Asia-Pacific Network for Sustainable Forest Management and Rehabilitation

Sustainable Forest Rehabilitation and Management for the Conservation of Trans-boundary Ecological Security in Montane Mainland Southeast Asia in Lao PDR

Thematic report on Sustainable Forest Rehabilitation and Management Plan for the project site in Laos

November, 2013

Participatory Agricultural and Forest rehabilitation management plan of Koum Houaykhot Cluster villages, Xiengngeun district, Luangprabang Province.

Introduction and rational

Agricultural and forest rehabilitation planning means consultation, planning, identification and mapping of agricultural and forest land uses within village management areas after boundaries have been agreed and mapped. This is an inter-active process in which all stakeholders (researchers, extension workers and farmers) both men and women participate.

Agricultural and forest rehabilitation planning defined are "future agricultural and forestry management planning" derived from existing or current land use areas identified on recent satellite image prints. The present land uses displayed on recent satellite images permits discussions to proceed directly to the identification of future Agricultural and forest rehabilitation planning process. . This approach requires less time than a whole process of agricultural and forestry planning.
The participatory agricultural and forest rehabilitation planning identified are those that villagers agree will be followed and managed in the five to ten years. Some degree of flexibility may be needed to accommodate changing to fit with the circumstances.

Agriculture and Forest rehabilitation planning is different from forest classification. Forest classification describes the type and composition of the forest or vegetation in a particular area. Forest and land use zoning indicates the uses and management practices that are appropriate in different agricultural land and forest areas.
Participatory agricultural and forest rehabilitation planning at village and village cluster levels is important for the following reasons:

- It enables villagers to participate in defining and understanding the future agricultural and forestry land of each land use type within the village management area and to prepare land and forest management rules, agreements or plans
- Villagers can be encouraged to limit future agricultural activity to the forest land that are delineated.
- Villagers have the opportunity to consider if there are lands within their village that should be rehabilitated and used for agricultural and forestry purposes.
- The boundaries of the forest zones for management and use are clearly understood by villagers prior to use these land.
- Agricultural and forest rehabilitation planning provides a framework for preparing village and village cluster land management plans.

Participatory agricultural and forest rehabilitation planning at village and village cluster levels consisting of two stages: 1.) Village and village cluster agriculture and forest management zoning and mapping.
2.) Village and Village Cluster Agricultural and Forest Land Management Planning

Village and village cluster agriculture and forest management mapping

Objectives:

- To ensure sustainable use of natural resources especially forest resources for future generation.
- To achieve consistency of agricultural and forestry land use zones between villages within the village cluster
- To improve past management of natural resources and retain forest areas within village management areas and within the village cluster
- To facilitate the preparation of village and village cluster agricultural and forest agreements and forest management plans
- To assign agricultural production efficiently for food security and commercial crops and self sufficiency as a means to increase income of farmers towards poverty alleviation

- To facilitate effective management and use of forest and agricultural land resources within villages and the village cluster.
- To guarantee small watersheds are protected in villages and village clusters
- To provide District and Provincial Authorities with information and land use maps for approving agricultural and forest resources available in the areas

Procedure

The following procedures have to be considered collectively when planning is being done. Consideration of only one or two criteria is likely to result in inappropriate planning.

- Consider if forest categories described in the Forestry Law, i.e., protection forest, production forest and conservation forest exist within the villages of the village cluster
- The uses of the existing forests in the village management area; this indicates how villagers currently utilize the natural resources, the potentials for zoning and current inappropriate land use practices.
- Types and condition of forests within villages. this indicates how villagers currently utilize the natural resources, potentials, and inappropriate land use.
- Bio-diversity that must be conserved, i.e.,flora and wildlife types and locations
- Land use "trends", forest clearance, land development, roads and village settlement
- Identify areas of degraded land areas that have potential for rehabilitation, agricultural or agro-forestry development
- Current fallow lands, low land, upland, grazing, and population growth trends to help ascertain future agricultural land needs of villagers
- The watershed protection needs to guarantee irrigation, fish pond and domestic water requirements and various land use zones are described as in the following table:

Table 1: Criteria for Distinguishing Village agriculture and forest management zoning and mapping

Land Use Zone Factors and Principles Purpose/Use

Land Use Zone	**Factors and Principles**	**Purpose/Use**
Village Residential Area	The area set aside for village settlement with provision for an expanding population	Housing, temple, school, health centre, shops, rice mills etc
Conservation Forest Zone	Areas where plant and animal bio-diversity is sufficient in quantity, variation and natural value to justify delineation as "conservation" Has eco-tourism potential (This will remain State land)	Fauna and flora conservation Species collection Eco-tourism Recreation Scientific research Non-prohibited NTFP collection
Spirit or Sacred Forests	Cemetery ("Pa sa"), "Huang harm", Maehasak" (These areas may later be registered as communal lands)	Sacred or spiritual forest conservation (Note: These areas are zoned on the land use map separately because they may later qualify for registration as village communal lands)
Protection Forest Zone	Areas with steep slopes Areas with fragile soils Areas near river, stream banks and roads Areas which should not be used for construction and industry Areas which should not be used	Steeply sloping land protection Soil erosion reduction Watershed and stream protection Regeneration of partially degraded forests Non prohibited NTFP collection

	for production Areas which can be regenerated to protection status Has potential to revert naturally to a protection forest category (This will remain State land)	Tree seed collection
Forest Utilized Zone	Forest areas for sustainable village use	Village NTFP collection Village housing and roof thatching Fuel wood Fencing Medicinal purposes Domestic purposes Tree seed collection
Agricultural Zone	Areas required for food and commercial crop production including upland and lowland areas Areas suitable for livestock production Land held in reserve for future populations Land for future conversion to terracing paddy Degraded land with low forest regeneration potential	Lowland rice production Upland farming production Fruit tree planting Economic tree planting Livestock grazing Agro-forestry Reserved agricultural land Fish ponds and small animal production (Note 1: This area may be sub zoned in accord with the purposes and uses indicated above. Note 2: This area needs to be large enough to allow all villagers dependent on rotational shifting cultivation or new families to have sufficient land access.)
Potential Land for Commercial Tree Planting	Degraded forest land or bare land Land in excess of village agricultural requirements for future populations Land with moderate slopes not in excess of 25 degrees Land which villagers have agreed to make available for plantation investment purposes	Tree planting livestock raising and fishing Annual cash crop production
Other areas	Other land areas such as bald or barren land, rock areas, gravel pits, streams, natural ponds, lakes or dams, roads	Recreation Irrigation

Steps in village and village cluster agriculture and forest management zoning and mapping

Step 1 Village cluster and village agriculture and forest management meetings

- Organise a meeting of village organization with the participation of target village representatives to explain the purpose, importance, objectives and procedure.
- Invite village authorities, elders, knowledgeable and respected villagers to attend meeting for explaining the purpose, objectives, criteria and procedures for agricultural and forest rehabilitation management plan. Also explain the villager rights to use agricultural and forest land .
- Discuss the circumstance on socio-economic, spare agricultural land and benefits from communal forest land use.
- After the socio-economic, land and forest data has been discussed request villagers to draw sketch maps of areas of existing land uses, including the locations of paddy fields, upland farming areas (fruit trees, economic or industrial trees, and annual crops), communal livestock grazing, or individual livestock grazing, agro-forestry, agricultural land held in reserve for future allocation (spare land), and land for other agricultural purposes.
- Explain the forest categories as specified in the Forestry Law, the agriculture and forest land use types that will be considered during the land zoning procedure, and the equipment and materials that will be used.
- Discuss the existing condition and uses of agriculture and forest land areas within the village using the satellite image , topographic map and aerial photographs if available.

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Step 2 Identify land use zones on satellite image or topographic map

- Define the village residential area including land that will be required for residential expansion of the village as population increases
- Assess the socio-economic data discussed above with villagers to gain an appreciation of agricultural land and forest needs for future populations
- Assist villagers to sketch in pencil or mapping pens on the satellite image prints, "provisional" agriculture and forest land use zones based on the following information:
- Existing village forest areas, land use practices and farming systems.
- Future agricultural land needs based on estimated population growth trends
- Details of existing village land use agreements or rules (written)
- Areas of any of the three national level forests (conservation, protection and utility forests) if they exist within the village cluster

Step 3 Ground survey

- Using the provisional land use zone map , or topographic map, conduct a ground survey with villagers to a) record GPS readings at various points along land use zone boundaries, b) observe different forest types, uses and locations.
- While conducting the ground survey, observe and record on the satellite image map or the topographic map the location and uses of forest and land types in areas adjacent to the village boundary.
- Take digital photographs of strategic points where GPS readings are taken along the boundaries of the various land use zones and record the positions on the Ground Survey Form
- After the ground survey, adjust the boundaries of the various land use zones on the satellite image or topographic map and prepare a provisional legend of the land use zones defined

Step 4 Meeting to verify agricultural and forest land use mapping

- Conduct a general village meeting to explain the information on the provisional agricultural and forest map, and based on feed-back from villagers, verify and adjust the land use zones and zone boundaries

Step 5 Digital mapping of land use zones

- If GIS capability exists in the field team, digitise the boundaries while in the field or District

Centre. Digitise the village and village cluster land use zones using the data from the satellite image sketch map and the GPS readings

- If GIS capability does not exist in the field team, secure the boundary information drawn on the satellite image print so it can be digitised at the selected GIS Unit after work is completed in the field
- When digitising the zone boundaries, use the digital camera data to confirm points along the land use zones boundaries

Step 6 Village cluster meeting to confirm land use zones

- After mapping agricultural and forest land use zones has been completed, it is necessary to review the results to village heads and representatives
- Conduct a village meeting to display, explain, and review the village and village cluster land use zoning maps to representatives of all villagers. Make adjustments on the land use map if required.

