. These initial findings were presented to a stakeholder's workshop in Mai District on 30 April 2014. Participants included the full survey team with leaders and representatives were invited from the District and Province (Appendix 5). Discussions were held to consider these findings and to suggest ways to improve the adoption of agroforestry systems by farmers in the region.



Figure 6: Visiting an agroforestry garden in HOT village

3.3 Limitations

As expected when conducting action research of this nature, various limitations during the process were encountered by the team. These include:

- *Limited time for training.* A full day of training was conducted with the survey team, longer than initially planned. This was largely due to a number of translation errors that created confusion for the team. Although the errors were addressed during the training, some questions may still have been misinterpreted when in the village. Fortunately, a number of experienced members were on each team to help share their experiences.
- *Short turn-around.* The team had a short timeframe between gathering data and presenting the findings. This may have restricted the time needed to reflect and draw together themes.
- *Large amounts of mostly qualitative data.* Despite limiting the size of the survey, a large amount of data was generated. Qualitative data, in particular, can be hard to summarise and synthesise.
- *Villagers' availability.* During these village visits, households were often busy preparing their rice fields. Evening and early morning were the best times to meet households and groups. In some villages, the individuals with agroforestry experience were unavailable, and the percentage of interviewed adults were lower than hoped.

Despite these challenges, the reported findings and synthesis are relevant, significant, accurate, and are a fair representation of the current situation. Any errors in this report remain the responsibility of the team leader.

4. RESULTS AND KEY FINDINGS

4.1 Crop rotation

In the target area, every household interviewed – except in HOT village – conducts upland farming using a form of shifting cultivation on sloping land. The individual land parcels varied from as small as 1 rai (1,600 m²) up to 2 ha (PLK village). The most common area for upland cultivation was 1 ha.

Cultivation follows a pattern of rotational shifting cultivation. After one season of cropping, almost always with upland rice, the field is abandoned and left fallow to allow the forest to regenerate. Farmers

reported that they allow this secondary forest to regrow for at least three years up to seven years before they begin to clear the area for cropping once again (Table 2, Figure 7).

In the village nearest to the District (HVK), villagers mentioned that the government came to tell them “to stop fighting the forest” and to enforce the forest allocation regulation. As evident in Luang Nam Tha (Thanichanon et al 2013), government policies are more rigorously enforced in areas nearer to the District.

At this point in time, villagers believe this fallow period is sufficiently long; however, many talked of having to walk farther to locate land. In MTN, one family shifted away due to a lack of land which reflects a too-short fallow period.

Farmers indicated that they clear virtually all trees on these slopes using a combination of cutting, felling and burning. We witnessed a fire that was lit in the valley, and within 30 mins, the fire had raced to the hill top. The fires are generally fast-moving and will not always kill the larger stumps remaining in the fields. Expertise is needed to coordinate the burn and prevent the fire from encroaching on nearby villages.

4.2 Fallow management

We also asked villagers if they practiced active management of their fallow areas to see if innovative practices are already taking place to accelerate or to intensify the fallow period.

Table 2: Age of fallow vegetation at the time of clearing, according to village leaders

Village	Age of fallow (years)	Age of fallow (years) ¹	Indications that the fallow is sufficiently long
HOT	7	--	<ul style="list-style-type: none"> Ground is ‘good’ Rice is beautiful; yields are poor if fallow is <7 years No weeds in the rice field or weeds don’t regrow as quickly and less labour is needed
SOY	7 (many 8-9)	6.8	<ul style="list-style-type: none"> Some wait 20 years
PLK	6-7 (many 8-10)	7.3	<ul style="list-style-type: none"> The ground recovers fertility fully Can’t see any rocks / stones
MTN	5	5.6	<ul style="list-style-type: none"> Lots of weeds / trees are growing
HVK	5	--	<ul style="list-style-type: none"> <i>No mention</i>
SOP	5 (vary 3-10)	6.1	<ul style="list-style-type: none"> <i>No mention</i>
NHW	4 (vary 3-6)	7.0	<ul style="list-style-type: none"> 3 years isn’t enough time Fallow area has a lot of growth with trees growing closely together allowing it to burn well When see <i>mai hok</i>, ground is ready for clearing again
SLG	3	3.7	<ul style="list-style-type: none"> Soil is fresh / good again

¹ Age of fallow was determined by household sampling at the End-of-Project evaluation (Kelly 2012)



Figure 7: Clearing of secondary forest near HOT village at the plot level (left) and the landscape level (right)

We found three types of perennial plants preserved in the fallow:

- (1) Akha women in three villages (SOY, PLK, MTN) described a tree called *Bor sheu* that villagers are forbidden to cut down; they say a person lives inside the tree, and “a curse will fall on the mother of the farmer if the tree is cut down”. The tree provides timber when it falls over naturally. It was unclear whether this tree provided additional fallow benefits.
- (2) One Tai Dam women in SLG village had left two types of trees (*mai an*, *mai haa*) in one of her upland fields for shade purposes. There may have been some fallow benefits as she was going to plant into the same field for a second consecutive year.
- (3) In NHW village, village leaders mentioned a kind of bamboo called *mai hok*. This short-lived bamboo re-grows in progressively larger stands such that when big stands are observed emerging from the fallow secondary forest, villagers know the area is ready for cultivation. Crops growing near former *mai hok* areas tend to do well suggesting a positive fallow effect.

None of the groups interviewed had heard of anyone introducing outside plants, such as leucaena or pigeon pea, for the purpose of accelerating the fallow.

4.3 Current agroforestry practice and adoption process

Every village has at least one household conducting agroforestry (Table 3). The plots described to the survey team were mostly close by or adjacent to the villages, or to irrigated rice fields. (Many fruit trees, but not planted as an agroforestry plot, were inside the village compound.) The closeness to the village may be related to convenience: to make it easier to utilise household labour in short bursts for the tasks of caring for the garden, collecting fruit, to do fencing, or to watch out for thieves. There was no mention of how to protect an agroforestry plot from the April fires, although presumably plots nearer the village will be more protected.

The most diverse plot was observed in HVK and nearly all households in HVK have an agroforestry plot. Farmers began to plant their plots as long ago as 1997 (SLG) but five villages (SOY, PLK, MTN, NHW, SLG) only began planting this way less than five years with Project assistance.

