

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 Field Assessment of Forest
Resources for the project site in Myanmar**

December, 2013

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1. Background

1.1 Geographical Information

Myanmar is still endowed with a forest covered area of 47% of the country's total land area 676,577 km², one of the highest in the Asia-Pacific Region and the largest country by geographical area in mainland Southeast Asia (FRA WP, 2006; FAO, 2007). It lies geographically between latitudes 9°32' N and 28°31' N and longitudes 92°10' E and 101°11' E and is bordered on the north and northeast by China, on the east and southeast by Laos and Thailand, on the south by the Andaman Sea and the Bay of Bengal and on the west by Bangladesh and India (MOECAAF, 2011).

1.2 Forest types and forest resources of Myanmar

The country is rich in forest resources with 1,347 species of big trees, 741 species of small trees, 1,696 species of shrubs, 102 species of bamboo, 36 species of rattan and 841 species of orchids so far recorded (FAO, 2007). Out of the 2,088 tree species, 85 have been recognized and accepted as producing multiple-used timber of premium quality (FAO, 2007).

As a result of great variation in rainfall, temperature, soil and topography, there are many different forest types in Myanmar. There are six major forest types while the majority of the forest area is covered by mixed deciduous forest and hill and temperate evergreen forest; 37 and 25 percent respectively (MOECAAF, 2011). Areas of respective forest types have been estimated as shown in Table 1 and the status of forest cover of Myanmar is given in Figure 1.

Table 1. Forest type and area of Myanmar

No.	Forest type	Area (1,000 ha)	% of total forest Area
1	Mangrove forest	1,375	4
2	Tropical evergreen forest	5,500	16
3	Mixed deciduous forest	13,407	37
4	Dry forest	3,483	10
5	Deciduous Indaing (Dipterocarpaceae) forest	1,719	5
6	Hill and temperate evergreen forest	8,939	25
7	Scrub land	998	3
Total		35,421	100

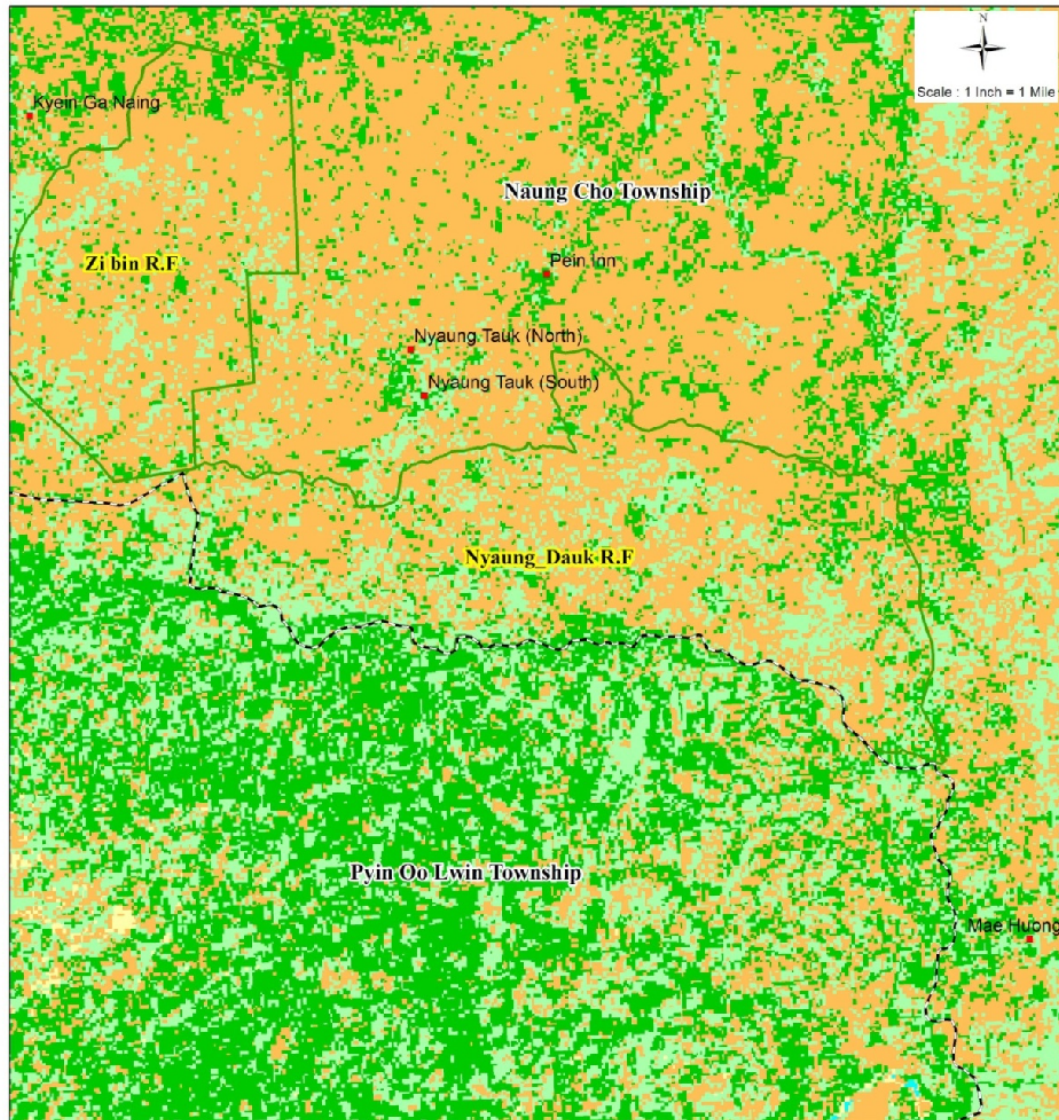
Source: MOECAAF, 2011

2. Description of the project site

The project site is located in **Compartment no. 2 of the Nyaung Htauk reserved forest**, located between 22° 45' and 23° 15' North latitude and 96° 00' and 97° 00' East longitude (shown in the map). And it is situated in **Nawngkhio Township, Kyaukme District in the Northern Shan State of Myanmar**. Elevation of the project area is ranging from 600 m to 700 m and the soil type is Acrisol (terms of FAO classification). According to the previous records (District Forest Management Plan), this area was primarily endowed with **natural forest of Moist Upper Mixed Deciduous forest type**.

Average number of raining days range from 90 to 130 days per year and annual rainfall varies from 1200 mm to 1800 mm. As it is located in the temperate zone of higher elevation, the temperature of the project site varies from 6-27 °C during the cold season to 16-35 °C during the hot season. From 2003 to 2012 the average minimum and maximum temperature is 7.8° C and 32.3°C respectively.

Landuse & Landcover Map of Nyaung Dauk Forest Reserved Area (2013)



Landuse and landcover map of Nyaung Dauk reserved forest in 2013

3. Methodology

3.1 Sampling Design and Stand Inventory

Systematic sampling design has been applied for stand inventory. The size of sample plot (primary unit) was established as 100 m x 100 m and total of 5 sample plots was laid out in the targeted study areas based on the forest status of the study area so that forest resources of

different forest conditions in the project area could have been assessed. And each primary unit was divided into 25 secondary units (20 m x 20 m) and stand inventory was conducted within these secondary units.

For the study area, the forest areas covered are mostly fallow lands affected by shifting cultivation and secondary forests which were degraded by excess collection of fuelwood by local people and illegal logging. But there are still some primary forests which are conserved by traditional means in terms of spiritual belief and protection objective for supplying water resources. In this context, primary unit was laid out each in fallow land and each in primary forest.

In each sub-plot of primary sample plots, number of tree species, scientific identification of each tree species and their utilization status were collected and diameter at breast height and tree height were measured. By this mean, the trend of deforestation and forest degradation dynamics could have been determined.

3.2 Participatory Rural Appraisal (PRA)

Collecting baseline information of the study area was conducted as a means of understanding socio-economic conditions and cultural status. The common concerns identified included socio economic status of village, village history, and dependence on forest resources were surveyed by using Participatory Rural Appraisal tools such as wealth ranking, histogram, seasonal calendar, resources map, village map, semi-structural interview (SSI), key informants interviews and group discussions.

4. Forest Resources Assessment

4.1 Classification on different forest conditions

The study area is located in compartment No (2) of Nyaung Htauk Reserved Forest situated in Nawngkhio Township, Kyaukme District in the Northern Shan State of Myanmar. Near the project area, there is one village named as Nyaung Htauk village and local community of this village depends on forest resources not only for their basic needs but also for their alternative source of income. Primarily, the type of forest had been moist upper mixed deciduous forest type (MUMD). According to Kermodé (1964), this forest is unique because of its composition by commercially important timber species such as Teak (*Tectona grandis*) and Pyinkado (*Xylia xylocarpa*) in Myanmar.

Until about 1988, the study area was endowed with high productive moist upper mixed deciduous forests so there had been legal logging and timber extraction as well as illegal logging. Moreover, fuelwood collection by local people not only for their subsistent needs but also for their livelihoods was also one of the major drivers for deforestation and forest degradation for that area.