Figure 1: Participatory agricultural and Forestry land use mapping of Houaykhong village

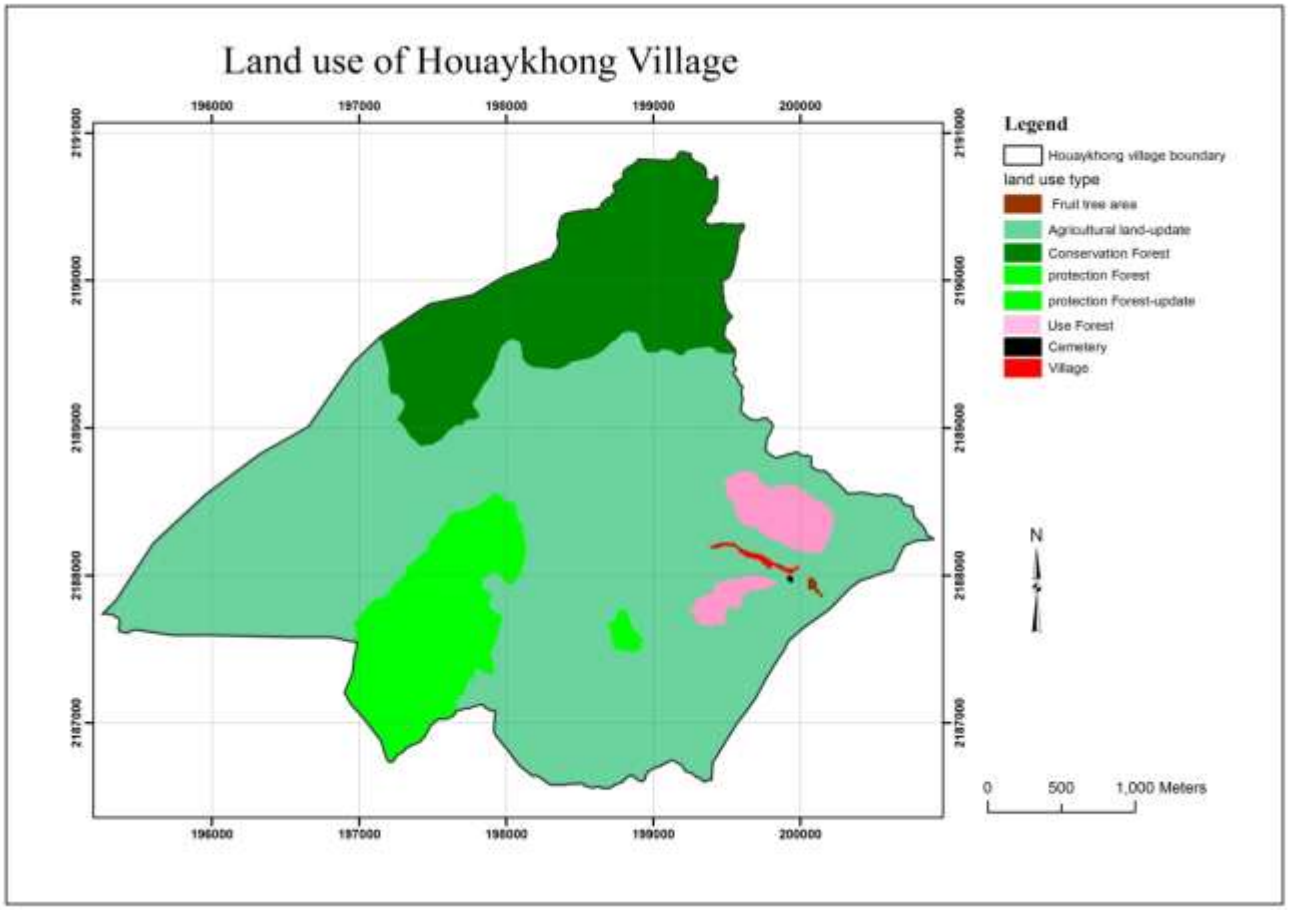


Figure 2: Participatory agricultural and Forestry land use mapping of Paktho village

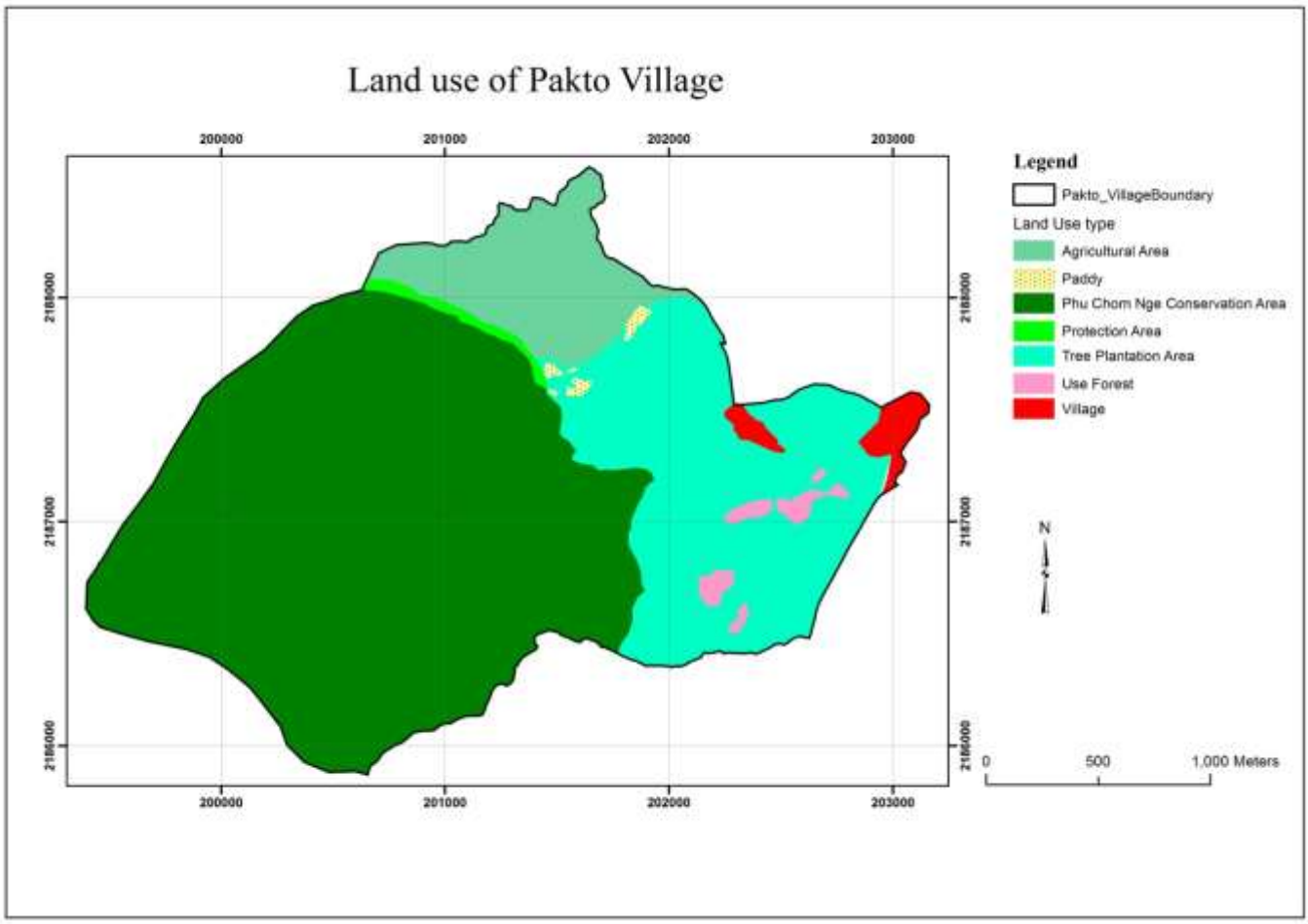


Figure 3: Participatory agricultural and Forestry land use mapping of Nakha village