A number of forest-based agroforestry systems were present in the target area. In these cases, farmers planted whatever material they had (or were given). Consideration of an agroforestry system design

that had optimal combinations of plants, such as that suggested by Armitage (2004), was not evident; attention was given more to raising seedlings, field spacing and shade than how to integrate combinations of plants. Agroforestry systems in the target area included (Figure 8, Table 3):

- (1) Coffee-based = HOT, PLK, MTN (the latter two villages were Project-initiated)
- (2) Cardamom-based = HOT, HVK, SOP, NHW, SLG (the latter three villages were Project-initiated)
- (3) Fruit tree-based = SOY, SLG (Project-initiated)
- (4) Teak-based = HVK

The women's groups of non-Akha villages reported taking plants from the secondary forest or fallow to plant into their permanent gardens. In SLG, several people took forest galangal, *ketsana*, wild guava and wild lime. In NHW village, one woman collected galangal and wild mango from the forest to plant in her garden near the village. In SOP and HVK, villagers collected forest galangal. Villagers in HVK also mentioned collecting wild lychee, wild rambutan, wild mulberry, and wild citrus (orange, lime).

Respondents in Akha villages knew of wild types of useful species in their forests which were allowed to regrow in their forest-based agroforestry garden or which were transplanted from the forest into their garden: *mak khai* (egg fruit) / wild mango / jackfruit (HOT), wild persimmon (SOY, PLK), *mak va* (edible fruit / leaves; SOY, MTN), *mak khai* (MTN), broom grass (MTN), bamboo (MTN), and rattan (MTN).

More NTFPs are collected from the forests by villagers, but this list is specifically those NTFPs collected for the purpose of transplanting. Wild types of cultivated fruits collected from the forest, as mentioned in several villages (e.g. lime, mango, jackfruit), are unlikely to be indigenous (J. Foppes, personal communication).

In SOY and MTN, the Project is currently supporting the grafting of improved varieties of persimmon onto the wild root stock. The advantages of this approach are: (1) fruit may be produced in 2-3 years, more rapidly than if the improved variety was planted directly into the ground; (2) the type of fruit is what the market wants and may be sold easily.



Figure 8: Agroforestry systems in the target area: coffee (PLK, top-left) and cardamom (HOT, right; HVK, above)

Table 3: Existing practices of agroforestry in the target area according to village leaders

Village	#HH	% total HH	Examples of the types of agroforestry plots observed during a transect walk in model garden	Area / distance to village	Year first planted
HOT	2	4%	Mr Do Sa: Cardamom-based plus banana, fruit trees (mango, persimmon, orange, mandarin, peach, guava), cassava, sugarcane, pineapple, papaya, <i>ketsana</i> , rattan, edible ferns, bamboo, <i>mai khai</i> , taro	~2 ha / 1 km	2001
SOY	3	6%	Mr Heu Lou: Fruit tree-based (grafted persimmon, orange, mango, jackfruit, lam nyai, guava), cardamom, <i>mak va</i> , tamarind, rattan, sugar palm	0.2 ha / 300m	2012
PLK	4	6%	Mr Cheu Nae: Coffee-based plus cardamom, eggplant, orange, grafted persimmon Mr Lou Theu: coffee-based plus cardamom, grafted persimmon, upland rice	0.8 ha / 300m	2012
MTN	1	3%	Mr Ali: Coffee-based plus rattan, fruit trees (mango, lam nyai, guava, orange, lychee, longan), bamboo, <i>mak va</i> , <i>ketsana</i> , broom grass	1.5 ha / 400m	2013
HVK	40	91%	Mr Nyot: Cardamom/teak-based plus fruit trees (mango, guava, jackfruit, lychee, orange, lime, lam nyai), papaya, pineapple, sugarcane, wild mulberry, forest galangal, tamarind, coconut, ginger, banana, lemon grass, timber trees (<i>mai dou</i> , <i>ketsana</i>), arrowroot, bamboo, <i>mak tai</i> , <i>mak taem</i> , <i>ton varn</i>	1 ha / 750m	2009
SOP	5	17%	Ms Sip: Cardamom-based plus sugarcane, cassava, forest galangal, fruit trees (mango, jackfruit, guava), tamarind, <i>nang niew</i>	2 ha / 500m	2003
			Ms Mone: cardamom-based plus sugarcane, banana, forest galangal, pineapple	<i>Not mentioned</i>	2011
NHW	6	20%	Ms Kham: Cardamom-based plus fruit trees (lychee, mango, jackfruit, <i>mak khai</i> , orange, wild mango), banana, papaya, coconut, chilli, forest galangal, leucaena, <i>mak katan</i> , teak [has several gardens]	1 ha total / 100-300m	2011
SLG	6	18%	Ms Ping: multiple crops such as taro, arrowroot, sweet potato (red, white), bananas, fruit trees (jackfruit, lychee, mango, lime, pomelo, orange, <i>lam nyai</i>), timber (<i>ketsana</i> , <i>sikor</i> tree), cardamom, ginger, forest galangal, <i>mak phab</i> , <i>mak khai</i> , <i>mak taen</i> , coconut	0.5 ha / 100m	2013

4.4 Adoption process

ADOPTION BY “INNOVATORS”

Key questions to those already practicing agroforestry were: why they are doing it, and what caused them to begin (Table 4). In general, overall results showed that men were more strongly motivated by the opportunity to raise their household income; women were generally more strongly motivated by the opportunity to provide something for their children particularly food (and a balanced diet) for their families. Both sets had a strong consideration of the future (see underlining).