Nowadays, primary moist deciduous forest type could be found only sparsely in the study area. Around the Nyaung Htauk village in the project area, primary forests were found as local communities have been conserving these forests by their traditional knowledge since 200 years ago. **The area of these primary natural forests is about 30 hectares.** In terms of local classification on these primary forests, they can be found as natural forests conserved in spiritual belief, natural forests conserved for water spring sources and natural forests conserved by monasteries.



Natural forest conserved in spiritual belief



Natural forest conserved for water resources

Another forest classification is **fallow land affected by shifting cultivation and this area was counted as 1200 hectares.**



Natural regeneration in fallow land

There are 140 hectares of about 7-year-old private teak plantation and 20 hectares of pine plantation which was established in 2013 by Forest Department near the project area.



Private teak plantation



Departmental pine plantation established in 2013

The resident area of the village is about 42 hectares. There are TOF (trees outside the forests) traditionally practiced by some households in the village growing together with perennial and annual crop trees as home garden. The sedentary private farm, found in the land at the disposal, cover the area of about 607 hectares and crops which the local people usually grow are maize, peanut, sesame and sometimes paddy. All of the crops grown are annual agricultural crop and people are used to use chemical fertilizers with the aim of increasing productivity of the annual crops such as high-yield variety of maize.



Home garden in the village



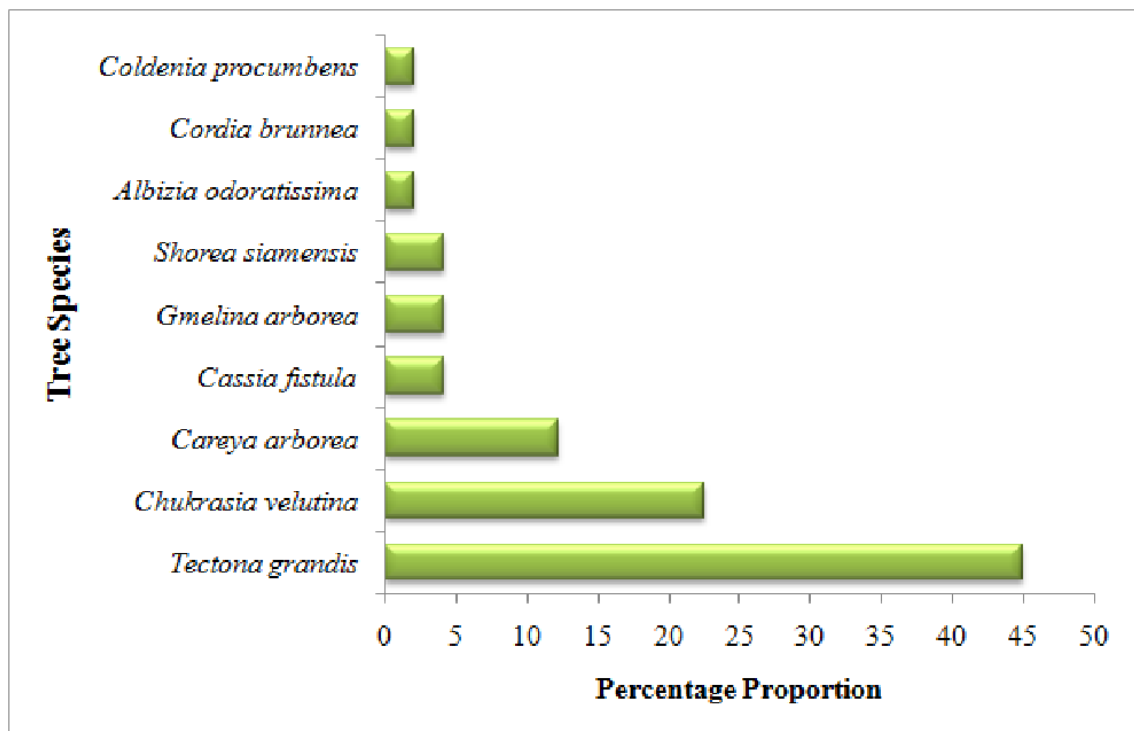
Sedentary farm outside the reserved forest

4.2 Assessment on Stand Inventory

4.2.1 Forest Resources in primary natural forest

Forest type of primary natural forest is moist deciduous forest type in terms of Myanmar forest classification. For the current assessment of this primary forest, teak (*Tectona grandis*)

was found having the highest proportion though the species composition was not high enough to be typical moist deciduous forest. The following graph show the percentage of tree species composition which was found in primary natural forest.



Percentage of each tree species composition in primary forest

The following table shows mean diameter at breast height (in centimeter) and mean top height (in meter) for each tree species in the primary forest.

Table 2. Mean DBH (cm) and mean height (m) for each tree species in the primary forest

No.	Scientific Name	Local Name	Family	Mean DBH (cm)	Mean Height (m)
1	<i>Gmelina arborea</i>	Yamanae	Verbenaceae	27.22	22.10
2	<i>Careya arborea</i>	Bantbwe	Lecythidaceae	19.68	18.47
3	<i>Tectona grandis</i>	Teak	Verbenaceae	19.34	15.04
4	<i>Cordia brunnea</i>	Taungthanut	Boraginaceae	13.69	12.19
5	<i>Cassia fistula</i>	Ngu	Caesalpiniaceae	13.37	9.14
6	<i>Chukrasia velutina</i>	Yinma	Meliaceae	11.55	11.72
7	<i>Albizia odoratissima</i>	Taungmagyi	Mimosaceae	11.14	8.23
8	<i>Coldenia procumbens</i>	Tanktaelattwa	Boraginaceae	11.14	10.67
9	<i>Shorea siamensis</i>	Ingyin	Dipterocarpaceae	10.50	6.10
All Species				16.85	14.09

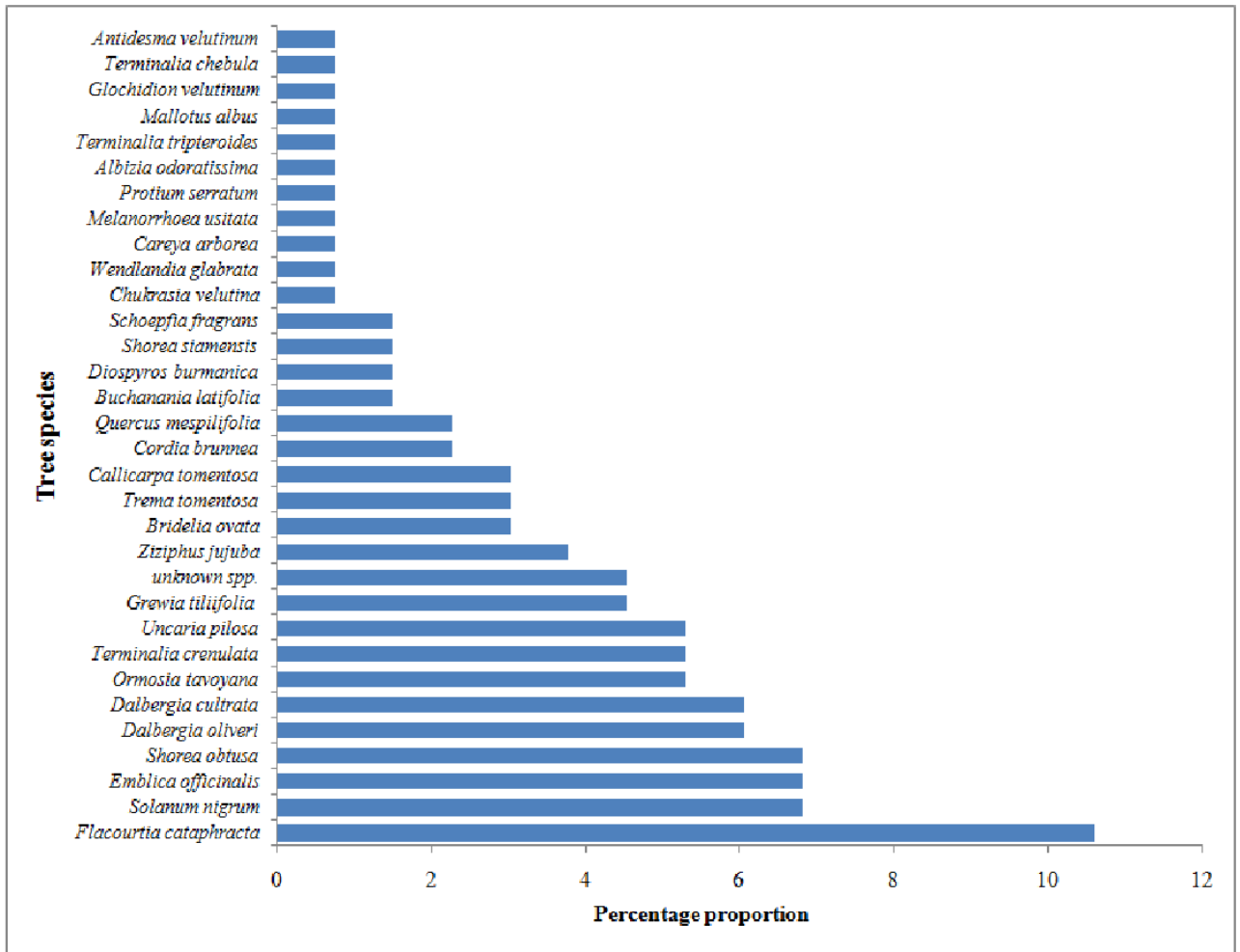
Although the primary forest has been managed traditionally since long time ago, the MAI (mean annual increment) of the tree species are seemed to be lower than the normal increment. One of the reasons for this case is that any proper silvicultural treatment such as thinning and other improvement activities has not yet been done, and consequently trees were congested in the forest leading to be slow their increment. In addition, it may lead to hinder the survival of the new regeneration. Number of tree species and their respective families were also in limited numbers though the number of tree individuals per hectare was found as 1225 individuals/ha.