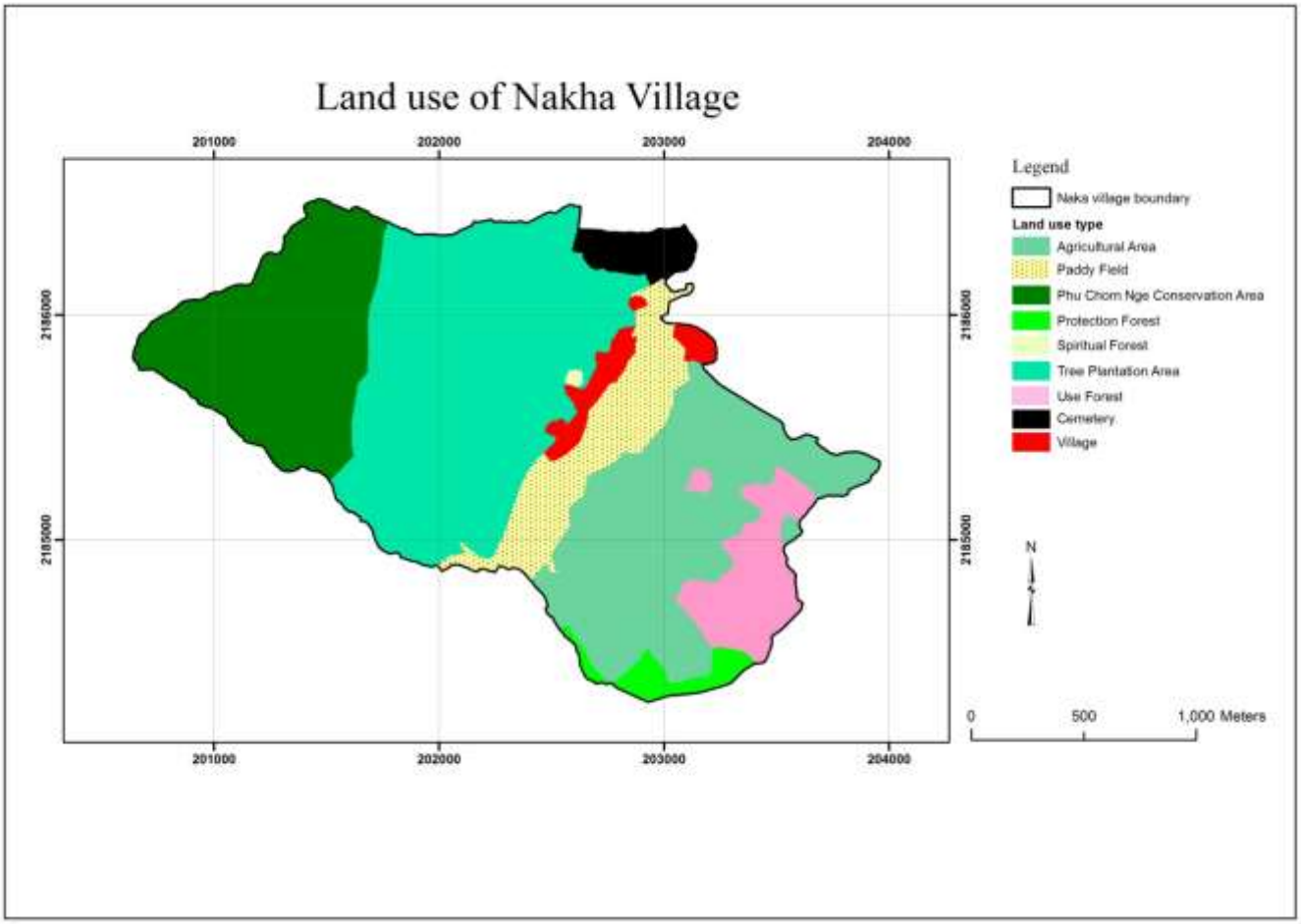
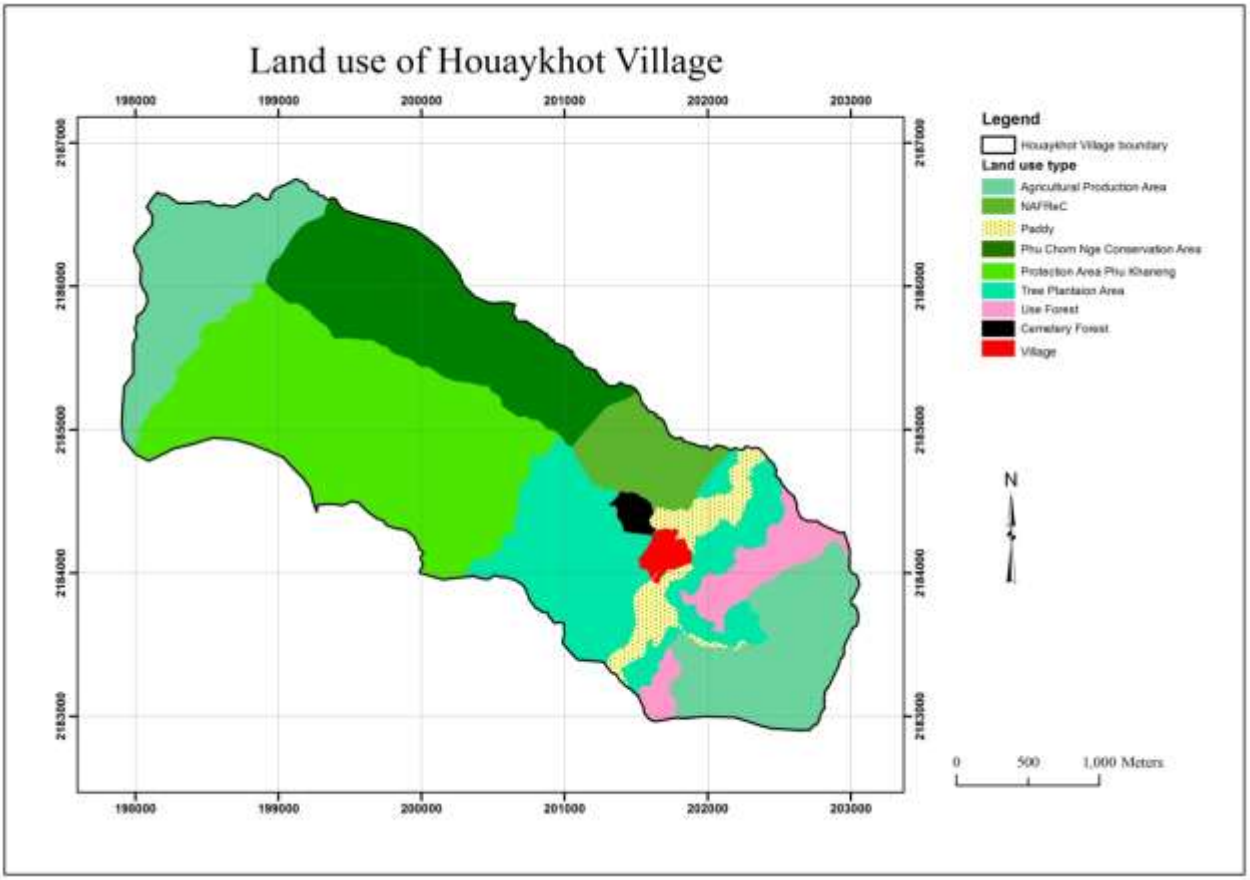


Figure 4: Participatory agricultural and Forestry land use mapping of Houaykhot village



Village and Village Cluster Agricultural and Forest Land Management Planning

Agricultural and forest Land management plans are the management activities that are defined for each of the village and village cluster agriculture and forest land use zones and other areas. The "land zone maps" are not actually "land use plans", however the village and village cluster boundary provides the framework for developing future land use plans. Land management planning takes into account traditional agricultural and social practices used by the various ethnic groups to manage forests and agricultural land.

Objectives:

- To assist villagers in planning, managing and using forest resources with productive and sustainable manner
- To optimize agricultural and forest land use planning within the village or village cluster
- To provide villages with a clearer understanding of agricultural and forest production, management and conservation activities within the agriculture and forest land use zones
- To facilitate step by step reduction and eventual cessation of inappropriate cultivation practices in the areas designated as protection forest, utility forest, and conservation forests
- To provide a basic planning tool for developing agricultural and forest village development plans (AFVDP)
- To ensure sustainable use of forest resources for future generation.

Procedure:

- location and types of current land use practices and farming systems
- Land slope categories for different agricultural land uses to determine how the agricultural zone can be sub-zoned for different agricultural uses

- Potentials and limitations of different agricultural and forest production areas as understood by villagers
- Potential for improved cropping practices to improve crop yields and productivity
- Potential for introducing agro-forestry to improve agriculture eco-system
- Current practices used in each of the forest zones
- Village requirements for domestic wood (housing, fuel, fencing etc)
- Village requirements for non-timber forest products (NTFPs) to ensure that particular NTFPs stocks are protected and sustained
- Minimum areas of agricultural and forest lands required to sustain the projected population in 10 years time. The agriculture and forestry land use information , village sketch maps and the land use zone maps are used to facilitate preparation of land management plans. Participatory discussions with both men and women are conducted to work out details of the plans.

Step 1 Utilize agriculture and forestry data
The agriculture and forestry data gathered is used to:

- Appraise and broadly define land slope categories within the village agricultural zone and sketch onto the satellite image map
- Indicate on the satellite image print the preferred tree species and cropping practices of villagers for different areas within the agricultural zone
- Record data on the current agricultural and forestry practices used for each of the village forest zones and draw record on the satellite image map
- Draw the locations of the main NTFP's on the satellite image map
- Evaluate village land use trends, i.e., annual cropping, commercial cropping, grazing, and exploitation of forest products

Step 2 Utilize socio-economic data
The socio-economic data gathered is used to:

- Map roads and tracks to provide knowledge on access to land use areas
- Calculate land areas in the village using the digitized map
- Calculate approximate 10 year village population growth from village births and deaths data
- Evaluate likely changes in land use in the village to calculate approximate increases or decreases in land use areas required for village livelihoods
- Estimate total future village areas required for cropping, forest, and housing

Step 3 Assess village land use issues and potentials
Land use information acquired from the problem census is utilised to analyse causes, impacts, and make proposals for addressing problems and capitalise on opportunities and potentials to improve current agriculture and forest management and use practices.

- Identify potentials and opportunities for improved land use practices in forest zones and the agricultural land use zone
- Identify cases where land is used for agricultural or forest production in the areas are not classified for such purposes, e.g., agricultural production are practiced in forest protection land , conservation forest land, and discuss what changes need to be made to rectify these situations
- Identify land that is used by villagers outside the village area or even outside the cluster and how these circumstances can be dealt with in the cluster land management plan
- Identify areas used by outsiders within the village or cluster area and what regulations applied

Step 4 Prepare village agricultural and forest land management plans

- Data from the analyses in Step 1, 2 and 3, and the village land and forest management agreement are synthesised to prepare future land management plans
- The aim is to attain a realistic balance between livelihood requirements and forest conservation and protection requirements
- The future locations and areas or sub-zones for different agricultural practices are designated within the agricultural zone using land slope and the village sketch map of preferred cropping practices for different areas, i.e., for paddy land, upland annual cropping, commercial crops and fruit tree cropping, grazing, and fish ponds etc
- Specify conservation farming practices that should be used in upland farming systems
- Specify feasible farming system and production improvements that could be addressed in the short and longer term
- Specify permitted utilization levels for wood, fuel, housing etc. for the village forest use zone
- Specify limits for extraction levels of NTFPs in various forest areas

Step 5 Prepare land and forest management & agreement

The agricultural land and forest management and use agreement is prepared to capture and elaborate the details of the land management plans for the various land use zones. Land and forest agreements, prepared in consultation with village authorities and villagers, are tools to help villagers manage and utilise village forest and agricultural land in accordance with the GoL policy and the requirements of the villagers. The rights, roles and responsibilities of village authorities and villagers in forest and agricultural land utilisation and protection are elaborated. The conditions and rules vary between villages depending on the types of forest and agricultural land present in the village and the uses of each type of forest or land.

The steps in preparing and accepting the Agreement are indicated below:

- Discuss existing village land and forest use rules and agreements with the village LFMC
- Review the future village land use zone map and the land management plans (see Step 4 above)
- Discuss the rules and agreements that should apply to each land use zone
- Prepare a first draft of the agreement which specifies the conditions and rules for each of the forest-land use zones and other areas. The agreement covers what activities are allowed/permitted or not permitted in each land use zone. The sanctions for breaches of the conditions and rules for each zone are specified.
- Present the draft agreement and the land use zoning map to a general village meeting.
- Both men and women are invited to the meeting with the LFMC to hear, review, improve/adjust and agree with all conditions for each land use zone covered in the village agreement.
- The agreement is re-written in detail following the decisions of the general meeting. The LFMC do this work facilitated by DAFO and DLMA staff
- The Village Land and Forest Management Agreement is certified and endorsed by the District Governor.
- The DAFO staff prepare and make enough copies of the agreement to distribute to all neighbouring villages after it has been signed and stamped by the Village Head, the village LFMC and the District Governor.

Note:
During the process of preparing land management plans in each of the cluster villages, cross-cutting issues that are not specific to individual villages are identified for consideration in the village cluster plan. For example, joint management of contiguous protection forest zones within two or three villages, problems of water distribution to paddy fields in one or more villages, or outsiders encroaching on village land to remove timber or NTFPs.