Table 4: Motivating factors suggested by agroforestry practitioners in target villages

Village	Practitioners in men's group	Practitioners in women's group
HOT	<ul style="list-style-type: none"> • Products for food • Products for a cash crop 	<ul style="list-style-type: none"> • For food for the family
SOY	<ul style="list-style-type: none"> • <i>No mention</i> 	<ul style="list-style-type: none"> • For food for the family
PLK	<ul style="list-style-type: none"> • Can get a good income <u>in the future</u> 	<ul style="list-style-type: none"> • For food for the family <u>into the future</u>
MTN	<ul style="list-style-type: none"> • Don't lose labour [i.e. convenient to do] • Can get a good result <u>for years to come</u> 	<ul style="list-style-type: none"> • For income
HVK	<ul style="list-style-type: none"> • Can get income • Household consumption, e.g. teak can be used to build your house • Plant by themselves to secure <u>a future</u> seed source 	<ul style="list-style-type: none"> • For income
SOP	<ul style="list-style-type: none"> • For family food <u>into the future</u> • To sell for income 	<ul style="list-style-type: none"> • For food for the kids / family <u>in the future</u>
NHW	<ul style="list-style-type: none"> • For eating fruit • For selling excess 	<ul style="list-style-type: none"> • Can get benefits [food] • Reduced labour requirement
SLG	<ul style="list-style-type: none"> • Want to receive lots of goods after selling these agroforestry products • Plant for family consumption • Have a desire to be a model family • Moving to a new area takes a lot of time and labour → convenient to plant in one plot 	<ul style="list-style-type: none"> • For food / consumption • For <u>future</u> income

BARRIERS TO ADOPTION

A further research question was to understand, despite adoption already evident in each village, why other households had not yet adopted. In each group, we asked those who have not yet planted perennial crops, “What stops you from going ahead?” and “What could be done to help you adopt?”

In most villages, the focus groups were able to put forward views and opinions. However, responses were detailed, variable and required much discussion (Figure 9). This reflects the complexities of decision-making in relation to innovations where results take time to appear. However, around 40% of households (excluding HVK village) were still interested to adopt (Table 5).

The women's groups noted the following four major barriers and suggestions:

- (1) A lack of knowledge (HOT, SOY, PLK, MTN, NHW, SLG): comments such as “I have never tried this before”, “we don't know how to do it”, “we need to ask field staff how to plant”. They suggested addressing this by asking others or seeing the experience of others in the village, visiting other sites, seeing results, or asking field staff.
- (2) A lack of desire or motivation (SOP, NHW, SLG): comments included “it's too hard to do”, “my husband [an opium addict] doesn't let me start”, “if they really wanted to [adopt], they could”. They suggested addressing this by seeing the results from a garden. For those who lack desire due to inability to access land, their husbands needed to be helped to secure land with the village.
- (3) A lack of seedlings (SLG): “we just lack seedlings”. This could be addressed by field staff providing or offering on a credit basis.



Figure 9: Opium addict, MTN village

Table 5: Number of households in each village conducting agroforestry, expressing interest, or not yet interested in conducting agroforestry

Village	Number HH conducting agroforestry	Number HH interested to do agroforestry	Number HH remaining (i.e. not yet interested)
HOT	2 (4%)	5 (9%)	51 (89%)
SOY	3 (6%)	25 (54%)	18 (39%)
PLK	4 (6%)	Many	Unclear
MTN	1 (3%)	16 (46%)	18 (51%)
HVK	40 (91%)	4 (9%)	0 (0)
SOP	5 (18%)	8 (3%)	16 (79%)
NHW	6 (20%)	13 (43%)	11 (37%)
SLG	6 (18%)	34 (82%)	0 (0)
Average	8 (21%)	15 (35%)	16 (42%)
Average (excl.HVK)	4 (11%)	17 (40%)	19 (49%)

- (4) A lack of market / buyers (MTN, HVK): comments included “we don’t want to plant if we don’t have any buyers”, “we need to plant what the market wants”. This could be addressed by giving more marketing information, by introducing buyers to the village who can explain what they will buy, or by forming a group to work together.

For the men, they described a similar number of major barriers that prevent adoption:

- (1) A lack of awareness / experience / knowledge (HOT, SOY, PLK, HVK, SOP, NHW, SLG): a “we don’t know” comment may simply be due to the fact that none in that group are practicing agroforestry, but other comments included “we don’t yet know how to plant in this way”, “we plant naturally and don’t know another way”, “since we didn’t know how to do, the seedlings all died”, “we want to know how to plant and the way to take care”. They suggested addressing this by visiting other sites, or by Project or government extension staff providing technical assistance on how to plant, how to propagate, and how to care for perennial crops / trees.
- (2) A lack of results (MTN, HVK, SOP, NHW): “we don’t yet see the results because the garden has been planted for just one year”, “all the cinnamon trees died”, “we don’t know what to do to get more fruit”. They suggested asking Project staff or seeing other productive gardens in nearby villages. (The men’s discussion in HVK focused on a lack of results from the long-term teak-based agroforestry system.)
- (3) A lack of planting material (MTN): “not yet enough seed”.
- (4) A lack of market awareness or confidence (MTN, HVK): “not sure about marketing”, “despite having [trees] planted already, we can’t get a good price or no-one comes to buy” (e.g. arrowroot). They suggested solving this by asking neighbours or specialists from the District to advise and help.

Leaders were also asked why others in the village don’t yet use the agroforestry system, and their responses were:

- Lack of desire (SOY), lazy / addictions (NHW): “no-one motivated to do” (this obstacle may reflect how hard it is to compete with the income earned from growing opium)
- Lack of seed / planting material (SOY) or not enough seed (HOT, HVK)
- Lack of knowledge (HOT, SOP): “we need know-how and advice on how to do”

- Lack of funds (HOT, SOP): “money is too hot [money is used for many things] and is lacking for buying seeds”, “we cannot buy planting material”
- Insufficient equipment (HOT)
- Lack of experience, “we have never done this before”; lack of confidence (PLK)
- They want to first see direct value flowing to the family (PLK), need to see useful results first (MTN)
- Insufficient labour (HVK, SOP, NHW)
- Fear of theft (NHW)

RANKING OF ADOPTION FACTORS

A similar question was again posed to each men’s and women’s group. Members were asked to vote for which factors, prompted using visual aids, were most necessary for agroforestry to be adopted in their village.

The top-three results from each group were then identified and averaged. The results (Figure 10, Figure 11) were slightly different to those qualitative responses indicated above.

For women, securing seed or planting material was the most significant factor that would assist adoption of agroforestry. Having sufficient land was almost as important as was having enough labour within the household. Three villages (SOP, NHW, SLG) mentioned that having the desire, or motivation, to do agroforestry was most important.

For men, having the right equipment was the most important factor with the highest average score but also the highest deviation; only a few groups mentioned it but those that did scored it highly. Other factors, such as having enough labour, having enough seed, having enough land and having road access, also scored highly.

No particular factor seemed to be singularly important. This reflects the complexity of factors that influence behaviour and decision-making associated with perennial crops.