Some part of primary forests have larger amount of underground vegetation where the tree crowns are open enough for sunlight but where the crowns are touched closely each other, the regeneration of underground vegetation becomes less.

4.2.2 Forest Resources in fallow land

The formerly primary forests had been degraded because of the practice of shifting cultivation by local people. Shifting cultivation means farming or practicing agricultural systems in which land under natural vegetation is cleared, planted agricultural crops for a few years, and then untended while the natural vegetation regenerated. The clearing of the land is conducted by the slash-and-burn method. The fallow period is the time leaving the shifting cultivated areas to become forest naturally again. With the passage of time and the rapidly growing population, that fallow period became shorter and shorter from 10 years primarily to 4 years in 2004. Starting from 2004, there was no fallow period. The reasons are increasing population and limited areas of land for agricultural practices, industrialization of agriculture, no alternative livelihood option and lack of extension program for systematic agriculture and income generation.

In this project area, these fallow lands are still young forest meaning that natural vegetation had regenerated within a few years ago. The species composition had changed from primary forests as some of the key species disappeared and later by, the forests had been degraded. The soil quality of the forest had reduced because of the effect of chemical fertilizer application for crops, lack of tree cover leading to soil erosion, decreasing water retention period of the soil due to sparse of trees and lack of fallow period due to increasing population in that area.



Percentage proportion of each tree species composed in secondary forest

The mean height of all tree species in the fallow land was 2.84 m while that of primary forest was 16.85 m. The mean diameter at breast height of all tree species in the fallow land was 4.51cm but that of primary forest was found as 14.09 cm.

Table 3. Mean DBH (cm) and mean height (m) for each tree species in the secondary forest

No.	Scientific Name	Local Name	Family	Height (m)	DBH (cm)
1	<i>Flacourtia cataphracta</i>	Naywe	Flacourtiaceae	3.83	4.74
2	<i>Chukrasia velutina</i>	Yinma	Meliaceae	1.83	4.04
3	<i>Ormosia tavoyana</i>	Talchin	Fabaceae	2.61	4.27
4	<i>Terminalia crenulata</i>	Htaukkyan	Combretaceae	2.74	4.39
5	<i>Buchanania latifolia</i>	Lunbo	Anacardiaceae	2.59	6.06
6	<i>Diospyros burmanica</i>	Tae	Ebenaceae	2.90	5.66
7	<i>Cordia brunnea</i>	Taungthanut	Boraginaceae	2.34	3.50
8	<i>Uncaria pilosa</i>	Kyettet	Rubiaceae	2.26	3.70
9	<i>Bridelia ovata</i>	Seikche	Euphorbiaceae	2.74	4.85
10	<i>Dalbergia oliveri</i>	Tamalan	Fabaceae	2.63	4.55
11	<i>Wendlandia glabrata</i>	Thitni	Rubiaceae	1.83	2.43
12	<i>Solanum nigrum</i>	Baungkalon	Solanaceae	2.40	4.58
13	<i>Quercus mespilifolia</i>	Yinku	Fagaceae	3.25	5.39
14	<i>Embllica officinalis</i>	Ziphyu	Euphorbiaceae	3.08	4.31
15	<i>Dalbergia cultrata</i>	Yinteikphyu	Fabaceae	3.66	4.55
16	<i>Shorea obtusa</i>	Thitya	Dipterocarpaceae	1.93	4.49
17	<i>Ziziphus jujuba</i>	Zi	Rhamnaceae	3.96	5.17
18	<i>Shorea siamensis</i>	Ingyin	Dipterocarpaceae	1.68	3.23
19	<i>Trema tomentosa</i>	Kywotsar	Ulmaceae	2.59	5.26
20	<i>Careya arborea</i>	Banbwe	Lecythidaceae	2.13	3.23
21	<i>Melanorrhoea usitata</i>	Thitsi	Anacardiaceae	1.52	4.85
22	<i>Protium serratum</i>	Kadi	Burseraceae	2.13	2.43
23	<i>Grewia tiliifolia</i>	Tayaw	Tiliaceae	3.15	4.31
24	<i>Callicarpa tomentosa</i>	Paepokegyi	Verbenaceae	2.67	4.45
25	<i>Schoepfia fragrans</i>	Daukyet	Olacaceae	2.74	5.26
26	<i>Albizia odoratissima</i>	Taungmagyi	Mimosaceae	2.44	4.04
27	<i>Terminalia tripteroides</i>	Thanpay	Combretaceae	3.66	4.85
28	<i>Mallotus albus</i>	Phatwine	Euphorbiaceae	3.05	4.85
29	<i>Glochidion velutinum</i>	Busok	Euphorbiaceae	2.13	4.04
30	<i>Terminalia chebula</i>	Phankhar	Combretaceae	3.05	5.66
31	<i>Antidesma velutinum</i>	Kanpalin	Euphorbiaceae	2.13	4.85
All Species				2.84	4.51

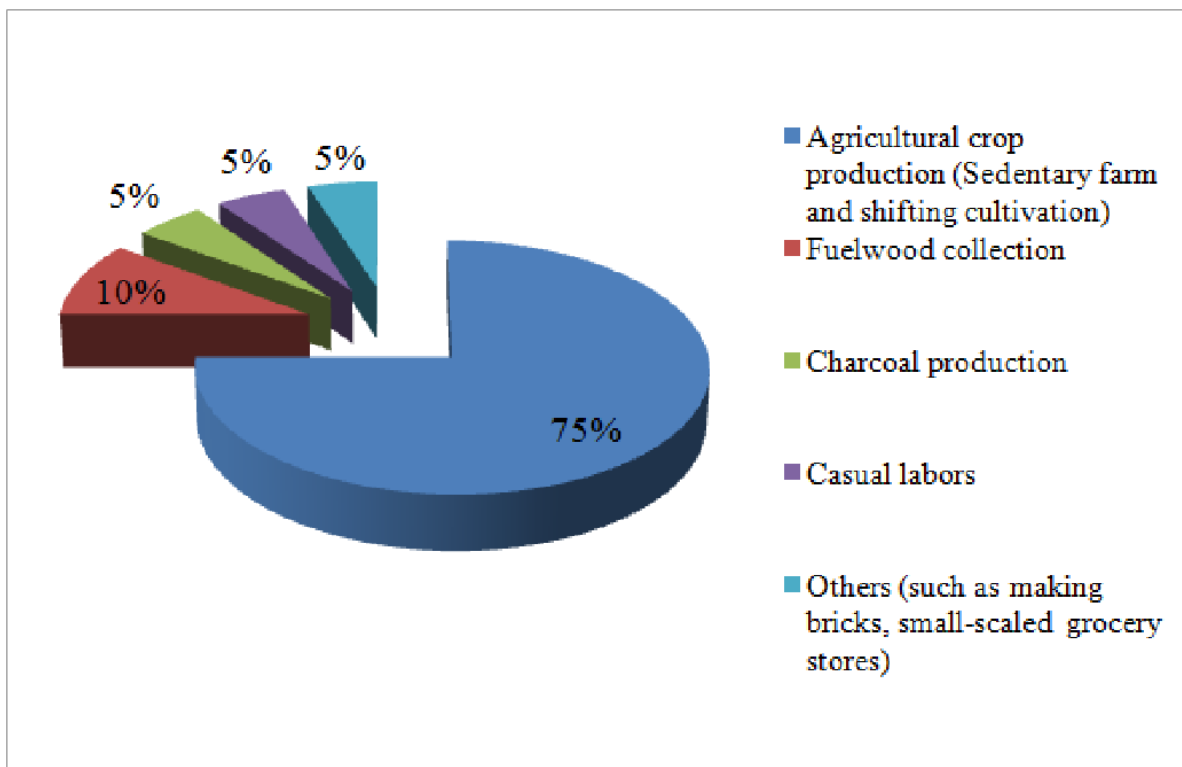
5. Assessment on socio-economic condition

5.1 Basic information about the village

The location of the project area is near a village named Nyaung Htauk Village and local people living in this village depend on the nearby forests for their subsistence needs as well as for their livelihoods. The number of households in this village is 219 having population of about 800. Ethnic of almost all of the people are Danu which is one races of Shan tribes in Myanmar and the major religion is Buddhism. The literacy rate is rather low because there is no graduated person although people who finished their high school education can be found in a limited number. Currently, there is only a middle school in this village established while it was only a basic primary school last over 10 years ago.

5.2 Livelihood patterns of the village

Different livelihood patterns and percentage of sources of income from each pattern of the local community in the project area is roughly drawn as shown in the following diagram.