Step 6 Prepare village cluster land and forest management plans

- After the land and forest management plans are prepared for the first village in the village cluster, a similar procedure is followed to prepare land and forest management plans for each of the other villages in the cluster. This includes the steps of gathering agriculture and forest data, analyzing socio-economic data, analysing village land use issues and potentials, preparing village land and forest management plans, and preparing land and forest management and use agreements. Activities to address these issues are incorporated in an overall management plan for the village cluster
- If it does not already exist a Village Cluster Development Committee is formed including district agency staff and village representatives from each village in the village cluster
- The roles and responsibilities of the Village Cluster Development Committee regarding the preparation and implementation of the future village cluster land management plans are defined
- The village cluster land management plan is prepared using the data from the village land management Plans
- A general meeting of the Village Cluster Development Committee discusses the issues, constraints and potentials and makes decisions about the most important cross-cutting conservation, protection and development activities that need to be undertaken by the village cluster member villages
- Areas to be used by villagers from neighbouring villages are clearly identified and discussed.
- The village cluster management technical team assists the Village Cluster Development Committee to formulate the "village cluster land management plans". These plans will be in accord with the village cluster land use zones defined and mapped and will specify the resources and funds required to implement them for a period of five years
- Land and forest user groups in the village cluster should be involved in the preparation of the cluster land management plan and the development plan
- To improve co-ordination between the villages in implementing the village cluster land management plan, a village cluster land and forest management and use agreement is prepared by the Village Cluster Development Committee and the Village Land and Forest Management Committees or Village Development Committees, and certified and endorsed by the District Governor.

Table 2 : Participatory Village Agriculture and Forest Management Plan Of Houaykhong village, XiengNgeun district, Luangprabang province

Forest and Land Use types	**Location**	**Area (ha)**	**Main problem**	**Management Activity**
Forest types				
1. Village Protection forest	**In southern part of the village, head water of Houayleng, Houaypoung**	**193**	Illegal logging of valuable timber, hunting and over harvesting of NTFP, encroachment for expansion of agriculture activities and forest fires in dry season	Watershed protection of water sources, protecting wildlife, village forest law legislation and enforcement. Forest break line implementing between forest and agricultural land
2. Village Conservation forest	**In northern part of the village, head**	**315**	Illegal hunting and and over harvesting of	Protecting wildlife species and village

	water of Houaykhong		NTFP and encroachment for expansion of agriculture activities, forest fires in dry season	forest law legislation and enforcement, Forest break line implementing between forest and agricultural land
3. Village Utility Forest	**Near village in northern and southern parts**	**34**	Over harvesting and use of timber and NTFP	Optimal harvesting of timber, NTFPs for sustainable domestic use, and replanting of valuable trees and NTFP
4. Sacred Forests (cemetery)	**Near the village (south west)**	**0.16**		It should be strictly respected and prohibited to cut trees, hunting, slashing , burning for agricultural purpose
sub-total				
Agricultural types				
1. Wet rice paddy fields	**In valley**	**0.56**	Gall midge, rats and birds	Improve rice varieties and soil fertility
2. Fruit tree		**0.59**	Low fruit quality	Improve fruit tree variety
3. Agricultural land (fallow land, upland field crops and livestock grazing areas)		**818**	Mono cropping of commercial crops. Steep land, soil erosion, yield declining, short fallow period. Weed manifestation, Low yield of annual field crops, conflict between livestock and crop production.	Mulching of crop residues, Agroforestry (Teak+ upland rice) Contour planting of rubber+ annual food crops, improved forage planting for backyard cattle fattening, land use zoning between livestock and agriculture land
sub-total				
Village residential area			Garbage and waste water and mosquito	Keep Hygiene and sanitation
Total areas		**1264**		

Participatory planning on demonstration of forest rehabilitation practices in Houaykhong Village

Land use	Models on forest rehabilitation practices to be demonstrated	Areas (ha)
Natural forest (conservation, protection)	**ANR of gap planting of Pterocarpus macrocarpus and Afzelia xylocarpa**	**1 ha**
Fallow land (Agricultural land)	• **Agroforestry: Teak (Tectona grandis) intercropped with Annual and semi perennial crops** • **Agroforestry: Rubber (Parra rubber) intercropped with Annual and semi perennial crops**	**4 ha**
Upland field crops (agricultural land)	• **Intercropping:Plukenetia Volubilis (mountain peanut) intercropped with annual and semi perennial crops (crop residues mulching)** • **Intercropping maize mixed with rice been (mulching of crop residue)**	**2 ha**

Table 3 : Participatory Village Agriculture and Forest Management Plan Of Paktho village, XiengNgeun district, Luangprabang province

Forest and Land Use types	Location	Area (ha)	Mains Problems	Management plan
Forest land types				
1. Village Protection forest	Between conservation and agricultural land in north-west of the village	4.00	Illegal cutting timber, over hunting and harvesting of NTFP, encroachment for expansion agriculture and forest fires in dry season	Watershed protection of water sources, protecting wildlife, village forest law legislation and enforcement. Forest break line implementing between forest and agricultural land
2. Village Conservation forest	In south-westhern part of the village, head water of houaykhot stream	335.00	Over hunting and harvesting of NTFP and encroachment for expansion agriculture, forest	Protecting wildlife species and village forest law legislation and enforcement, Forest

			fires in dry season	break line implementing between forest and agricultural land
3. Village Utility Forest	Scattered within agricultural land in southern parts of the village	6.00	Over harvesting and use of timber and NTFP	Optimal harvesting of timber, NTFPs for sustainable domestic use, and replanting of valuable trees and NTFP
sub-total				
Agricultural land types				
1. Wet rice paddy fields	In valley	2.00	Gall midge, rats and birds	Improve soil fertility and gall midge resistance varieties
2. Tree plantation	Along the road sides to Muangnan district	136.00	Low quality of timber due to high density and fires in dry season	Thinning and fire break line implementing during the dry season
3. Agricultural land (fallow land, upland field crops)	In northern part of the village	53.00	Weed suppression due to short fallow period, erosion due to steep land, mono cropping of commercial crops. Low yield of annual field crops,	Maintain present areas under sustainable rotation; introduce no tillage farming and Agroforestry, perennial mixed with annual crops. Improve fallow by using leguminous species
sub-total				
Village residential area		9	Garbage and waste water and mosquito	Keep sanitation and hygiene
Total		**545**		

Participatory planning on demonstration of forest rehabilitation practices in Paktho Village

Land use	**Models on forest rehabilitation practices to be demonstrated**	**Areas (ha)**
Natural forest (conservation, protection)	**ANR of gap planting of Pterocarpus macrocarpus and Afzelia xylocarpa**	**1 ha**
Tree plantation	• **Thinning and pruning of teak (under storey creation)**	**2 ha**
Fallow land (Agricultural land)	• **Agroforestry: Biofuel tree (Aleurites Montana) intercropped with Annual and semi perennial crops**	**4 ha**

	• **Agroforestry: Teak (Tectona grandis) intercropped with Annual and semi perennial crops** • **Agroforestry: Rubber (Parra rubber) intercropped with Annual and semi perennial crops**	
Upland field crops (agricultural land)	• **Intercropping of planting broom grass (Thysanolaena latifolia), rattan (Daemonorops jenkinsiana) intercropped with paper mulberry (Broussonetia papyrifera** • **Intercropping of native NTFP tree (Oroxylum indicum) and cash crops like banana and papaya**	**2 ha**

Table 4 : Participatory Village Agriculture and Forest Management Plan Of Nakha village, XiengNgeun district, Luangprabang province

Forest and Land Use types	**Location**	**Area (ha)**	**Mains Problems**	**Management plan**
Forest land types				
1. Village Protection forest	In south-eastern part of the village,	8	Illegal cutting timber, and harvesting of NTFP, encroachment for expansion agriculture and forest fires in dry season	Watershed protection of water sources, protecting wildlife, village forest law legislation and enforcement. Forest break line implementing between forest and agricultural land
2. Village Conservation forest	In western part of the village, head water of Houayfat	77	Over hunting and harvesting of NTFP and encroachment for expansion agriculture, forest fires in dry season	Protecting wildlife species and village forest law legislation and enforcement, Forest break line implementing between forest and agricultural land
3. Cemetery forest	Northern part near village	9		It should be strictly respected and prohibited to cut trees, hunting, slashing , burning for agricultural purpose

3. Village Utility Forest	In the eastern parts of the village	26	Over harvesting and use of timber and NTFP	Optimal harvesting of timber, NTFPs for sustainable domestic use, and replanting of valuable trees and NTFP
sub-total				
Agricultural land types				
1. Wet rice paddy fields	Along Namkhan river sides	135	No problems	
2. Tree plantation	Along the left road side to Houaykhot village	35	high density and fires in dry season	Thinning and fire break line implementing during the dry season
3. Agricultural land (fallow land, upland field crops)	In left river bank of Khan river	90	Weed suppression due to short fallow period, erosion due to steep land, mono cropping of commercial crops. Low yield of annual field crops,	Maintain present areas under sustainable rotation; introduce no tillage farming and Agroforestry, perennial mixed with annual crops. Improve fallow by using leguminous species
sub-total				
Village residential area		9	Garbage and waste water and mosquito	Keep sanitation and hygiene
Total				

Participatory planning on demonstration of forest rehabilitation practices in NakhaVillage

Land use	**Models on forest rehabilitation practices to be demonstrated**	**Areas (ha)**
Natural forest (conservation, protection)	**ANR of gap planting of Pterocarpus macrocarpus and Afzelia xylocarpa**	**0.5 ha**
Tree plantation	• **Thinning and pruning of teak (under storey creation)**	**1**
Fallow land (Agricultural land)	• **Agroforestry: Teak (Tectona grandis) intercropped with Annual and semi perennial crops** • **Agroforestry: Rubber (Parra rubber) intercropped with Annual and semi perennial crops**	**2 ha**
Upland field crops	• **Intercropping of native NTFP tree**	**1 ha**

(agricultural land)	**(Oroxylum indicum) and cash crops like banana and papaya** • **Intercropping of Maize with rice been**	

Table 5: Participatory Village Agriculture and Forest Management Plan Of Houaykhod village, XiengNgeun district, Luangprabang province

Forest and Land Use types	**Location**	**Area (ha)**	**Mains Problems**	**Management plan**
Forest land types				
1. Village Protection forest	In western part of the village,	282	Illegal cutting timber, and harvesting of NTFP, encroachment for expansion agriculture and forest fires in dry season	Watershed protection of water sources, protecting wildlife, village forest law legislation and enforcement. Forest break line implementing between forest and agricultural land
2. Village Conservation forest	In nort-western part of the village, head water of Houaykhod stream	165	Over hunting and harvesting of NTFP and encroachment for expansion agriculture, forest fires in dry season	Protecting wildlife species and village forest law legislation and enforcement, Forest break line implementing between forest and agricultural land
3. Cemetery forest	Western part near village	6		It should be strictly respected and prohibited to cut trees, hunting, slashing , burning for agricultural purpose
3. Village Utility Forest	In the eastern parts of the village	41	Over harvesting and use of timber and NTFP	Optimal harvesting of timber, NTFPs for sustainable domestic use, and replanting of valuable trees and NTFP
sub-total				
Agricultural land types				
1. Wet rice paddy fields	Along Namkhan river sides	35	No problems	