Adoption is the process taken by individuals, households or communities that leads them from a previous practice or behaviour to a new and potentially improved approach. The rate of adoption varies according to many factors, such as the extent of any improvement, the opportunity for non-adopters to see the differences for themselves, and the period it takes for improvements to be evident. This survey found that every target village has a small group of innovators conducting agroforestry, some now experimenting and testing out new approaches (see Box 2).

These innovators had various reasons for wanting to try out this new approach, but overall, they had a lower risk threshold than others in the village. A large group of “interested” households appear to be waiting to see the results from this testing. It would be important for the Project to facilitate exchange of this information between the innovators and the interested group, particularly in terms of production outcomes.

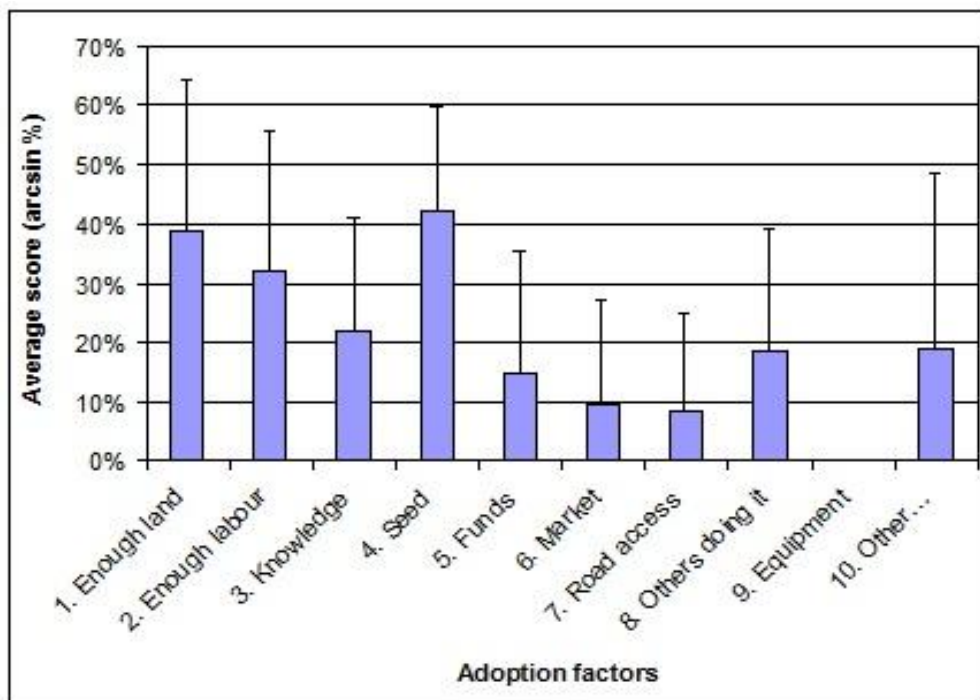


Figure 10: Adoption factors as voted by women groups

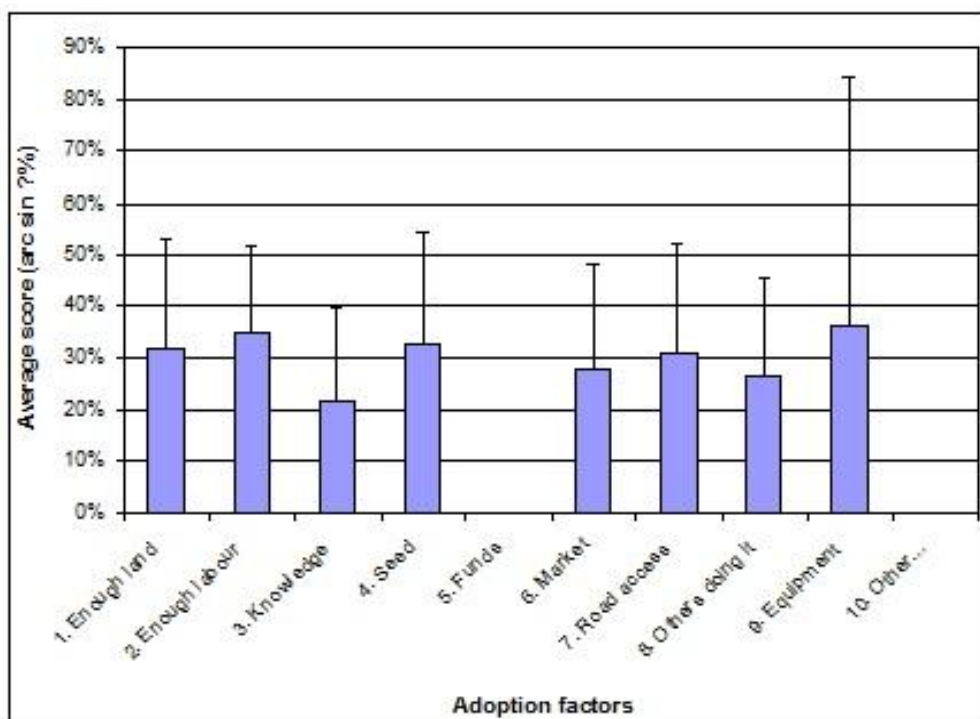


Figure 11: Adoption factors as voted by men groups

Box 2: Examples of on-farm testing of agroforestry systems

- Ms Sa Seu (MTN) said she wanted to see for herself how coffee grew under shade, a new idea for her. She planted coffee into one area with shade and one area with no shade. She said, “The plants in the shade did better, the plants in the sun weren’t beautiful.” She thought this was because weed control in the shade was better. In the future, she will plant this way.
- Mr Cheu Neu (PLK) realised that he lacked the labour to raise and transplant coffee seedlings. Instead, he decided to direct-seed his coffee seeds into his agroforestry garden, a steeply-sloped ex-opium garden near the village. He sowed two seeds per hole in October, towards the end of the wet season. After 10 months, the survival rate is >90%, so he plans to thin out his plants in the upcoming wet season.
- Mr Lou Theu (PLK, below right) wanted to see if he could plant coffee seedlings into both a forested site (below left) and a cleared upland rice field (below middle). After a year, the coffee grown in the open appears less healthy and strong although he was able to harvest rice. There are costs and benefits of each approach.