Among the households in the village, 57 % are poor in economic status and possessing the lowest cultivable lands and some are landless people. The main livelihood patterns of this village are Ya (one of agricultural practices in sedentary farms) and shifting cultivation (clearing natural forests and planting annual crops). Among all households, about 80 households possess sedentary land and each household has about 1 to 5 hectares respectively.

Therefore, they encroach natural forests to practice shifting cultivation and this is also one of the livelihood options for local people as well as one of the drivers to deforestation. The main crops growing in those lands are annual crops such as groundnut, sesame, paddy and maize. Some households, without having cultivated land, work as casual labors in others' lands, carpenter and collect firewood from the nearby forest.

5.3 Water Supply and energy sources

Around the village, there are primary forests conserved for water spring sources by their traditional knowledge. In this context, there are two forms of water supply for their village; from water ponds in the natural forests and from wells dug artificially by villagers in the village campus.



Water supply in the primary natural forest

All of the households use charcoal and firewood as energy for cooking and for some cottage industries such as making bricks because there is no electricity supply for their village. They usually collect those firewoods from the nearby forests and as a result, collecting fuelwood and making charcoal is one of the main threats of degrading natural forests and deforestation. Local people usually practice collecting fuelwood from the forests for their alternative income during off-farm seasons.

6. Conclusions

Although there are certain amounts of natural forests remaining nearby the project areas, the primary forests are fragmented as shifting cultivation is being practiced in some areas. As a result, some parts of primary forests had been affected by anthropogenic disturbances and secondary forests became established after abandoning shifting cultivation practices and as result of over-exploitation of fuelwood. In this context, it is inevitably necessary to

rehabilitate these degraded secondary forests and the most viable approach should be community based forest management. The proposed methodology is community forestry which would be designed by different agroforestry designs and, by this mean, local people would participate in this effort and then they would have alternative livelihood pattern in place of shifting cultivation.

7. References

FAO, 2007: Brief on national forest inventory NfI, Myanmar, MAR-SFM Working Paper 23/2007, Rome. 18p

FRA WP 126, 2006: Country report on bamboo resources in Myanmar, Food and Agriculture Organization of the United Nations, Rome. 32p

Kermode, C. W. D., 1964: Some aspects of Silviculture in Burma. Central Press, Rangoon, Burma. 168p

MOECAAF, 2011; Forestry in Myanmar, Ministry of Environmental Conservation and Forestry, Nay Pyi Taw, Myanmar. 56p

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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)

**Baseline Inventory for Forest Land Uses in Puwen
Project Site**

Yunnan Academy of Forestry

Kunming Yunnan, China

Oct.2013

1. Land uses surveyed

Six types of typical degraded forest land uses from the project site have been selected for the investigation based on previous interviews and field survey, which are *Pinus caribaea* 加勒比松 plantation , rubber plantation, *Mytilaria laosensis* 米老排 (壳菜果) + *Choerospondias axillaris* 南酸枣 mixed plantation , *Parashorea chinensis* 望天树 + *Pometia tomentosa* 绒毛番龙眼 mixed plantation , *Betula alnoides* 沉香 plantation and Dai homegarden.

2. Methodology for the investigation

(1) Forest stand volume and biomass 蓄积量与生物量

Tree DBH and height were determined in the sample plots with size 20×20m and individual plant volume was calculated according to binary volume formula (二元材积方程式) while individual plant biomass was calculated by plant regression equation built by Xishuangbanna Tropical Botanical Garden (CAS), Chinese Academy of Forestry, Yunnan Academy of Forestry. The volume and biomass of tree layer was made by individual numerical accumulation.

(2) Biodiversity

Quadrat sampling method is used. Size of sample plots : 20×20m for tree (including rattan) , 5 m×5 m for shrubs, 1 m×1 m for herb plants. Three repetitions were made for different plots except for degraded secondary forest (only one for this type). The indicators are the species for different trees, shrubs, herbs, rattans, numbers of individual plant or clusters and coverage degree etc. The species richness of each forest type and their Shannon-Wiener index and Simpson index were calculated as below:

a. Species richness (S): all species in the samples

b. Shannon-Wiener index (H')

$$H' = - \sum_{i=1}^n P_i \ln P_i ; P_i = n_i / N$$

n_i is the individual number of i species while N is the sum of all individual species number in the same level.

c. Simpson index (D)

$$D = 1 / \sum P_i^2$$

(3) Soil

Soil profile was made for each type of sample plot and soil was collected from different layer (0~30cm, 30~60cm). Each stand soil at the same layer was mixed as a sample by cutting ring tube. The indicators for the test were soil bulk density; soil organic matter content, total nitrogen, effective nitrogen, effective phosphorus (磷) and potassium (钾). The fixed C in each stand soil was calculated through organic matter and soil bulk density. The formula for the calculation as below:

Soil C density = soil volume × soil bulk density × soil organic matter content ÷ 1.724.

3. Results

3.1 Typical degraded secondary forest land

The target for the investigation is a typical degraded secondary forest mainly with *Wendlandia uvariifolia* 疏毛水锦树, *Castanopsis echidnocarpa* 短刺栲, *Phyllanthus emblica* 余甘子, which is moonsoon evergreen broad leaved forest, it is natural regeneration forest after degradation and a typical forest stand in project site.

(1) Growth index

There are 850 individual tree plants and DBH are big more than 5cm, average DBH is 6.8cm, tree height is 7.2m and the volume recovery is very low.

(2) Species diversity

Twenty-seven tree species from the sampling plots are recoded, of which 11 are shrubs, 14 herbs and 5 species are interlayer plants (see table 1).

Species diversity index in the sampling plots showed relatively higher level, of which Shannon-Wiener index (香农-威纳指数) was 3.03, Simpson index was 0.94 in tree layer, Shannon-Wiener index was 2.28, Simpson index was 0.89 in shrub layer, Shannon-Wiener index was 2.41 and Simpson index was 0.88 at herb layer (see table 18).

Table 1 Name list of tree species in the typical degraded secondary plots

Tree layer:27species, coverage degree 70%~80%.

Chinesename	Latin name	Chinese name	Latin name
岗稔	<i>Eurya groffii</i>	中平树	<i>Macaranga denticulata</i>
水锦树	<i>Wendlandia uvariifolia</i>	合果木	<i>Paramichelia baillonii</i>
银柴	<i>Aporosa dioica</i>	小叶滇越杜英	<i>Elaeocarpus poilanei</i>
山黄麻	<i>Trema tomentosa</i>	五月茶	<i>Antidesma bunius</i>
银叶栲	<i>Castanopsis argyrophylla</i>	毛叶八角枫	<i>Alangium kurzii</i>
短刺栲	<i>Castanopsis echidnocarpa</i>	红梗润楠	<i>Machilus rufipes</i>
云南黄杞	<i>Engelhardtia spicata</i>	槟榔青	<i>Spondias pinnata</i>
茶梨	<i>Anneslea fragrans</i>	野漆	<i>Toxicodendron succedaneum</i>
毛桐	<i>Mallotus barbatus</i>	幌伞枫	<i>Heteropanax fragrans</i>
余甘子	<i>Phyllanthus emblica</i>	川楝	<i>Melia toosendan</i>
象鼻藤	<i>Dalbergia mimosoides</i>	红花木樨榄	<i>Olea rosea</i>
黑黄檀	<i>Dalbergia fusca</i>	榕树	<i>Ficus sp.</i>
虎刺榕木	<i>Aralia armata</i>	黄豆树	<i>Albizia procera</i>
披针叶楠	<i>Phoebe lanceolata</i>		

Shrub layer: 11species, coverage degree 30%~40%.

Chinesename	Latin name	Chinese name	Latin name
密花树	<i>Rapanea neriifolia</i>	鹅掌柴	<i>Schefflera octophylla</i>
思茅蒲桃	<i>Syzygium szemaoense</i>	裂果金花	<i>Schizomussaenda dehiscentis</i>
猪肚木	<i>Canthium horridum</i>	银叶巴豆	<i>Croton cascarilloides</i>
毛叶算盘子	<i>Glochidion hirsutum</i>	地桃花	<i>Urena lobata</i>
毛叶木姜子	<i>Litsea mollis</i>	葫芦茶	<i>Tadehagi triquetrum</i>
玉叶金花	<i>Mussaenda simpliciloba</i>		

Grass layer: 14species, coverage degree 40%~50%

Chinesename	Latin name	Chinese name	Latin name
斑鸠菊	<i>Vernonia esculenta</i>	飞机草	<i>Chromolaena odoratum</i>
海金沙	<i>Lygodium japonicum</i>	黑面神	<i>Breynia fruticosa</i>
刚莠草	<i>Microstegium ciliatum</i>	山菅兰	<i>Dianella ensifolia</i>
苦竹	<i>Pleioblastus amarus</i>	紫茎泽兰	<i>Ageratina adenophora</i>
双花耳草	<i>Hedyotis biflora</i>	大叶千斤拔	<i>Flemingia macrophylla</i>
山稗子	<i>Carex baccans</i>	肿柄菊	<i>Tithonia diversifolia</i>
闭鞘姜	<i>Costus speciosus</i>	叶下珠	<i>Phyllanthus urinaria</i>

Interlayer plants: 5 species

Chinesename	Latin name	Chinese name	Latin name
桐叶千金藤	<i>Stephania hernandifolia</i>	粉背菝葜	<i>Smilax hypoglauca</i>
白花酸藤子	<i>Embelia ribes</i>	椭圆悬钩子	<i>Rubus ellipticus</i>
黄独	<i>Dioscorea bulbifera</i>		

(3) Forest soil

Table 2 Soil analysis for degraded secondary forest

	Depth /cm	Bulk density /g·cm ⁻³	Organic matter /g·kg ⁻¹	Total nitrogen /g·kg ⁻¹	Effective nitrogen/mg ·kg ⁻¹	Effective phosphours /mg·kg ⁻¹	Effective potassium /mg·kg ⁻¹	Soil carbon density/ t.hm ⁻²
Degreded secondary forest	0~30	1.18	26.65	1.03	103.32	1.75	84.12	84.3
	30~60	1.27	13.39	0.533	56.13	0.72	49.12	

Soil nutrient of degraded secondary forest see table. The organic matter content of surface soil is 26.65 g/kg, ranking grade 3 according to the grading system of the national standard for the second census of soil, the effective nitrogen is grade 3, the effective potassium is grade 4 and the effective phosphorus is grade 6 and very low. The result shows that the land is lack of phosphorus. The soil carbon density is 84.3 t/hm² at the depth of 60cm.