2. Tree plantation	Along the left road side to Houaykhang village	150	high density and fires in dry season	Thinning and fire break line implementing during the dry season
3. Agricultural land (fallow land, upland field crops)	In eastern with border of Houaykhang village and western part with border of Nakha village	206	Weed suppression due to short fallow period, erosion due to steep land, mono cropping of commercial crops. Low yield of annual field crops,	Maintain present areas under sustainable rotation; introduce no tillage farming and Agroforestry, perennial mixed with annual crops. Improve fallow by using leguminous species
Agricultural and forestry research centre	Near village in the north	49		Providing agricultural and forestry techniques
sub-total				
Village residential area		3	Garbage and waste water and mosquito	Keep sanitation and hygiene
Total				

Participatory planning on demonstration of forest rehabilitation practices in Houaykhot Village

Land use	**Models on forest rehabilitation practices to be demonstrated**	**Areas (ha)**
Natural forest (conservation, protection)	**ANR of gap planting of Pterocarpus macrocarpus and Afzelia xylocarpa**	**0.5 ha**
Tree plantation	• **Thinning and pruning of teak (understorey creation)**	**1.5**
Fallow land (Agricultural land)	• **Agroforestry: Teak (Tectona grandis) intercropped with Annual and semi perennial crops** • **Agroforestry: Rubber (Parra rubber) intercropped with Annual and semi perennial crops**	**2.5 ha**
Upland field crops (agricultural land)	• **Intercropping of native NTFP tree (Oroxylum indicum) and cash crops like banana and papaya** • **Agroforestry of fruit trees with annual crops** • **Intercropping of Maize with red been** • **Intercropping:Plukenetia Volubilis (mountain peanut) intercropped with annual and semi perennial crops (crop**	**1 ha**

	residues mulching)	

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Asia-Pacific Network for Sustainable Forest Management and Rehabilitation

APFNet

Project Title: Sustainable Forest Rehabilitation and Management for the Conservation of Trans-boundary Ecological Security in Montane Mainland Southeast Asia – Pilot Demonstration Project of Lao PDR, Myanmar and China/Yunnan (SFR-MMSEA)

Implementation Plan of Forest Rehabilitation of the Project Site in Puwen, Yunnan, China

Yunnan Academy of Forestry

Kunming Yunnan, China

Dec.2013

1. Methods for the implementation plan design

(1)Implementation site selection

The implementation sites were confirmed at Puwen Tropical Forestry Institute, Lianhe village, Wandaohe village, and Mangfeilong village, Puwen Township, Xishuangbanna Autonomous Region.

(2)Establishment of design group

An implementation plan design group was established with interdisciplinary professionals. The team consisted of forestry professionals, bio-conservation professionals, the forest products development professionals, the community development professionals, local forestry officials, forest farm owners, the director of village committee and forest rangers.

(3)Collection of related literature of the implementation site

The basic information of the implement sites including Tropical Forestry Institute, Lianhe village, Wandaohe village and Mangfeilong village was collected and analyzed.

(4) Investigation on main existing forestland uses

Forest land uses were investigated in Puwen Tropical Forestry Institute, Lianhe village, Wandaohe village and Mangfeilong village with focus on 7 types. The survey methods used for the investigation included the use of satellite imagine , sketching mapping of land use, and conventional forestry investigation methods as specified in the forest land use investigation report.

The 7 dominant forest land uses in the Puwen were investigated. Surveyed land uses included the typical degraded secondary forest land , *Pinus caribaea* plantation, Rubber （*Hevea brasiliensis*）plantation, *Mytilaria laosensis* + *Choerospondias axillaris* mixed forest, *Parashorea chinensis* + *Pometia tomentosa* mixed forest, *Betula alnoides* plantation, and Dai home garden. The indexes covered the economic value, ecological value and cultural value of different forest land uses.

(5) Evaluation on the surveyed forestland uses

Based on investigation results, the rationalities of the surveyed forest land uses

and were assessed from the perspectives of ecology, economy and social development.

(6) Identification of land uses to be improved

Based on results of forestland uses evaluation, the forestland uses with low value were selected for improvement. The planning team conducted discussions with the staffs of the Tropical Forestry Institute and villagers and find out those land uses to be improved for the project. Forestland uses identified for improvement include over mature pine plantation, middle-aged monoculture broadleaved plantations, degraded natural forestland, pure rubber plantation.

(7) Rehabilitation plan design

The planning team discussed with plantation owners, village cadres, villagers and local forestry officials on how to improve the targeted forestland uses identified during the evaluation process. According to the willingness of plantation owners and villager, the planning group proposed 2-3 improving plans for each targeted forest land uses on the basis with consideration on ecological improvement, economic output, cultural adaptability and technological feasibility.

(8) Evaluation on the implementation plan

The project team invited interdisciplinary senior experts to evaluate each rehabilitation plan for main targeted forestland uses. The expert team assessed the rationality of each plan, and then ordered the proposed plans for each forest land uses based on their expertise.

(9)Formulation of final implementation plans

The optimal plans assessed by the expert team were fed back to forestland owner and villagers in project implementation area. The project team, landowner, the directors of village committee and villagers selected together one final plan for each type from recommended plans by the expert with reasonable modifications. Finally, there were 7 forest rehabilitation models to be implemented in Puwen site.

2. Implementation plans/models for forest rehabilitation in Puwen

Model 1: Existing middle-aged broadleaved plantations + landscaping plants （0.67ha）

Introduction:

The rotations of timber use plantation are relatively long, so the investment recovery periods are also long. To generate economic income before final cutting, some ornamental seedlings are to be planted inside the existing plantations, making full use of inside plantation and shade-tolerance of ornamental seedlings.

Details of Implementation Plan:

（1） Implementation site and time

Puwen Tropical Forestry Institute, 2013

（2） Plantation types

Parashorea chinensis(望天树)+ *Pometia tomentosa*(绒毛番龙眼)plantation

（3）Ornamental plants to be planted

Dipterocarpus turbinatus（羯布罗香）、*Parashorea chinensis*（望天树）、*Erythrophleum fordii*（格木）、*Mesua ferrea*（铁力木）、*Pterocarpus macarocarpus*（大果紫檀）、*Pterocarpus indicus*（印度紫檀）and *Cinnamomum cassia*（肉桂）

（4） Size of ornamental plants

1-3 years seedling

（5）Planting time

July- August

（6）Planting procedures

Planting holes were dug in the middle or the edge of the mixed plantation, the size was 40cm×40cm×40cm and planting space was 1.5m. Before planting, shrub 1m around planting holes was cleared.

（7）Monitoring index

Biodiversity index: species richness, abundance, stand diversity index;

Environmental index: insect and pest, frequency of disease, soil fertility, soil erosion;

Economic index: tree growth, seedling price, per unit economic output.

Model 2：Jungle rubber plantation（0.67ha）

Introduction:

To tackle the negative environmental impacts of the increasing rubber plantation in the region, jungle like environmentally friendly rubber plantation is to be tried and demonstrated by planting suitable indigenous trees with rubber at the same time to increase ecological stability, and to improve the structure and function of rubber plantation.

Details of the model:

（1）Implementation site and time

Puwen experimental forest farm, 2013

（2）Previous forest land use

Typical degraded secondary forestland

（3）Site preparation and clearing

Strip-like site preparation, shrubs and trees are cut in May with biologically and economically valuable trees untouched.

（4）Tree species to be mixed

Hevea brasiliensis（橡胶）

Parashorea chinensis（望天树）

Dipterocarpus turbinatus（羯布罗香）

Mesua ferrea（铁力木）

(5)Mixed pattern

Three rubber trees are planted in a cluster with 2-3m apart, clusters are randomly distributed. 10 rubber trees per mu are planted at average and its ratio is 25%.

（6）Planting time

August 2013

（7） Size of seedlings

2 year grafted rubber seedling

1 year seedlings for *Parashorea chinensis*、*Dipterocarpus turbinatus* and *Erythrophleum fordii*

（8）Planting hole

40cm×40cm×40cm

（9）Tending operation

Weeding and fertilization are carried out 3 times a year at the first years.

（10）Monitoring index

Biodiversity index: species richness, abundance, diversity index;

Environmental index: insect and disease, soil fertility, soil erosion, carbon stock;

Economic index: tree growth, rubber production, per unit economic outputs.

Model 3: Existing rubber plantation+ precious timber trees (6.7ha)

Introduction:

This model is designed to minimize the negative impacts of the existing rubber plantation at present and prepare for converting rubber plantation in the future.

Indigenous precious trees are planted in-between the wide rows of existing rubber plantation. With the precious trees growing up, rubber trees would be replaced gradually. This model is designed and to be tried as a model to convert existing rubber plantation into the forests in the future.

Details of the model

（1） Implementation site and time

Puwen Tropical Forestry Institute 2013

（2） Rubber plantation to be improved

8-year rubber plantation

（3）Tree species to be mixed with rubber

Pterocarpus indicus（印度紫檀）

Dalbergia odorifera（降香黄檀）

Erythrophleum fordii(格木）

Dipterocarpus turbinatus（羯布罗香）

Mesua ferrea（铁力木）

Altingia excellsa（高阿丁枫）

（4） Mixed pattern

The ratio of rubber trees to indigenous valuable trees planted between rubber rows is 2:1, the density of indigenous valuable trees is 450 tree/ha.

（5）Planting time

July 2013

（6）Size of seedlings

Two or three-year seedlings

（7）Site preparation

Pit-like site preparation, the size of planting hole is 40cm×40cm×40cm and planting

space is 2m×3m.

（8）Tending operation

3 times weeding and fertilization each year.

（9）Monitoring index

Biological index: species richness, abundance, diversity index

Environmental index: pest and disease, soil fertility, soil erosion

Economic index: Tree growth, economic outputs

Model 4: Understory cultivation of Dendrobium (0.067ha)

Introduction:

Dendrobium, as orchidaceae epiphyte species, grows on the stem and branch of the trees in hot and humid environment. Dendrobium forms one of the largest genera in the Orchidaceae, of which about 80 species have been recorded in China, Many species of this genus are used as raw material for the famous Chinese materia medica "Shi-hu" which has been used for centuries in China and its adjacent countries. At present Dendrobium resources are collected from wild environment and greenhouse cultivation. For the cultivation in greenhouses, the main problems is the residues of pe residues, and for the collection of wild Dendrobium, it is prohibited now. Therefore, it is urgent to develop an organic planting model. This model is to cultivate Dendrobium inside both the nature forest and plantation.