POVERTY AS A BARRIER TO ADOPTION

One key question was whether poverty was preventing adoption of agroforestry. This question was put to those in the leader’s groups. A number of comments were provided that suggest poverty can reduce the adoption of agroforestry:

- A more important issue for poor families is the lack of labour (HOT, SOP)
- “No, poverty isn’t the problem...it’s more due to a lack of knowledge / lack of motivation” (SOY)
- The three most-interested households are all middle-income households; “the richer and middle-income families would be more inclined to do”, “poverty is a problem if you have to pay for seeds” (MTN) (Box 3)
- “Unsure”, more important for households to see outcomes and results (PLK)

Box 3: Hot-and-cold adoption

In MTN village, a group of 20 families signed up to plant coffee into their upland gardens in 2013 – but a month before the activity was due to begin, all but one family pulled out. No real reason was given apart from the fact that they changed their minds.

However, all of these families have signed up in 2014 and were raising seedlings at the time of the survey. Perhaps they needed to see the field results of the one innovative family before committing their limited labour and land.

Collective behaviour is a village value that can be tapped into when encouraging villagers to adopt a new technique.

- Most of the village has planted this way already; issue now is not enough seed (to expand or to start new) (HVK)
- All of the interested families are the middle / richer households, around half of the poorer households are addicts and “aren’t interested” (NHW)
- Those with only a little land planted to agroforestry are unlikely to see results (SLG)

Poverty is clearly an issue when it impacts on land, labour and availability of planting material – and a large number of “poor” households (65%) exist in the target area (Table 6). However, no clear correlation was evident between the per capita income and adoption rate (data not shown).

Table 6: Relative poverty ranking of households (HH) in the target villages by the leaders’ groups

Village	# very poor HH	# poor HH	% of poor or very poor HH	# medium HH	# rich HH	Total HH	Average per capita income pa (EOP 2012)
HOT	13	26	68%	18	0	57	-
SOY	0	40	87%	6	0	46	206,000 Kip
PLK	17	43	83%	12	0	72	281,000 Kip
MTN	8	14	63%	13	0	35	372,000 Kip
HVK	0	10	23%	30	4	44	-
SOP	12	11	79%	6	0	29	280,000 Kip
NHW	0	21	70%	6	3	30	575,000 Kip
SLG	5	11	47%	18	0	34	248,000 Kip

EXTENSION PROCESS AND ROLE EXPECTATIONS

All groups were asked about their aspirations, and how might the various stakeholders assist in the adoption of agroforestry systems. (See **Error! Reference source not found.** for an example of a mature agroforestry plot.)

These stakeholders were identified as the village leadership, the wider village community, the Project staff, and government bodies (Table 7). Role expectations were clear, even between villages. The roles which each stakeholder could play in adoption of agroforestry were strongly held views.

CLUSTERING OF ADOPTION FACTORS

One way to approach extension is to look for similarities between villages and tailor an extension strategy according to their profile. The major clusters based on current practice and interest, were:

- (1) A few HH doing it now (<10%), little interest (<10%) = HOT
- (2) A few HH doing it now (<10%), a lot of interest (>10%) = MTN, PLK, SOY
- (3) Some HH doing it (10-30%), little interest (<10%) = SOP
- (4) Some HH doing it (10-30%), a lot of interest (>10%) = SLG, NHW
- (5) A majority of HH doing it (50-100%) = HVK

Table 7: Suggestions from leaders' groups on how to encourage further adoption of agroforestry

Village	Leaders	Community	Project	Government
HOT	<ul style="list-style-type: none"> • Help push • Help identify candidate products 	<ul style="list-style-type: none"> • Ideas • Labour 	<ul style="list-style-type: none"> • Seed • Materials • Know-how 	<ul style="list-style-type: none"> • Plan • Inspect •
SOY	<ul style="list-style-type: none"> • Train / motivate villagers 	<ul style="list-style-type: none"> • Be active • Listen to project 	<ul style="list-style-type: none"> • Provide seed 	<ul style="list-style-type: none"> • Help train
PLK	<ul style="list-style-type: none"> • Push HH to participate 	<ul style="list-style-type: none"> • Labour to plant crops 	<ul style="list-style-type: none"> • Seed 	<ul style="list-style-type: none"> • Push along
MTN	<ul style="list-style-type: none"> • Help train (many times) 	<ul style="list-style-type: none"> • Put into practice 	<ul style="list-style-type: none"> • Seed 	<ul style="list-style-type: none"> • Show them how to do
HVK	<ul style="list-style-type: none"> • Training • Study tour 	<ul style="list-style-type: none"> • Put into practice 	<ul style="list-style-type: none"> • Seed • Training 	<ul style="list-style-type: none"> • Monitor • Help with policy
SLG	<ul style="list-style-type: none"> • Motivate • Model 	<ul style="list-style-type: none"> • Commit to putting into practice 	<ul style="list-style-type: none"> • Help with funds • Seed 	<ul style="list-style-type: none"> • Knowledge, know-how • Find markets
NHW	<ul style="list-style-type: none"> • Encourage • Follow-up with advice 	<ul style="list-style-type: none"> • <i>No mention</i> 	<ul style="list-style-type: none"> • Seeds • Funds 	<ul style="list-style-type: none"> • Training on techniques
SOP	<ul style="list-style-type: none"> • Promote, push 	<ul style="list-style-type: none"> • Provide labour • Must really do 	<ul style="list-style-type: none"> • Seeds • Know-how 	<ul style="list-style-type: none"> • Issue of market • Help with know-how

The extension strategy needs to vary for each cluster. In HOT, extension needs to raise interest and demonstrate the benefits of agroforestry. Cross-village visits may help facilitate this change in mindset. In MTN, PLK and SOY, an extension strategy needs to try and convert the high interest into adoption through, for instance, the provision of seedlings or by village leaders working to push each family to test a small area. In SOP, further work is needed to address the mindset and why interest is low. This may be related to a high mortality of cinnamon trees in the village.

ENCOURAGING ADOPTION

The slow growth rate and lack of early results can reduce interest and adoption of agroforestry. We asked the village leaders what they believed would encourage adoption of agroforestry. Their suggestions helped indicate why adoption is slow (Figure 12):

- Set up a demonstration plot (or a model) so that others can see what's happening and they can follow the progress / results (SOY), progress is measured by food that may be consumed and by products that may be sold (NHW)
- Change attitude: "You [i.e. the villagers] will need to use a little bit of labour to implement" (SOY), "need to do little by little" (NHW), look ahead more than two years (SLG)
- Showing others that there is a good income – and "you can really get an income" (PLK); need to talk about income potential (NHW)
- Need the leaders to promote and 'push' (or urge) the villagers to improve their lives (PLK leaders) and to really do it (SLG)
- There is nothing yet causing the villagers to try and plant this way (MTN)

Box 4: Story of Mr Phiang

Mr Phiang and his family began their agroforestry garden in 1997 near their village of Saluang, planting a total of 0.5 ha in two areas.