3.2 *Pinus caribaea* plantation

Pinus caribaea plantation forest was introduced and planted in monsoon evergreen broadleaved forest cutting site in 1983, which is overmatured forest now.

(1) Growth index

At present, the preservation of the Caribbean pine density is 1232 plants/ hm², average DBH is 21.9 cm, the average tree height is 18.5 m, volume is 413.1 m³ / hm², Caribbean pine biomass is 246.7 t/ hm², conversion of carbon density is 119.4 t/ hm² (see table 3).

Table 3 Growth index of *Pinus caribaea* plantation forest

Type	age	density /plant.h m ⁻²	Average DBH/ cm	Average tree height/m	volume/ m ³ .hm ⁻²	Biomass/ t.hm ⁻²	Plant carbon density/ t.hm ⁻²
<i>Pinus caribaea</i> plantation forest	30	1232	21.9	18.5	413.1	246.7	119.4

(2) Species diversity

19 tree species, 5 shrubs, 16 herbs and 3 interlayer plants are recoded from the 3 plots of *Pinus caribaea* plantation forest, see table 4.

Diversity index shows that in tree layer Shannon-Wiener index is 2.71, Simpson index is 0.91, in shrub layer the Shannon-Wiener index is 1.52, Simpson index is 0.77, in herb layer the Shannon-Wiener index is 2.69, Simpson index is 0.77.

Table 4 Name list of plant Species in the plots of *Pinus caribaea* plantation forest

Tree layer: 19species, coverage degree 80%~90%

Chinese name	Latin name	Sample plot 1	Plot 2	Plot 3
加勒比松	<i>Pinus caribaea</i>	+	+	+
盐肤木	<i>Rhus chinensis</i>	+	+	+
岗桉	<i>Eurya groffii</i>	+	+	+
银柴	<i>Aporosa dioica</i>	+	+	+
水锦树	<i>Wendlandia uvariifolia</i>	+	+	+
红木荷	<i>Schima wallichii</i>	+	+	+
野漆	<i>Toxicodendron succedaneum</i>	+		+
杜茎山	<i>Maesa japonica</i>	+	+	+
银叶栲	<i>Castanopsis argyrophylla</i>	+		
粗穗石栎	<i>Lithocarpus grandifolius</i>	+	+	+
余甘子	<i>Phyllanthus emblica</i>	+	+	+

山黄麻	<i>Trema tomentosa</i>	+	+	+
刺栲	<i>Castanopsis hystrix</i>	+		
短刺栲	<i>Castanopsis echidnocarpa</i>	+	+	
中平树	<i>Macaranga denticulata</i>	+	+	+
云南黄杞	<i>Engelhardtia spicata</i>		+	+
毛桐	<i>Mallotus barbatus</i>		+	
茶梨	<i>Anneslea fragrans</i>		+	+
鸡嗉子果	<i>Ficus semicordata</i>		+	

Shrub layer: 5 species, coverage degree 20%~30%

Chinese name	Latin name	Plot 1	Plot 2	Plot 3
地桃花	<i>Urena lobata</i>	+	+	+
毛叶算盘子	<i>Glochidion hirsutum</i>	+	+	+
密花树	<i>Rapanea neriifolia</i>	+		+
玉叶金花	<i>Mussaenda simpliciloba</i>		+	+
葫芦茶	<i>Tadehagi triquetrum</i>			+

Herb layer: 16species , coverage degree 20%~30%

Chinese name	Latin name	Plot 1	Plot 2	Plot 3
飞机草	<i>Chromolaena odoratum</i>	+	+	+
紫茎泽兰	<i>Ageratina adenophora</i>	+	+	+
芒萁	<i>Dicranopteris linearis</i>	+	+	+
斑鸠菊	<i>Vernonia esculenta</i>	+		
山稗子	<i>Carex baccans</i>	+	+	+
闭鞘姜	<i>Costus speciosus</i>	+	+	+
鱼眼草	<i>Dichrocephala integrifolia</i>	+		+
大叶千斤拔	<i>Flemingia macrophylla</i>	+	+	+
黑面神	<i>Breynia fruticosa</i>	+		+
排线草	<i>Phyllodium pulchellum</i>	+	+	
滇玉凤花	<i>Habenaria tienensis</i>	+		+
小蓬草	<i>Conyza canadensis</i>	+	+	+
海金沙	<i>Spora Lygodii</i>		+	+
多花野牡丹	<i>Melastoma affine</i>		+	+
山菅兰	<i>Dianella ensifolia</i>		+	
凤尾蕨	<i>Pteris cretica</i>		+	+

Interlayer plant: 3species

Chinese name	Latine name	Plot 1	Plot 2	Plot 3
白花酸藤子	<i>Embelia ribes</i>	+	+	+
粉背菝葜	<i>Smilax hypoglauca</i>	+	+	+
桐叶千金藤	<i>Stephania hernandifolia</i>		+	

Note: + means the species can be found in the plot

(3) Forest soil

The soil nutrient in *Pinus caribaea* plantation forest see table 5. The organic matter content of surface soil is 28.18 g/kg, ranking grade 3 according to the grading system of the national standard for the second census of soil, the soil fertility declines since long time artificial plantation. The effective nitrogen is grade 3, the effective potassium is grade 4 and the effective phosphorus is grade 6. The soil carbon density is 89.9 t/hm² at the depth of 60cm.

Table 5 Soil analysis of *Pinus caribaea* plantation forest

Vegetation type	Depth /cm	Bulk density /g·cm ⁻³	Organic matter /g·kg ⁻¹	Total nitrogen /g·kg ⁻¹	Effective nitrogen/mg·kg ⁻¹	Effective phosphorus /mg·kg ⁻¹	Effective potassium /mg·kg ⁻¹	Soil organic carbon density/t.hm ⁻²
Pinus caribaea plantation forest	0~30	1.22	28.18	1.349	102.45	1.24	78.22	89.9
	30~60	1.23	14.07	0.576	48.76	0.68	88.33	

3.3 Rubber plantation

The rubber plantation was planted in 2005. At present it is mid-maturation forest stage and at the age of rubber tapping, but not starting yet.

(1) Growth index

There are 450 rubber trees/hm², average DBH is 11.0cm, average tree height is 9.5m and the volume is 19.7 m³/hm², the biomass is 19.1 t/hm², conversion of carbon density is 9.2 t/hm² (see table 6).

Table 6 Growth index of rubber plantation

Type	age	density /plant.h m ⁻²	Average age DBH/cm	Average tree height/m	volume/ m ³ .hm ⁻²	Biomass s/t.hm ⁻²	Stand carbon density/t.hm ⁻²
Rubber plantation	8	450	11.0	9.5	19.7	19.1	9.2

(2) Species diversity

190 tree species, 10 shrubs, 13 herbs and 5 interlayer plants are recorded from the 3 plots of Rubber tree plantation forest, see table 7.

Diversity index shows that the species diversity is relative lower compare with other plantation forest. In tree layer Shannon-Wiener index is 1.68, Simpson index is 0.69, in shrub layer the

Shannon-Wiener index is 2.25, Simpson index is 0.89, in herb layer the Shannon-Wiener index is 2.29, Simpson index is 0.87.