Details of the model

（1）Implementation site and time

Puwen Tropical Forestry Institute, 2013

（2） Forests to plant Dendrobium

Choerospondias axillaris+ Mytilaria laosensis mixed Plantation

Surrounding natural forest

（3）Planting time

August, 2013

（4） *Dendrobium* Seedling

Wild *Dendrobium* Seedlings sold on the market

Tissue culture seedlings of *Dendrobium officinale*

（5）Planting density

2400 clump/ha

（6）Planting procedures

Plant *Dendrobium* seedlings in rainy season. *Dendrobium* Seedlings are tied to the stems and branches of the trees with over 10cm DBH and rough bark by non-woven fabrics or rope, the height of the tree to tie is 1.5m-3.0m .Each tree is tied with 2-3 clumps of seedlings.

（7）Monitoring index

Pests and disease, Tree growth, *Dendrobium* production, Active ingredient content of *Dendrobium*, Pesticide residues , inputs in terms of money and labor, net income generate per ha.

Model 5: Conservative planting of extremely rare and endangered species degraded nature forest（2 ha）

Introduction:

With the decrease or degradation of natural forest, climate change and intensive human disturbance in the region, more and more plant species are endangered, some are already extinction. This mode is to plant cultivated seedlings of extremely rare and endangered tree species into forests, helping them to establish their population and at the same time improve the quality of the forest.

Details of the model

(1) Site and time

Puwen Tropical Forestry Institute, 2014

(2)Forest type

Seasonal rain forest,

Parashorea chinensis+ Pometia tomentosa mixed plantation.

（3）Extremely rare and endangered plant species to be planted

Nyssa yunnanensis (云南蓝果树)protected and national 1 level

（4）Planting time

July, 2014

（5）Size of seedlings

Two-year or three-year old seedlings

（6）Planting procedures

In seasonal rain forest, small trees with the DBH below 5cm around nature gap are cleared selectively according to their values, then 3-5 planting holes of 60 cm×60 cm×60cm each are dug in clusters with 4m depart from each other. *Nyssa yunnanensis* seedlings are planted in May. In plantation, *Nyssa yunnanensis* seedlings are planted in-between rows with a density of approximately 300 per ha.

（7）Tending operation

Weeding and cutting of shrubs are conducted 1.5m surrounding the planted seedlings 2-3 times a year for the first 3 years.

（8）Monitoring index

Biological index: Species richness, abundance, diversity index

Environmental index: Pest and disease, soil fertility, soil erosion

Economic index: Tree growth

Model 6: End use-oriented cultivation of industrial plantation (9.3ha)

Introduction:

The industrial plantation will be established by using genetically improved seeds and intensive cultivation methods, to maximize the productivity of forest land. This model is designed to grow enough timber and other raw material at less area so as to ease the increasing pressure on natural forest.

Details of the Model

（1）Implementation site and time

Puwen Tropical Forestry Institute, 2014

（2）Previous land use

Over-mature Caribbean pine plantation

（3）Silvicultural regime

The Caribbean pine plantation is logged by clear-cut method, then planted with high yield rosin variety of *Pinus kesiya* var. *langbianensis* and intensively managed as high yield rosin plantation with technology developed by YAF.

（4）Planting time

July, 2014

（5） Seedling variety

"No.1 High yield rosin" (Improved variety code: Dian R-SF-PK-010-2007), approved by Forest variety Approval Committee of Yunnan Province

（6）Size of seedling

100-day Seedling of *Pinus kesiya* var. *langbianensis*

（7）Key Techniques for planting operation

Land clearing and site preparation: Fully clean the land, 3m wide strip site

preparation;

Planting hole: 40cm×40cm×40cm;

Spacing: 2m×3m;

Planting strictly follows the standard technical procedures of taking the soil back to the planting hole, tearing out the plastic bag and pressing tight the soil around the buried seedling roots and digging smooth the soil around the seedling.

（8）Tending operation

Weeding is conducted twice a year for the first 3 years after planting.

（9）Monitoring index

Biological index: species richness, abundance, diversity index;

Environmental index: pest and disease, soil fertility, soil erosion, carbon stock;

Economic index: Tree growth, rosin production, inputs in terms of money and labor, per ha net income.

Model 7: Improvement of Dai homegarden

During the investigation, some problems were found out to keep the culture of Dai traditional home garden, such as the expansion of commercial tree species and techniques, the influence of modern life way. Therefore, the project group decided to select 1-2 households to improve their traditional home garden, help their home garden more useful according to their need and willingness. The measures will include:

(1) Plant some precious timber tree species in the home garden, such as *Aquilaria sinensis*（*牙香树*）.

(2) Plant some multi-purpose tree species, such as *Oroxylum indicum*, which can be used as medicine and sold in the market.

(3) Help the farmers to sell the produces from home garden, such as market information.

普文点社区参与规划

1. 傣族庭院改良

傣家园林庭院的面积虽然有限，但栽种的植物种类较多，且乔木、灌木、草本、藤本间作，最高层是椰子、槟榔、菠萝蜜；第二层是柚子、芒果、缅桂、番木瓜等较高树木；第三层是是香蕉、缅枣、臭菜等植物；林层下面是刺五加、香茅草等草本的药用植物和香料植物，菜园内还种植有各种蔬菜，乔木上还附生着藤本植物和用绳索捆附在树干上的石斛等树生花草。庭院内即形成了多物种、多层次的生态结构，不但提高了土地利用率，还加快了对野生植物的培育利用，使傣族居民获得了大量日常所需的食物和原料。同时，还使得居住环境优美，人与自然更加和谐。针对西双版纳地区传统庭院的种植方式逐步被现代农作方式替代的危险，项目计划在调查傣族传统庭院的基础上，**在普文镇曼飞龙村选择 1~2 户傣族庭院开展传统庭院的改良示范**。目前由于现代生活方式的冲击，傣族居民开始逐步减少了植物的栽植。**项目计划通过增加傣族庭院的经济产出功能，增加农户保持传统庭院的农作方式的积极性，并通过傣族庭院的恢复改良示范效果，鼓励社区居民采用传统的种植方式。**

实施内容包括：（1）根据去年与农户的沟通和交流的情况，将在庭院中补植千张纸（海船）、石斛等多用途植物；

（2）调查整理传统庭院的种植技术和传统知识，通过培训加强对传统知识的传承和宣传；

（3）为农户提供有机农产品生产及市场营销等方面的信息和技术。

2.茶园改良

茶园改良是指在茶园中利用茶树行间或丛间种植一种或一种以上的种植方式。在茶园进行合理间作，能够促进茶树生长，起到增产提质的作用，达到高效经济地利用土地与空间的效果。茶园间作后，夏季间作植物对茶树起到遮阴的作用，冬季提高土温，减轻或防止冻害。雨季能拦截径流，有利于蓄水保土。平时能抑制杂草生长，减少养分损失。茶园里间作的植物其落叶及部分根腐烂后，能提高土壤有机质，尤其是豆科作物，还具有固氮作用，有利于提高土壤肥力。西双版纳地区目前有台地茶园共计 16 万亩，合理的进行茶园间作改良，对于提高经济效益和生态效益都具有重要的意义。

实施内容包括：（1）通过与茶园农户的沟通和交流，根据农户的意愿，将在普文镇曼飞龙村的 1~2 个茶园中间种珍贵用材树种海南黄花梨等多用途植物；

（2）通过授课和实地考察等方式，为周边农户进行茶园改良技术的培训，提高农户进行

茶园改良的能力和积极性。

3.土地管理

针对林场周边社区不断蚕食天然林，盲目发展经济林，从而导致森林退化和环境恶化的现状，项目计划开展**森林资源社区共管活动**。在开展社区共管示范活动的村社，组织村民分析目前的生存状况、社区经济发展的需求、制约因素和机遇，提高社区居民的生态保护意识和资源永续利用意识。在社区内选出社区资源管理委员会成员，引导群众制定《土地利用现状图》和《社区森林资源管理办法》，通过这些规划的制定，让林地管理的相关各方明确土地利用现状，指导社区合理管理森林资源。

实施内容包括：

（1） 由项目组成员和林业站指导，帮助社区居民自己勾划《土地利用现状图》；

（2）采用利用参与性办法，制定《社区森林资源管理办法》；

4. 培训

通过参与式调查，了解社区农户所需要的技术和信息。采取室内培训和现地教学的方法，开展森林资源管理和森林恢复技术的培训，包括珍稀濒危乡土树种的育苗、整地、栽植等技术的试验示范及培训；林下种植的试验示范及培训，农产品市场和消息等。

Asia-Pacific Network for Sustainable Forest Management and Rehabilitation

APFNet

Project Title: Sustainable Forest Rehabilitation and Management for the Conservation of Trans-boundary Ecological Security in Montane Mainland Southeast Asia – Pilot Demonstration Project of Lao PDR, Myanmar and China/Yunnan (SFR-MMSEA)

Report on Participatory Planning of Sustainable Forest Management and Rehabilitation

Yunnan Academy of Forestry

Kunming Yunnan, China

June.2013

1 The general situation in two pilot sites

（1）Longchuan site

The pilot site is located in Yingjing village, Chengzi Town of Longchuan County, 2 km from Chengzi Town, covers 0.29 square kilometers; 52 household, the total population is 234, and labor force population is 157. In 2012, the total income of Yingjing village is 1,750,000 RMB, per capita net income is 3,935 RMB. The main income comes from sugarcane plantation.

The average elevation is 1200m, semi-mountainous, annual average temperature is 17 ℃, mean annual precipitation 1800 mm, the soil is latosolic red soil, soil fertility in this area is at a middle level.

(2) Ruili site

The pilot site is located **Mengmao town,** the natural forest in this area is composed by secondary tropical monsoon forest and monsoon evergreen broad-leaved forest, annual rainfall is 1490mm, soil type is krasnozem, PH ranges from 4.38 to 5.48, the main indigenous dominant tree species are *Schima wallichii*, *Betula alnoides*, *Choerospondias axillaris*, *Bischofia polycarpa*, *Cyclobalanopsis longinux*, etc. Although it is secondary forest, it still remain relative rich biodiversity, some of them are rare and endangered species under provincial and national protection.

2 Participators and their tasks in the planning

The participants should involve local villagers, entrepreneur, government staff, grassroots foresters, forestry experts, young researchers, and graduate students; they come from Donghong Prefecture Forestry Institute, Yunnan Academy of Forestry, Forestry bureau of Longchuan County, Southwest Forestry University, bamboo processing factories.

The framework of this participators planning is as shown in Fig 1.