In 2011, they began using an integrated cropping approach, mixing annual crops (corn, pumpkin, eggplant, chilli, taro) with larger fruit trees, bananas, and forest products (galangal, cardamom).

Their range of fruit trees is diverse: jackfruit, lychee, mango, rambutan, guava, *mak khai*, *mak man*, *mak tam*, tamarind, *lamnyai*, Chinese plum, and others (Figure 13).

A 3 ha plot is planned for 2015, 20 km from the village – but near the road for easy access.

They expanded to provide for their future, food for their 3 kids, and income. Right now, they sell only a few bananas in the village.

Managing the gardens, usually just one person, is now their main occupation – though they do put time into their upland and lowland rice fields.

Mr Phiang would like to know more about techniques to improve and expand their fruit production, such as grafting. An access road to market, seeds or planting material, and help with technique are most important.



Figure 13: Mature agroforestry garden of Mr Phiang (Photo: Sarah Whittaker)

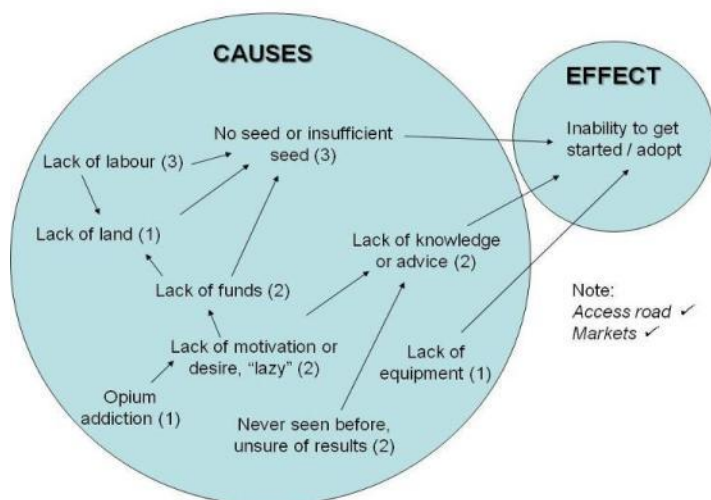


Figure 12: Factors that affect adoption of agroforestry, according to village leader's groups

- If we have planting material / seed, we will do (HVK)
- Government promotion (i.e. identification of which economic activities they should do) (SOP, NHW)

INFORMATION FLOWS

The adoption of new ideas is partly related to how new information flows into a community. During the field survey, a number of information entry-ways were identified (see Figure 14 for women's responses):

- *From previous generations.* Women's groups referred to their "grandparents" or the elders in a village providing useful information and advice on how to plant perennial crops / trees. Indigenous knowledge is obviously passed on in this way (see Box 4).
- *From innovators in the village.* Observations and conversations with innovators in the village provided new information for others.
- *From neighbouring villages.* Several groups described visiting neighbours, friends or relatives in nearby villages to see agroforestry approaches in action. For example, the MTN and SOY groups have visited the coffee gardens in PLK.
- *From distant villages.* A number of innovators had visited Chiang Mai, Thailand, on a Project study tour. This was instrumental in helping them to put the new ideas into practice, and to catch the vision of a diverse and productive agroforestry system.

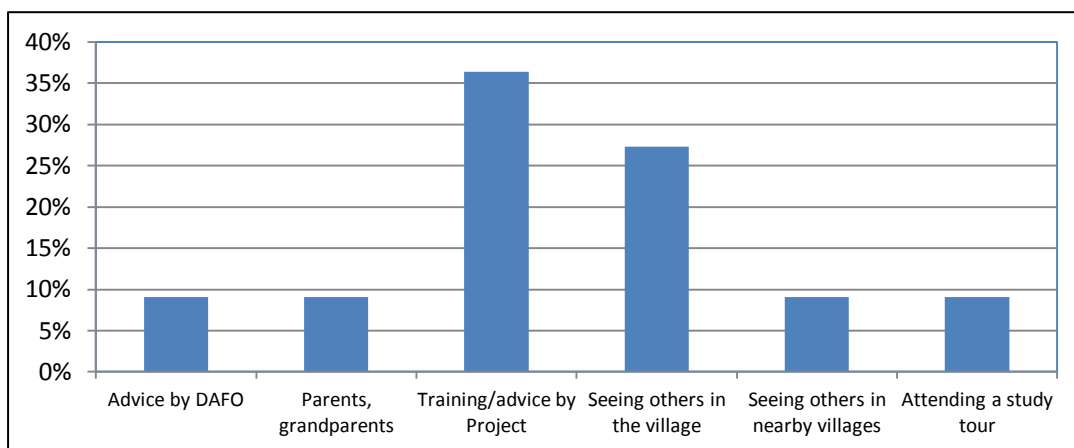


Figure 14: Percentage of women groups that receive information from these sources

- *From visitors to the village.* Project staff, government staff, and representatives from commercial companies are all visiting the target villages. Information about agroforestry may be provided formally, such as by the Project, or informally, such as hearing of a market opportunity.

4.5 Cross-cutting themes

A number of cross-cutting themes were discussed by the survey team following the village consultations. These were participation, gender, environment, and food security.

PARTICIPATION

Collective action, either formal or informal, was not often found among those conducting agroforestry. In part, this may be due to the early state of adoption in the area. Many households have taken a wait-and-see approach. Groups for raising seedlings (see **Error! Reference source not found.**) have been formed by the Project but few other activities are group-based.

Even in HVK where agroforestry is most advanced, a formal cooperative has not yet begun; however, respondents appeared to be sharing planting material and ideas, and acting ‘collectively’.

Potentially this could change. Two Akha villages (MTN, SOY) have groups that received training in June 2014, and who may work together to plant and care for cardamom gardens. In SOY, 25 HH have formed into three groups, and people are saying, “I should join the group or I might miss out”. This positive peer pressure will play an important role in encouraging less motivated HH to join in. The influence of a village elder, such as in MTN, appears to have encouraged group participation; a group of 16 HH has begun to plant coffee seedlings.