Table 7 Name list of plant species in Rubber plantation plots

Tree layer: 12species, coverage degree 60%~70%				
Chinese name	Latin name	Plot 1	Plot 2	Plot 3
橡胶	<i>Hevea brasiliensis</i>	+	+	+
红木荷	<i>Schima wallichii</i>	+		+
水锦树	<i>Wendlandia tinctoria</i>	+	+	
野桐	<i>Mallotus barbatus</i>	+		
思茅蒲桃	<i>Syzygium szemaoense</i>	+		
虎刺楸木	<i>Aralia armata</i>	+		
小叶灯台树	<i>Alstonia scholaris</i>		+	+
银柴	<i>Aporusa octandra</i>		+	
云树	<i>Garcinia cowa</i>			+
披针叶楠	<i>Phoebe lanceolata</i>			+
茶梨	<i>Anneslea fragrans</i>			+
Shrub layer: 10species, coverage degree 20%~30%.				
Chinese name	Latin name	Plot 1	Plot 2	Plot 3
象鼻藤	<i>Dalbergia pinnata</i>	+	+	
多花野牡丹	<i>Medinilla polyanthum</i>	+	+	+
地桃花	<i>Urena lobata</i>	+	+	+
酸藤子	<i>Embelia ribes</i>	+	+	+
玉叶金花	<i>Mussaenda pubescens</i>	+	+	
银叶巴豆	<i>Croton cascarilloides</i>	+		
光叶算盘子	<i>Glochidion lanceolarium</i>	+		
单叶密菜萸	<i>Melicope simplicifolia</i>	+		
金毛榕	<i>Ficus chrysocarpa</i>		+	+
合欢一种	<i>Albizia sp.</i>		+	
扁担杆	<i>Grewia celtidifolia</i>			+
Herb layer: 13species, coverage degree 50%~60%.				
Chinese name	Latin name	Plot 1	Plot 2	Plot 3
山蚂蝗	<i>Nicolsonia triflora</i>	+	+	+
叶下珠	<i>Phyllanthus urinaria</i>	+	+	+
白茅	<i>Bletilla striata</i>	+	+	
粽叶芦	<i>Thysanolaena maxima</i>	+	+	
短叶黍	<i>Panicum brevifolium</i>	+	+	+

耳草	<i>Hedyotis biflora</i>	+	+	+
飞机草	<i>Eupatorium odoratum</i>	+	+	+
香清	<i>Anaphalis sp.</i>	+	+	+
千里光	<i>Cissampelopsis araneosus</i>		+	
芒萁	<i>Dicranopteris linearis</i>		+	
皱叶狗尾草	<i>Setaria plicata</i>		+	
山芝麻	<i>Helicteres angustifolia</i>			+
鬼针草	<i>Bidens pilosa</i>			+

Interlayer plant: 5species

Chinese name	Latin name	Plot 1	Plot 2	Plot 3
五叶薯蓣	<i>Dioscorea pentaphylla</i>	+	+	
椭圆悬钩子	<i>Rubus ellipticus</i>	+	+	+
粉背菝葜	<i>Smilax hypoglauca</i>	+		
鸡血藤	<i>Millettia pulchra</i>		+	
钩藤	<i>Piricampylus glaucus</i>			+

(3) Forest soil

Soil nutrient of degraded secondary forest see table 8. The organic matter content of surface soil is 22.45 g/kg, ranking grade 3 according to the grading system of the national standard for the second census of soil, the effective nitrogen is grade 3, the effective potassium is grade 4 and the effective phosphorus is grade 6. The soil carbon density is 75.03 t/hm² at the depth of 60cm. The rubber plantation is at the stage of mid-maturation, the soil nutrient declines do not occur due to regular fertilizer. However the soil erosion happens in some rubber plantation area and soil hardening because of long time fertilizer use and rains.

Table 8 Soil analysis of Rubber plantation

Vergetation type	Depth /cm	Bulk density /g·cm ⁻³	Organic matter /g·kg ⁻¹	Total nitrogen /g·kg ⁻¹	Effective nitrogen/mg ·kg ⁻¹	Effective phosphours /mg·kg ⁻¹	Effective potassium /mg·kg ⁻¹	Soil carbon density/ t.hm ⁻²
Rubber plantation	0~30	1.24	22.45	1.133	97.59	1.45	73.88	75.0
	30~60	1.37	11.13	0.702	50.58	0.52	47.64	

3.4 *Mytilaria laosensis* and *Choerospondias axillaris* mixture plantation

Mytilaria laosensis and *Choerospondias axillaris* mixture plantation forest for 1:1 was planted in 1978 and is matured forest at present.

(1) Growth index

The density of *Mytilaria laosensis* and *Choerospondias axillaris* mixture plantation forest is 930 trees/hm², average DBH is 22.7cm, average tree height is 21.3m, the volume is 381.1 m³/hm²,

the biomass for the 2 species is 290.4t/hm², and the carbon density is 145.2 t/hm².

Table 9 Growth index of *Mytilaria laosensis* and *Choerospondias axillaris* mixture plantation forest

Type	age	density /plant.hm ⁻²	Average DBH/cm	Average tree height/m	volume/m ³ .hm ⁻²	Biomass/t.hm ⁻²	Stand carbon density / t.hm ⁻²
<i>Mytilaria laosensis</i> and <i>Choerospondias axillaris</i> mixture plantation forest	33	930	22.7	21.3	381.1	290.4	145.2

(2) Species diversity

10 tree species, 5 shrubs, 11 herbs and 3 interlayer plants are recoded from the 3 plots of *Mytilaria laosensis* and *Choerospondias axillaris* mixture plantation forest, see table 10.

Diversity index shows that in tree layer Shannon-Wiener index is 1.92, Simpson index is 0.82, in shrub layer the Shannon-Wiener index is 1.58, Simpson index is 0.79, in herb layer the Shannon-Wiener index is 2.33, Simpson index is 0.90.

Table10 Name list of plant species in *Mytilaria laosensis* and *Choerospondias axillaris* mixture plantation forest

Tree layer: 10species, coverage degree>90%。

Chinese name	Latin name	Plot 1	Plot 2	Plot 3
米老排	<i>Mytilaria laosensis</i>	+	+	+
南酸枣	<i>Choerospondias axillaris</i>	+	+	+
鱼尾葵	<i>Caryota ochlandra</i>	+	+	
董棕	<i>Caryota urens</i>	+		+
肉桂	<i>Cinnamomum cassia</i>	+	+	
绒毛番龙眼	<i>Pometia tomentosa</i>	+	+	+
羯布罗香	<i>Dipterocarpus turbinatus</i>		+	+
思茅黄肉楠	<i>Actinodaphne henryi</i>		+	
披针叶楠	<i>Phoebe lanceolata</i>		+	
木奶果	<i>Baccaurea ramiflora</i>			+

Shrub layer: 5species, coverage degree 10%~20%.

Chinese name	Latine name	Plot 1	Plot 2	Plot 3
九节木	<i>Psychotria rubra</i>	+		
干花豆	<i>Fordia cauliflora</i>	+		+
金毛榕	<i>Ficus chrysocarpa</i>	+	+	
紫珠	<i>Callicarpa bodinieri</i>		+	+
玉叶金花	<i>Mussaenda simpliciloba</i>			+

Herb layer: 11species, coverage degree 10%~20%.

Chinese name	Latine name	Plot 1	Plot 2	Plot 3
柃叶	<i>Phrynium rheedei</i>	+	+	
仙茅	<i>Curculigo orchioides</i>	+	+	
山芝麻	<i>Helicteres angustifolia</i>	+	+	+
白酸脚杆	<i>Medinilla septentrionalis</i>	+		+
飞机草	<i>Chromolaena odoratum</i>	+	+	+
葵叶	<i>Piper betle</i>	+	+	+
粽叶芦	<i>Thysanolaena maxima</i>	+	+	+
皱叶狗尾草	<i>Setaria plicata</i>	+	+	+
心叶凹唇姜	<i>Boesenbergia fallax</i>	+	+	+
山稗子	<i>Carex baccans</i>	+	+	
钩藤	<i>Piricampylus glaucus</i>	+		

Interlayer plant: 3 species

Chinese name	Latin name	Plot 1	Plot 2	Plot 3
钩藤	<i>Piricampylus glaucus</i>	+	+	
思茅崖豆藤	<i>Millettia leptobotrya</i>	+	+	
粉背菝葜	<i>Smilax hypoglauca</i>	+		+
千金藤	<i>Stephania hernandifolia</i>	+		+

(3) Forest soil

Soil nutrient of *Mytilaria laosensis* and *Choerospondias axillaris* mixture plantation forest see table 11. The organic matter content of surface soil is 31.52 g/kg, ranking grade 2 according to the grading system of the national standard for the second census of soil and which shows that the soil fertility is good. Meanwhile the effective nitrogen is grade 3, the effective potassium is grade 4 and the effective phosphorus is grade 6. The soil carbon density is 90.9t/hm² at the depth of 60cm.

Table 11 soil analysis of *Mytilaria laosensis* and *Choerospondias axillaris* mixture plantation forest

Vegetation	Depth /cm	Bulk	Organic	Total	Effective	Effective	Effective	Soil carbon
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type	density /g·cm ⁻³	matter /g·kg ⁻¹	nitrogen /g·kg ⁻¹	nitrogen/mg ·kg ⁻¹	phosphours /mg·kg ⁻¹	potassium /mg·kg ⁻¹	density/ t.hm ⁻²
<i>Mytilaria laosensis</i> and <i>Choerospondias axillaris</i> mixture plantation forest	0~30	1.10	31.52	1.091	114.73	1.62	86.24
	30~60	1.26	13.92	0.635	49.83	0.56	43.83
							90.9

3.5 *Parashorea chinensis* and *Pometia tomentosa* mixed plantation

Parashorea chinensis and *Pometia tomentosa* mixed plantation forest was planted in 1979.

(1) Growth index

The density of the plantation is 876 plant/hm², average DBH is 22.0cm, tree height is 23.1m, volume is 374.6 m³/hm², the biomass is 335.1t/hm² and carbon density is 167.5t/hm², see table 12.