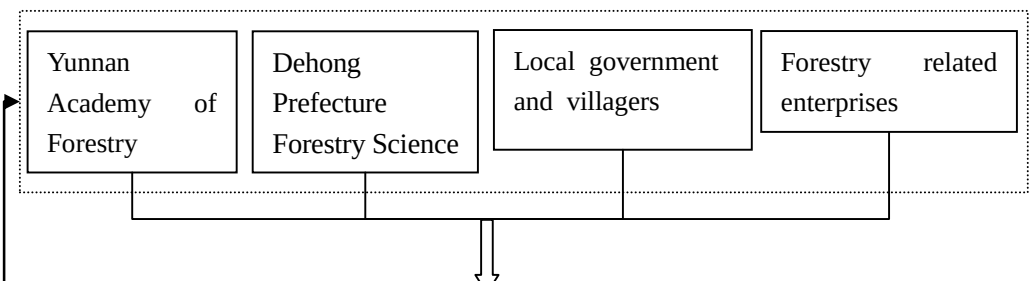

Fig 1 The framework of the participatory planning

The basic activities of the participatory planning are as follow:

(1) Experience exchanging and cooperation

Facilitate the experience exchanging and cooperation among forest-related enterprises, government, research institute and local planters.

This project invited government staff and entrepreneurs from Longchuan county and Chongqing City who get successful experience visit the demonstration site and exchanged useful experiences with staff of YAF, Dehong Prefecture Forestry Science Research Institute, and local farmers, discuss the potential cooperation in the future.

Based on this, it is possible to find out the problems in sustainable forest management and rehabilitation, form suitable solution, assess and consult for project complementation.

(2) Capacity building

Some measures are took for the young trainees to get better understanding on filed assessment and participatory planning, they are:

- Documents collection and literature review.
- Collecting secondary material from different ways.
- In house discussion related to project implementation.
- Field survey and interview with local people.
- Summarize local best practices.
- Training work shop on the project implementation, basic knowledge and

techniques of sustainable forest management and rehabilitation for young generation and local villagers.

3 The participatory planning of forest management and rehabilitation

(1)Sustainable bamboo forest management

There are more than 30,000 ha natural and artificial bamboo forest in Dehong Prefecture, only in Longchuan county, the area of bamboo forest reached to 15866.7 ha in 2012, but most of the bamboo forest is suffering predatory harvesting and rare management, leading to bamboo forest degradation such as soil productivity decline, biodiversity loss, local villagers can not benefit from the bamboo forest sustainably any more.

To address this problem, a demonstration base of large size sympodial bamboo forest (*Dendrocalamus latiflorus*) will be built in Longchuan County to do experiment and extent the good practices. The demonstration bamboo species is Dendrocalamus latiflorus since it is the most popular bamboo species with high productivity of both its timber and shoot, and the techniques on its' cultivation and management is similar as other local large size sympodial bamboo species.

- Demonstration and training on basic knowledge and techniques on cultivation and high yield management of large size sympodial bamboo. (6.8 ha)
- Arbor tree-bamboo inter-planting

To improve the biodiversity and soil productivity in pure bamboo forest, and to add other alternative ways to improve local villagers' income. The arbor tree species are *Betula alnoides*(0.67 ha), *Alnus nepalensis*(0.67 ha), and *Cunninghamia Lanceolata* (0.67 ha)which with fast growth character and good market demand.

- Understory planting

The target species are economic crops with good market demand and economic benefit such as bamboo fungus (*Diciyophora duplicata*) (0.3ha).

- Facilitate the cooperation among related bamboo processing enterprises, research institute, and local planters, to share the information of market demand and supply.

(2) Sustainable second natural forest management

To avoid natural forest degradation and get comprehensive ecological benefit, considering both long term and short term benefits, some measures will be took at the demonstration site in Ruili City, and they include:

- Breeding large size timber and planting rare and endangered trees (13.34 ha)

Large size trees are good to carbon stock and conservation of water and soil, habitat conservation, and economic values, to promote the growth of existing standing trees, some measures will be carried out such as selective cutting common trees, tending the standing big tree (6.67 ha), and replanting rare and endangered trees species in open forest to form renewable layers (6.67 ha), so that people can get comprehensive ecological benefit and economic benefit from it.

- Afforesting in fir clear cutting land, and planting economic crops in understory (2 ha), fir (*Cunninghamia lanceolata*) and bamboo (*Dendrocalamus hamiltonii*) are selected as the afforestation species due to their fast growth and economic value, the two species can recover the vegetation in clear logging land.

- Understory planting (7 ha)

Some experiment will be carried out to promote the growth speed of Rattan (*Calamus nambariensis* *版纳省藤*), and get high yield harvesting for *Fructus Tsaoko* *草果*, which have good economic value.

- Control the alien invasive plants

Mikania micrantha and *Ageratina adenophora* are two alien invasive plants; they are flooding in open land and damage the young growth seriously. It is a urgent issue should be solved.

Discussion

Local government staffs, entrepreneurs from Chongqing and local bamboo processing factories, researchers from YAF, are visiting the bamboo forest.

Visiting the bamboo forest processing factory

Interview with local villagers

Invasive plant (*Mikania micrantha*)

Understory planting (tea)

Asia-Pacific Network for Sustainable Forest Management and Rehabilitation

Sustainable Forest Rehabilitation and Management for the Conservation of Trans-boundary Ecological Security in Montane Mainland Southeast Asia– Pilot Demonstration Project in Myanmar

Thematic report on sustainable forest rehabilitation/management plan

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1. Introduction

In accordance with participatory land use plan of the target village located near the Nyuak-Htauk reserved forest, there are residence area, private farm lands, shifting cultivation lands in reserved forest and unclassed forest, spiritual forests, spring water forests and forests where villagers collect fuelwood for home consumption. Different forest rehabilitation strategies were designed for each land use systems that are required forest rehabilitation based on the base line assessment. During this reporting period, sustainable forest rehabilitation plan for home garden, shifting cultivation lands, spiritual forests and spring water resources were formulated through participatory process involving local communities, authorities and scientists. The following sections will elaborate management plan for forest rehabilitation.

2. Forest rehabilitation in community based forest management

Forest rehabilitation plan was prepared based on scientific literature on best practices, field survey, local perceptions and concerns, involvement of local officials and local FD staff.

2.1 Establishment of community forest in shifting cultivation areas

The pilot demonstration site is located in the reserved forest where local communities have being practicing shifting cultivation significantly since after 1988. Total area is 24.3 ha, of which, 8.41 ha is affected by shifting cultivation while other 15.89 ha is degraded secondary forest areas covered with Teak (*Tectona grandis*) and some hardwoods species such as Thit-ya (*Shorea obtusa*) and In-gyin (*Shorea siamensis*). Along with increased population and industrialization of agriculture, swidden Taungya is likely to change into sedentary agriculture. Nowadays, the commons crops planted in the Taung-ya include maize, groundnut, sesame and paddy as illustrated in figure (1). Maize becomes commercial crop for the local community because of ensure market access and simple processes compared to other crops. The industrialization of agriculture with intensive use of inputs has increased productivity and farmers' income, on the other hand, it may lead to reduce agro-ecosystems to prevent erosion and mitigate climate change. To demonstrate good practices for forest rehabilitation in such area, community forestry model was introduced to address real needs of communities as well as to rehabilitate the degraded natural forest.

Figure (1) maize and groundnut cultivation in Taungya

2.1.1 Management plan for community forestry with agro-forestry

Community forest user group was organized with nine households who are doing Taungya in 8.41 ha of cultivated land. According to the present vegetation and land use, two management strategies were designed under community forestry i.e. agro-forestry and conservation of existing natural forests. Individual member, thus, will manage agro-forestry plot as well as natural forests plot. Management plan to manage agro-forestry and natural forest was prepared by collaboration among user group members, authorities, elder people and scientists.

To accomplish preparing management plan to meet the objectives of the project, the following activities were conducted.

1. Gathering community information and identify village needs through village meeting and informal interview by scientists.
2. Presenting concept of community forestry and agro-forestry in the village meeting
3. Sharing economic outcomes of agro-forestry using example from other user group
4. Facilitating local communities to develop preferable agro-forestry design including preferable species to be planted
5. Confirming developed agro-forestry design in the meeting
6. Discuss about conservation of existing natural forest
7. Make a consensus meeting among user members for conservation of natural forest by the help of scientists
8. Site visit to Wundwin township community forest to study the present rehabilitation practices of agroforestry
9. Nursery and preparation of planting materials
10. Demonstrate tree management practices to user group members such as planting trees and improvement felling by local FD staff and scientists
11. Identification of tree vegetation in community forest area and home garden to measure the success of forest rehabilitation

12. Aside from above mention extension activities to raise awareness of user group members in sustainable forest rehabilitation, compost making training was also provided to local communities with the aim of raising awareness about soil management practices

In this thematic report, items of afforestation by means of agro-forestry and natural forest conservation were illustrated more detail. The lay out design for agro-forestry varies among members based on their species preference, availability of the land, traditional knowledge and scientific knowledge on agroforestry practices. For intercropping, 12 feet x12 feet wide inter row spacing is used for the members who have above 10 acres of shifting cultivation area as shown in figure (2). In the case of user group members who have limited shifting cultivation area, 12 feet x 24 feet spacing or 36 feet X 36 feet spacing will be used as illustrated in figure (3).