Despite this, older persons may choose to opt out. Others, such as those without adequate land or labour (such as single-parent families), may still miss out. The Project may need to consider actions that can draw in the poor, such as food-for-work schemes or negotiating with village leaders for access to small plots near to the village. Dealing with addicts will continue to be challenging.

In summary, group activities will strengthen the ability for group members to learn and to reflect on their actions. By facilitating group formation around the common theme of agroforestry, it is likely that

village mobilisation and adoption will occur faster than if individuals do the activities just by themselves. However, it is important that the Project helps group members to work together, to learn together, and to reflect on what they have learned (Box 5). Seed swaps might be one way to foster interaction between members or between villages.

GENDER

Women were only moderately represented in the group meetings; between 17 and 44% of those interviewed in each village were female. Discussions took place in the ethnic language for Akha villages, highlighting the challenge of how to present new ideas.

Women indicated that they are actively involved in the decision-making of their gardens. For example, the women's group in HOT indicated that both genders decide on what to plant; both collect seeds. Women do the bulk of the weeding; both genders are involved in collecting harvest. Men take the products to market, if that is required. In HVK where traders arrive from the District most days, it is the women who are more involved than men in trading activities.

Women appear more likely to benefit from an agroforestry initiative. This is due to two major reasons: firstly, a productive and diverse garden will provide more food for the family. Secondly, the convenience of collecting both food and saleable items (fodder, timber) from the same location could free up time for other important household duties.

The team observed that it is the women who are often pushing the men to conduct agroforestry. In MTN, women are beginning to become more involved than the men in the coffee nursery.

In summary, the Project has much to gain by encouraging women to be actively involved in planning and initiating agroforestry plots. Despite the challenges of literacy, women are more likely to see the benefits of growing an integrated and diverse garden than men.

ENVIRONMENT

Agroforestry has much to contribute towards ecosystem services and stabilising the environment. In HVK, villagers told us that agroforestry can: (1) restore the health and productivity of the soil; (2) provide mulch to the soil; (3) help control the water cycle including preventing flash flooding, maintaining flow to their fish ponds and their rice paddies. They have linked agroforestry systems with improvements in the ecosystem and with food sustainability.

Groups also described the diversity of species found within their agroforestry plots. More mature plots had fewer than 10 (PLK, SOP) to over 20 (HVK) types of trees, semi-annual crops, and vegetables. The Project should continue to show that agroforestry is based on diversity.

Box 5: Best-practice coffee-growing

Coffee seeds may be hand-sown into a clean raised nursery bed made of finely tilled surface soil. Cover the seeds with a mix of fine soil and mulch. Provide water at regular intervals – but don't saturate. Seeds should begin to germinate within 10 to 14 days.



Two or three months old seedlings may be carefully dug up and separated out with their root system intact. These may be transplanted into holes dug into the garden. Fill each hole with mulch about a week before transplanting.

Provide water for the young seedlings during the first six months.

For best results and optimal strike, sow seeds in February or March then transplant seedlings in May or June.



(Drawn from interviews with practitioners in HOT, PLK and MTN villages.)

In a coffee-based agroforestry plot, while coffee is the majority plant, a range of other useful non-coffee plants should be present to maximise the available space.

One obvious issue with agroforestry is whether this land management practice can be conducted alongside the current practice of fire-based rotational cultivation. The Project will need to discuss if fire is a consideration in placement of these plots.

Lack of land was not considered a major issue but it was referred to. This may relate to the lack of long-term tenure on upland sites and the lack of incentive to then invest in tree-based farming systems. A lack of land may also refer to the lack of land convenient to or near the village (SOP, SLG and NHW villages). Very few upland fields far from the village are considered as agroforestry plots.

Respondents had not heard of the concept of accelerated fallow period. However, indicator species are known, such as the *mai hok* bamboo (mentioned in NHW) that can show the forested plot has recovered following a fallow phase.

FOOD SECURITY

Can agroforestry improve the food security situation in the target area? A major reason why villagers wish to try agroforestry is evidently for food production. Fruit consumption, in particular, can balance the diet and improve the nutrition of young children. It would be important for the Project to ensure that trees being promoted for agroforestry are not just the non-edible, timber or plantation cash crops (e.g. rubber, coffee, tea or teak) but include a range of fruit trees, nut trees and other edible varieties.

In general, few had ever heard of integrated agriculture, where annual crops (such as rice or corn) may be planted alongside semi-annual or perennial crops (Figure 15). Some households were growing vegetables and tubers among their trees. Various approaches, such as hedgerows, alley cropping or relay cropping, could be useful for farmers combine annual crops with perennials.

Security of agroforestry plots was mentioned as a blocking factor due to stealing and animal intrusion. The concept of a “living fence” may be useful for the Project to extend to these villages, where a useful shrub or fast-growing tree is planted closely around the perimeter of a garden in order to deter pests and to provide a benefit to the garden or the farmer.



Figure 15: Coffee integrated with upland rice in PLK village

5. RECOMMENDATIONS

In summary, the following issues were observed among communities in the study area.

Defining agroforestry: The term “agroforestry” is not clearly understood by upland communities or by agricultural extension agents. Land is either allocated to agriculture or to forest protection or conservation, and so agroforestry remains misunderstood. Many existing agroforestry systems in the area are not highly productive.

Agroforestry systems can therefore include both traditional and modern land-use systems where trees are managed together with crops and/or animal production systems in agricultural settings (FAO 2013).

Due to the long-term investment needed to develop an agroforestry system, secure land or tree tenure is an essential factor.

Factors that favour adoption: Those farm families who have adopted agroforestry (an average of 11 percent per village, when excluding HVK) have done so because of several inter-related factors: (1) they are better linked to markets and traders by a road network; (2) they examined other agroforestry plots, exchanged with practitioners in the field, and they learned about the relative advantages of agroforestry over conventional systems; (3) they were provided with planting material (e.g. coffee, cardamom) and nursery facilities as a credit scheme (e.g. pay back after two years) or as a grant; (4) they received ongoing technical advice and support.