Table 12 Growth index of *Parashorea chinensis* and *Pometia tomentosa* mixed plantation forest

Type	age	density /plant.hm ⁻²	Average DBH/ cm	Average tree height/ m	volume/m ³ .hm ⁻²	Biomass/t.hm ⁻²	Stand carbon density / t.hm ⁻²
<i>Parashorea chinensis</i> and <i>Pometia tomentosa</i> mixed plantation forest	35	876	22.0	23.1	374.6	335.1	167.5

(2) species diversity

11 tree species, 6 shrubs, 12 herbs and 3 interlayer plants are recoded from the 3 plots of *Parashorea chinensis* and *Pometia tomentosa* mixed plantation forest, see table 13.

Diversity index shows that in tree layer Shannon-Wiener index is 1.82, Simpson index is 0.86, in shrub layer the Shannon-Wiener index is 1.78, Simpson index is 0.83, in herb layer the Shannon-Wiener index is 2.15, Simpson index is 0.86.

Table 13 Name list of plant species in *Parashorea chinensis* and *Pometia tomentosa* mixed plantation forest

Tree layer : 11species, coverage degree 90%

Chinese name	Latin name	Plot 1	Plot 2	Plot 3
望天树	<i>Parashorea chinensis</i>	+	+	+
绒毛番龙眼	<i>Pometia tomentosa</i>	+	+	+
水锦树	<i>Wendlandia tinctoria</i>	+		
中平树	<i>Macaranga denticulata</i>	+		+
幌伞枫	<i>Heteropanax fragrans</i>	+		
山黄麻	<i>Trema tomentosa</i>	+	+	
披针叶楠	<i>Phoebe lanceolata</i>		+	+
对叶榕	<i>Ficus hispida</i>		+	
红木荷	<i>Schima wallichii</i>		+	+
川楝	<i>Melia toosendan</i>			+

Shrub layer : 6species, coverage degree 20%

Chinese name	Latin name	Plot 1	Plot 2	Plot 3
地桃花	<i>Urena lobata</i>	+	+	+
山芝麻	<i>Helicteres angustifolia</i>	+	+	+
玉叶金花	<i>Mussaenda simpliciloba</i>	+		+
葫芦茶	<i>Tadehagi triquetrum</i>		+	
银叶巴豆	<i>Croton cascarilloides</i>		+	
奇叶榕	<i>Ficus heterophylla</i>			+

Herb layer: 12species , coverage degereee30%

Chinese name	Latin name	Plot 1	Plot 2	Plot 3
皱叶狗尾草	<i>Setaria plicata</i>	+	+	+
柃叶	<i>Phrynium rheedei</i>	+	+	+
双花耳草	<i>Hedyotis biflora</i>	+	+	+
仙茅	<i>Curculigo orchioides</i>	+	+	+
白酸脚杆	<i>Medinilla septentrionalis</i>	+	+	+
心叶凹唇姜	<i>Boesenbergia fallax</i>	+		
短叶黍	<i>Panicum brevifolium</i>	+	+	
穿鞘花	<i>Amischotolype hispida</i>	+	+	
萎叶	<i>Piper betle</i>		+	+
海金沙	<i>Spora Lygodii</i>		+	
泥胡菜	<i>Hemistepta lyrata</i>		+	+
云南旱蕨	<i>Pellaea yunnanensis</i>		+	+

Interlayer plant: 3species

Chinese name	Latin name	Plot 1	Plot 2	Plot 3
椭圆悬钩子	<i>Rubus ellipticus</i>	+	+	+
钩藤	<i>Piricampylus glaucus</i>	+	+	+
娃儿藤	<i>Toxocarpus atrofliculata</i>		+	

(3) Forest soil

Soil nutrient of *Parashorea chinensis* and *Pometia tomentosa* mixed plantation forest see table 14. The organic matter content of surface soil is 31.85 g/kg, ranking grade 2 according to the grading system of the national standard for the second census of soil and which shows that the soil fertility is high. Meanwhile the effective nitrogen is grade 3, the effective potassium is grade 3 and the effective phosphorus is grade 6. The soil carbon density is 92.9t/hm² at the depth of 60cm.

Table 14 soil analysis of *Parashorea chinensis* and *Pometia tomentosa* mixed plantation forest

Vergetation type	Depth /cm	Bulk density /g·cm ⁻³	Organic matter /g·kg ⁻¹	Total nitrogen /g·kg ⁻¹	Effective nitrogen/mg·kg ⁻¹	Effective phosphours /mg·kg ⁻¹	Effective potassium /mg·kg ⁻¹	Soil carbon density/t.hm ⁻²
<i>Parashorea chinensis</i> and <i>Pometia tomentosa</i> mixed plantation forest	0~30	1.12	31.85	1.312	123.32	2.23	119.25	92.9
	30~60	1.24	14.29	0.797	53.07	1.01	76.22	

3.6 *Betula alnoides* plantation

Betula alnoides, one of fast-growing timber tree species in tropical area and good used for large diameter timber cultivation. The *B. alnoides* plantation forest was planted in 2006 in degraded forest area.

(1) Growth index

The density of *Betula alnoides* plantation forest is 1245plant/hm², average DBH is 12.3cm, tree height is 9.8m, the volume is 72.7 m³/hm², biomass is 66.5t/hm², the soil carbon density is 31.9t/hm², see table 15.

Table 15 Growth index of *Betula alnoides* plantation forest

Type	age	density /plant.hm ⁻²	Average DBH/cm	Average tree height/m	volume/m ³ .hm ⁻²	Biomass/t.hm ⁻²	Stand carbon density/t.hm ⁻²
<i>Betula alnoides</i> plantation forest	7	1245	12.3	9.8	72.7	66.5	31.9

(2) species diversity

18 tree species, 11 shrubs, 12 herbs and 6 interlayer plants are recoded from the 3 plots of *Betula alnoides* plantation forest, see table 16.

Table 16 name list of plant species in *Betula alnoides* plantation forest

Tree layer: 18species, coverage degree 70%~80%				
Chinese name	Latin name	Plot 1	Plot 2	Plot 3
西南桦	<i>Betula alnoides</i>	+	+	+
云南石梓	<i>Gmelina arborea</i>	+	+	+
红木荷	<i>Schima wallichii</i>	+	+	+
红椿	<i>Toona ciliata</i>	+	+	+
南酸枣	<i>Choerospondias axillaris</i>	+	+	
盐肤木	<i>Rhus chinensis</i>	+	+	+
中平树	<i>Macaranga denticulata</i>	+	+	
披针叶楠	<i>Phoebe lanceolata</i>	+		
五瓣子楝树	<i>Decaspermum fruticosum</i>	+		
水锦树	<i>Wendlandia tinctoria</i>	+	+	
粗糠柴	<i>Mallotus philippinensis</i>	+	+	
浆果乌柏	<i>Sapium baccatum</i>	+		
奇叶榕	<i>Ficus heterophylla</i>	+		
思茅黄檀	<i>Dalbergia szemaoensis</i>	+		
潺槁木姜子	<i>Litsea glutinosa</i>		+	
思茅蒲桃	<i>Syzygium szemaoense</i>		+	+
野柿叶木姜子	<i>Litsea monopetala</i>		+	
槟榔青	<i>Spondias pinnata</i>			+
Shrub layer : 11species, coverage degree 30~40%				
Chinese	Latin	Plot 1	Plot 2	Plot 3
柴龙树	<i>Apodytes dimidiata</i>	+	+	+
钝叶黄檀	<i>Dalbergia obtusifolia</i>	+	+	
黄牛木	<i>Cratoxylon cochinchinense</i>	+	+	
大叶千斤拔	<i>Flemingia macrophylla</i>	+		+
毛八角枫	<i>Alangium kurzii</i>	+	+	
毛叶算盘子	<i>Glochidion eriocarpum</i>	+		+
象鼻藤	<i>Dalbergia pinnata</i>	+	+	+
余甘子	<i>Phyllanthus embica</i>		+	+
猪肚木	<i>Canthium horridum</i>		+	+
萝芙木	<i>Rauvelfia yunnanensis</i>		+	
白檀	<i>Symplocos paniculata</i>			+

Herb layer : 12species, coverage degree 50%~60%

Chinese name	Latin name	Plot 1	Plot 2	Plot 3
白茅	<i>Bletilla striata</i>	+	+	
虫豆	<i>Atylosia mollis</i>	+	+	+
地桃花	<i>Urena lobata</i>	+		+
短叶黍	<i>Panicum brevifolium</i>	+	+	
飞机草	<i>Eupatorium odoratum</i>	+	+	+
紫茎泽兰	<i>Ageratina adenophora</i>	+	+	+
山稗子	<i>Carex baccans</i>	+		
葫芦茶	<i>Tadehagi triquetrum</i>	+		
香清	<i>Anaphalis sp.</i>		+	
马鹿草	<i>Microstagum ciliatum</i>			+
山芝麻	<i>Helicteres angustifolia</i>			+
豆蔻	<i>Alpinia blepharocalyx</i>			+

Interlayer plant: 6species

Chinese name	Latin name	Plot 1	Plot 2	Plot 3
悬钩子	<i>Rubus ellipticus</i>	+	+	+
粉背菝葜	<i>Smilax hypoglauca</i>	+	+	+
娃儿藤	<i>Toxicarpus atrofliculata</i>	+	+	
思茅藤	<i>Epigynum auritum</i>	+		+
扁担藤	<i>Tetrastigma cruciatum</i>	+		
五叶薯蓣	<i>Dioscorea pentaphylla</i>	+		

(3) forest soil

Soil nutrient of *Betula alnoides* plantation forest see table 17.