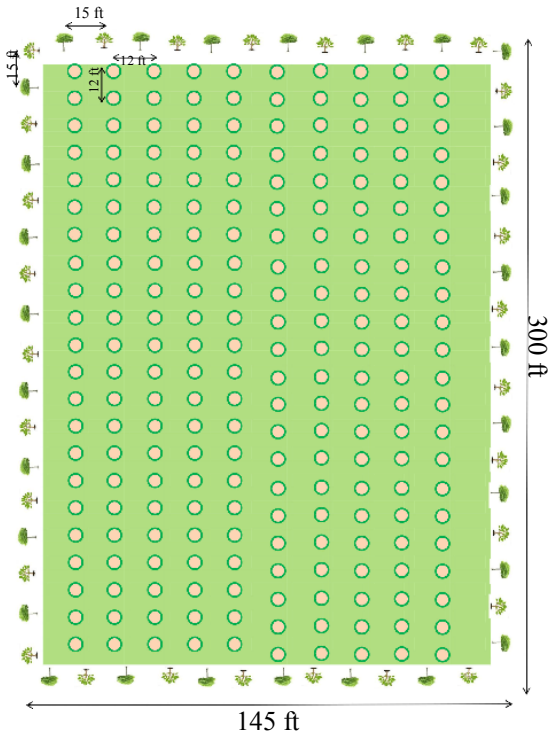


Figure (2) intercropping design

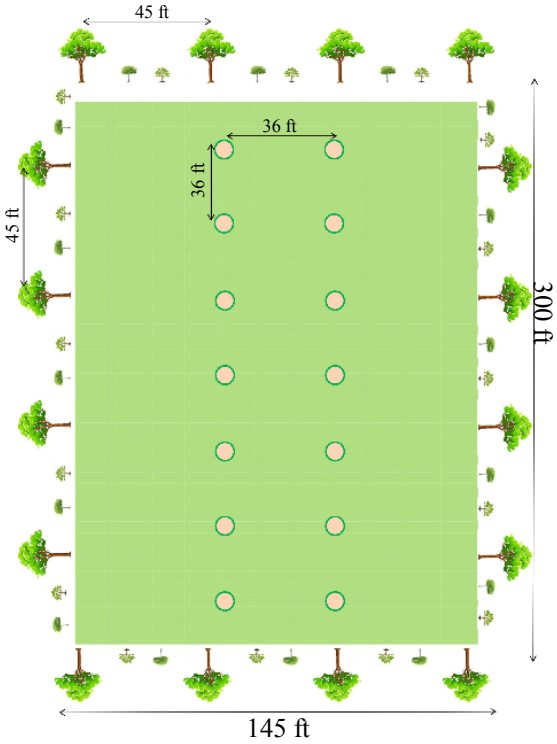
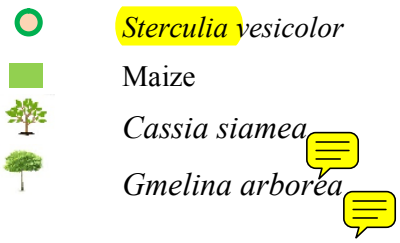
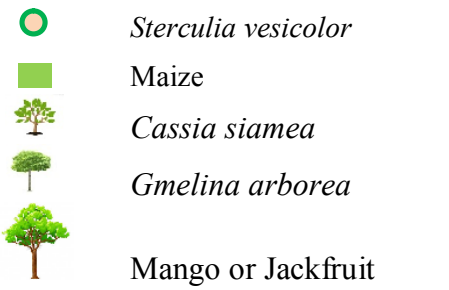


Figure (3) intercropping design





At the planting season of this year, six members have planted about 2550 seedlings of Shaw Phyu (*Sterculia versicolor*) in some parts of their individual farm land at a spacing of 12 feet x 12 feet as main plant as shown in figure (4) and (5). Shaw-phyu trees are efficient enough in providing higher economic return within short rotation period so local people prefer to plant it. In the next year, Mango trees (*Mangifera indica*), Jackfruit (modified seedlings which can produce fruit within three years after planting) , Lemon and Danyin will be planted in the remaining unused land for growing trees this year. These fruit trees are planted to provide subsistence needs as well as to generate additional income from farm land. In accordance with their traditional knowledge, Dog fruit are good for soil decomposition and it has smaller canopy size.

Different intercrops grown by user group members in interspaces are maize, groundnut or rice. Even though fellow system was almost disappeared now-a-days, some farmers still practise traditional knowledge on rotational cropping system to reduce soil degradation. For the first year, they plant groundnut or rice (mostly groundnut) and maize are then planted for three consecutive years. After that, they plant again groundnut. Figure (4) shows that local communities plant groundnut, rice and corn by dividing cultivated land into three plots.

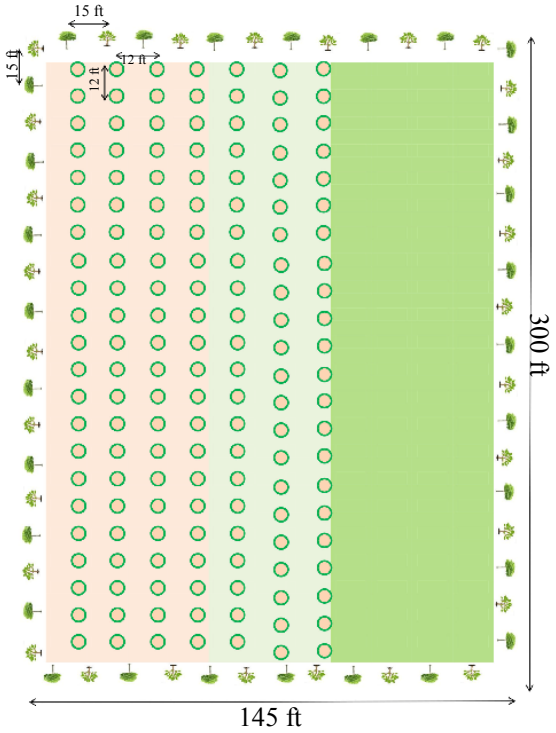


Figure (4) intercropping design

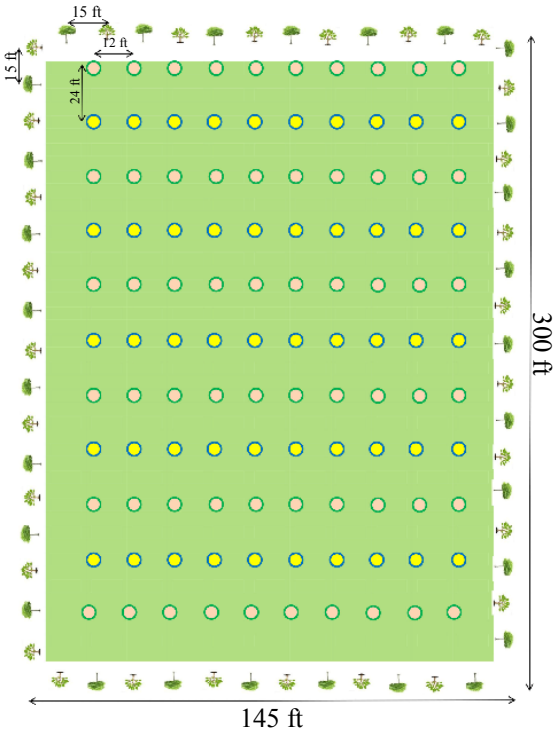


Figure (5) intercropping design

Sterculia vesicolor
Maize
Cassia siamea
Gmelina arborea

Sterculia vesicolor Lemon or Mango
Maize
Cassia siamea
Gmelina arborea

Along the farm boundary, about 1000 seedlings of Mezali (*Cassia siamea*) and about 1000 seedlings of Yamanae (*Gmelina arborea*) were planted with the purpose of producing fuelwood, pole, post and manure. The planted tree around the farm boundary is 15 feet x 15 feet. As per lay out design indicated in figure (4), some user group members will plant forest trees by mixing fruit trees such as Jack fruit and Mango along the farm boundary. Operational activities for intercropping will be carried out as their farm schedule (Table 1).

Table (1) operational schedule for intercropping

No	Activities	Operational season (month)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Soil preparation												
2	Seedling collection												
3	Fertilizer gathering												
4	Planting fruit & forest trees												
5	Crop planting												
	i. paddy												
	ii. groundnut												
	iii. corn												
6	Harvesting												
	i. paddy												
	ii. groundnut												
	iii. corn												

2.1.2 Community forestry with conservation of existing natural forest

15.89 ha of natural forest area will be managed individually under the group. According to the field inventory of natural resources, there are about 31 tree species in natural forest area. To conserve that existing natural forest, proper silvicultural treatments such as improvement felling, enrichment planting, weeding, pruning, thinning and fire protection have being carrying out. Table (2) shows seasonal plan for each activity, workload sharing system and how to implement activities decided by integrating their traditional knowledge and scientific point of view through participatory decision making process. For the gap planting, preferable species by user group members are Teak (*Tectona grandis*), Bamboo (e.g. Wani *Dendrocalmus latiflorus*) and Yamane (*Melina arborea*) which will plant in 2014.

Table (2) management plan for conservation of existing natural forest

Activities	Operation season	Implementation activities	Work sharing system	Remark
1.Land allocation for CF management in the reserved forest	August-September	Natural forests are divided individually through users' consensus	Collective decisions	Nil
2.Improvement felling	September-October-November (will be conduced every year)	Cutting inferior trees for developing healthy and sound trees; climber cutting and coppicing will be carried out	Individually	For these operations, Staff from Forest Research Institute provided practical training by working together with user group members
3.Fire protection	February-March	Outer fire line is 6 feet wide while inner line is 3 feet	Collective action	Fire protection will be conducted every year
4. Planting trees (enrichment planting)	May-June-July	Rare, endangered and locally preferably species will be planted.	Individually	About 250 tree seedlings will be planted in 2014.
5. Weeding	October-November-December	3 times of weeding will be carried out.	Individually	
6. Rotation for harvesting	7- years for fuelwood 25-years for pole 30-years for post	Selected trees will be harvested using coppice selection system.	Individually	

2.2 Home Garden

Majority of villagers are Danu who used to plant home garden inside their residence traditionally as shown in figure (6). This practice consists of a house surrounded by cultivation of annuals and perennials. Commons annual crops planted in home garden are: egg plant, pumpkin, lemon, various kinds of beans, chili, ladies' finger, bitter guard, mustard and tomato. Perennials crops and fruit trees include banana, papaya, mango, coconut and coffee. Aside from edible crops and fruit trees, they also plant ornamental plants such as rose, jasmine, kiss me quick, temple tree (*Plumeria acutifolia*) and ywet hla (*Musaenda luteola*).

In order to do experiment for enhancement of home garden, 55 households (one fourth of total households) were randomly selected and their preferable crops, fruit trees and forest trees were identified through face to face interview by home visit. Interview results indicated that home garden products partly contribute for subsistence consumption and small amount of income as well. Common preferable species to be planted by local communities are modified Jackfruit, Papaya, Mango (*Mangifra indica*), Sandal wood (*Sandal album*), Aga wood (*Aquilaria malaccensis*) and coconut. This year, about 500 Mango (*Mangifra indica*) seedlings have been distributed to local communities. In coming planting season, remaining desirable seedlings will be supported by the project.

Figure (6) home garden

3. Conclusions

As indicated in base line assessment of socio-economic conditions of the target village, Taungya has been a chronic practice to generate subsistence food and income of local communities since the village was established. On the other hand, it is also a culturally deep-rooted practice so that it will not be easy to eliminate among local communities. In addition to this, forest provides fuelwood not only for home consumption but also for income sources in

off-farm season, which lead to deforestation. As mentioned above, therefore, participatory planning processes are necessary for achieving sustainable forest rehabilitation. In the next year, forest rehabilitation plan will be preceded based on participatory land use plan involving local communities, private sector, local officials, elder people and scientists. Meanwhile, training and extension activities will be conducted to raise awareness on forest resource management, sustainable agricultural practices and income generating activities.