Factors that hinder adoption: A large group of households (40 percent on average in each village, excluding HVK) wish to adopt agroforestry to supplement their income and food production. Barriers to adoption include: (1) uncertainty about the benefits of agroforestry when compared with the conventional upland system; (2) planting material is insufficient to expand agroforestry plots; (3) uncertainty about market needs; (4) lack of technical knowledge, especially on how to maximise yields (Note: Slash-and-burn agriculture is based on the premise that shade is a constraint to high yields; thus, there is a hesitancy to cultivate annual crops alongside perennial trees.)

Selection of agroforestry candidate crops: Several perennial species are already being cultivated as the major cash crop in existing agroforestry systems, namely: cardamom, galangal, coffee, grafted persimmon, cinnamon, and teak.

Choosing candidate species for agroforestry should meet several criteria. These might include: (1) suitability to the environment and the ability to thrive in combination with other crops; (2) by-products are easily transported to markets; (3) demand from an existing market; and, (4) the crops are more profitable than cultivating upland rice.

Benefits to the community: Agroforestry is seen as a viable supplementary farming system that can support upland communities through the production of food and cash crops. Agroforestry would best be introduced as a means to stabilizing shifting cultivation over the medium- to long-term; it will not replace upland rotational systems – but will enhance it. Perennial crops are important elements of ‘climate-smart’ agricultural systems. Agroforestry can provide a buffer for communities to better cope with changing weather patterns, to sustain agricultural landscapes, and to diversify income from on-farm sources as a buffer against market shocks.

LESSONS LEARNED

From the farmers’ perspective, the survey team learned:

- (1) A few farmers are testing many kinds of agroforestry. But farmers are unsure how agroforestry might improve their livelihood. Extension agents also do not fully understand the concept of agroforestry, and are unaware of the benefits of an agroforestry system. There is no comprehensive policy space yet in place that promotes agroforestry, that provides security of land tenure, or that provides incentives to make this farming system attractive for adoption.
- (2) Emerging agroforestry systems require more rigorous evaluation to ensure that the combinations of annual and perennial crops are productive and profitable. These combinations should take into account the diversity of environments found within upland landscapes.
- (3) Farmers frequently lack sufficient planting materials or the capital to purchase planting material. This constraint prevents or slows the expansion of agroforestry.

- (4) Farmers lack technical knowledge. They need the support of knowledgeable and experienced agricultural extension agents as they develop their agroforestry systems, and seek to show the relative advantages of agroforestry over their conventional upland system.

POLICY RECOMMENDATIONS FOR FURTHER CONSIDERATION BY GOVERNMENT

- (1) The Ministry of Agriculture and Forestry should consider mainstreaming agroforestry farming systems in upland areas by applying the following measures:
 - a. Develop a comprehensive 10-year Agroforestry Master Plan that defines the concepts of agroforestry, sets out priorities, builds partnerships, sets investment targets, and seeks to build better markets for agroforestry products².
 - b. Improve coordination between concerned MAF agencies to determine the lead MAF agency for promoting agroforestry.
 - c. Direct NAFRI to build stronger research and development linkages with the World Agroforestry Centre to identify profitable and sustainable combinations of crops suitable for adoption by smallholders in the various upland environments of northern Laos.
- (2) The Ministry of Agriculture and Forestry should consider developing technical criteria to guide in the selection of suitable combinations of annual and perennial species as part of agroforestry farming systems.
- (3) The Ministry of Agriculture and Forestry should consider developing a micro-financing scheme for medium- and long-term credit in support of smallholder farmers interested to establish agroforestry farming systems in priority upland districts.
- (4) The Ministry of Agriculture and Forestry should consider assigning trained and experienced agroforestry extension technicians to priority upland districts, who are capable of promoting diverse agroforestry systems to smallholder upland farmers.

RECOMMENDATIONS FOR IMPLEMENTING PARTNERS

Several recommendations are made for consideration by the implementing partners to consolidate and scale-up agroforestry within the Project area.

The Project can promote adoption through various means:

- Continue to use a hands-on approach such as encouraging group formation, providing field visits and farmer-to-farmer (or peer-to-peer) field walks, encouraging group learning, and reflection. Results from mature agroforestry plots need to be compared with the conventional upland system so that farmers can make more informed decisions about adoption. Creative ways to share the message, such as radio snippets, MP4 videos, or sharing farmer interviews could help distribute core messages. Use fact sheets that explain concepts, and how to improve productivity in the field. Extension approaches may need tailoring from village to village based on their adoption / interest profile to address the barriers to adoption.

² See the 20 Feb 2014 media release by WAC on the Indian government's decision to adopt a National Agroforestry Policy: <http://worldagroforestry.org/newsroom/highlights/india-leads-way-agroforestry-policy>. The policy may be found here: <http://agricoop.nic.in/imagedefault/whatsnew/Agroforestry.pdf>.

- Consider up-skilling lead farmers with core competencies, who can train others in specialty skills. Competencies related to agroforestry might include nursery-raising of seedlings, grafting, pruning, avoiding disease, how to transplant forest cardamom, using accelerated fallow shrubs, selling fast-growing leguminous seedlings, or building a living fence. Competent practitioners could establish a village (or cluster) nursery as a small business.
- Work with District and Provincial partners to identify more productive combinations of perennial and annual crops. There are various ways to blend annuals with perennials, such as selective regrowth³, living fences, relay cropping, or hedgerows. The Project would benefit by visiting the WAC project in north-west Viet Nam to see novel combinations in the field (see Hoang et al 2013). A partnership between NAFRI and WAC would support the Project partners to identify productive agroforestry designs.

District and Provincial partners can also contribute to improved adoption in Mai District:

- Promote local agroforestry products and help to expand the local market for agroforestry products. When farmers produce a range of fruits, nuts or other cash crops, the risk of price fluctuations is reduced and farmers are better supported in the long-term.
- Consider broadening District nursery services, or encourage commercial nurseries, to include trees useful for agroforestry. These might include fallow accelerators (*leucaena*, *Glyricidia*,) and improved fruit varieties suitable for local environments.
- Work with MAF to consider how to support the land tenure needs of smallholder farmers who wish to invest in long-term mixed-farming systems such as agroforestry.

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³ Also known as FMNR (Farmer-Managed Natural Regeneration); see <http://fmnrhub.com.au>.

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7. LIST OF APPENDICES

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Figure 16: Electricity is now being installed at the Akha villages, further affecting the pace of development