Soil nutrient of *Betula alnoides* plantation forest see table 17. The organic matter content of surface soil is 33.07 g/kg, ranking grade 2 according to the grading system of the national standard for the second census of soil and which shows that the soil fertility is good. Meanwhile the effective nitrogen is grade 3, the effective potassium is grade 4 and the effective phosphorus is grade 6. The soil carbon density is 99.3t/hm² at the depth of 60cm.

Table 17 soil analysis of *Betula alnoides* plantation forest

Vegetation type	Depth /cm	Bulk density /g·cm ⁻³	Organic matter /g·kg ⁻¹	Total nitrogen /g·kg ⁻¹	Effective nitrogen/mg·kg ⁻¹	Effective phosphours /mg·kg ⁻¹	Effective potassium /mg·kg ⁻¹	Soil carbon density/ t.hm ⁻²
<i>Betula alnoides</i> plantation forest	0~30	1.17	33.07	1.363	119.74	2.15	97.02	99.3
	30~60	1.34	14.60	0.795	58.80	0.72	56.75	

3.7 Dai Home garden

The Dai home gardens surveyed were located in the Mangfeilong village, Puwen township, Xishuangbanna. Dai home gardens were practiced for generations believed to be productive, ecologically and culturally sustainable.

Wide range of species managed in a home garden including vegetables like *Brassica spp*, *Colocasia esculenta*, *Toona sinensis*, *Acacia intsia*, *Sauropus androgynus etc.*, fruits like *Atrocarpus heterophylla*, *Crica Papaya*, *Psidium guajava*, *Litchi chinesis* and *Musa nana etc.*, beverages like *Camellia asamica* and *Coffea Arabica*, Medicinal plants *Oroxylum indicm*, *Dioscorea zingiberensis*, *Dendrobium officinale*, *Cassia alata*, *Euphorbia antiquorum*, *Phyllanthus urinaria* and *Curcuma longa etc.*, Ornamentals like *Allium vittata*, *Agave Americana*, *Dlonix regia*, *Codiaeum variegatum*, *Murraya paniculata*, and *Hedychium chrysoleucum etc.*

Dai Homegarden canopy strata in Puwen

- ★the upper most layer : fruit trees like *Mangifera indica*, *Longan lour*
- ★medium-sized layer(4-12m): *Psidium guajava*, *Prunus persica*
- ★the lower layer(1-3m) : *Musa spp*, *Sauropus androgynus*
- ★the lowest layer(less than 1m): herbaceous vegetables and medicines.

Crop arrangement patterns:

- ★Usually a house in the center, ornamentals like Euphorbiaceae species planted along boundaries , serving as living fences.
- ★ Bamboo always clustered at the back or in a corner.
- ★ Vegetables like cabbage and beans planted on small and open patches with bananas around.
- ★ Fruits like mango, jackfruit and guava in a random mixed pattern with woody vegetables planted underneath.

It' s hard to generalize arrangement patterns. However, farmers seem know where to plant in a practical manner !

The carbon stock of Dai homegarden ranged from 76.23 to 141.07 with a mean of 99.85 Ton/ha.

Carbon Stocks by Component of Dai Homegarden in Puwen, Xishuangbanna									
Ton/Ha									
Carbon Pool	HG1	HG2	HG3	HG4	HG5	HG6	HG7	HG8	Mean (SD)
Above-ground	15.81	39.28	64.81	21.50	22.14	50.91	23.65	17.21	34.21 (18.02)
Below-ground	4.38	8.52	6.45	4.86	4.56	4.68	5.72	3.03	5.40 (1.73)

Litter	0.45	2.15	0.68	0.80	0.21	1.52	0.51	0.34	0.89 (0.70)
Soil(0-50cm)	76.33	55.90	69.13	61.55	62.00	55.45	58.58	55.64	61.82 (7.45)
Total (Vegetation +litter)	20.63	49.95	71.94	27.16	26.91	57.11	29.88	20.58	38.02 (19.17)
Total (including soil)	96.98	106.85	141.07	88.71	88.91	112.57	88.47	76.23	99.85 (20.13)

4. Review of present forest land uses

(1) Typical degraded secondary forest

The secondary forest mainly with *Wendlandia tinctoria*, *Castanopsis echidnocarpa*, *Phyllanthus embica*, is natural regeneration forest stand from zonal vegetation deterioration. The main trees are small about tree with low value and mainly use for fuel wood. The field investigation result shows that the stand has very species diversity with rich species in tree layer and shrub layer and relative high index in Shannon-Wiener and Simpson. The analysis for forest land soil nutrient illustrates that the soil fertility is poor and in degradation. In general, this type forest has certain value but very low economic value and use value, which can be the target for improvement.

Table 18 Summary table of biodiversity indicators for different types of forest stand

Type	Tree layer			Shrub layer			Herb layer			Interlayer plant
	S	H	D	S	H	D	S	H	D	S
Secondary forest	27	3.03	0.94	14	2.28	0.89	14	2.41	0.88	5
<i>Pinus caribae</i>	19	2.71	0.91	5	1.52	0.77	16	2.69	0.77	3
Rubber plantation	10	1.68	0.69	10	2.25	0.89	13	2.29	0.87	5
米老排、南酸枣	10	1.92	0.82	5	1.58	0.79	11	2.33	0.90	3
望天树、绒毛番龙眼混交林	11	1.82	0.86	6	1.78	0.83	12	2.16	0.86	3
<i>Betula alnoides</i>	18	2.71	0.92	11	2.02	0.82	12	1.87	0.76	6

Note: S. Richness; H. Shannon-Wiener index; D. Simpson index

Table 19 Summary tables for different types of related indicators

Type	age	density /plant.h m ⁻²	Average DBH/ cm	Average tree height/m	volume/ m ³ .hm ⁻²	Biomass s/t.hm ⁻²	Stand carbon density/ t.hm ⁻²	Soil carbon density / t.hm ⁻²
Secondary forest	-	850	6.8	7.2	-	-	-	84.3

<i>Pinus caribae</i>	30	1232	21.9	18.5	413.1	246.7	119.4	89.9
Rubber plantation	8	450	11.0	9.5	19.7	19.1	9.2	75.0
米老排、南酸枣人 工混交林	33	930	22.7	21.3	381.1	290.4	145.2	90.9
<i>Parashorea chinensis</i> and <i>Pometia tomentosa</i>	35	876	22.0	23.1	474.6	335.1	167.5	92.9
<i>Betula alnoides</i>	7	1245	12.3	9.8	72.7	66.5	31.9	99.3

Table 20 Summary table for Different types of forest soil nutrient index

Vergetation type	Depth /cm	Bulk density /g·cm ⁻³	Organic matter /g·kg ⁻¹	Total nitrogen /g·kg ⁻¹	Effective nitrogen/mg· kg ⁻¹	Effective phosphours /mg·kg ⁻¹	Effective potassium /mg·kg ⁻¹
Secondary forest	0~30	1.18	26.65	1.030	103.32	1.75	84.12
	30~60	1.27	13.39	0.533	56.13	0.72	49.12
<i>Pinus caribae</i>	0~30	1.22	28.18	1.349	102.45	1.24	78.22
	30~60	1.23	14.07	0.576	48.76	0.68	88.33
Rubber plantation	0~30	1.24	22.45	1.133	97.59	1.45	73.88
	30~60	1.37	11.13	0.702	50.58	0.52	47.64
<i>Mytilaria laosensis</i> + <i>Choerospondia s axillaris</i> plantation	0~30	1.1	31.52	1.091	114.73	1.62	86.24
<i>Parashorea chinensis</i> and <i>Pometia tomentosa</i> plantation	30~60	1.26	13.92	0.635	49.83	0.56	43.83
	0~30	1.12	31.85	1.312	123.32	2.23	119.25
<i>Betula alnoides</i>	30~60	1.24	14.29	0.797	53.07	1.01	76.22
	0~30	1.17	32.07	1.363	119.74	2.15	97.02
	30~60	1.34	14.60	0.795	58.80	0.72	56.75

(2) *Pinus caribae* plantation

Pinus caribae plantation forest has been planted for a long time, the stand volume is 413.1 m³/hm² and with low growth at the stage of maturation. The plantation can be harvested in the view of analysis on forest land use rate for improvement of economic benefits. Although the *P. caribae* is

a introduced tree species, its growth performance is very good when planted in Puwen. Based on the investigation on community, the results shows that there are of very high species diversity in matured *P. caribae* plantation forest, especially in tree layer lots of local native tree species regeneration can be seen there in the plots. Shannon-Wiener index and Simpson index are high with healthy forest stand, which shows good adaptability of the species. *P. caribae* plantation forest has very good ecological benefit, on one hand it has very strong carbon sequestration ability (119.4 t/ha), on the other hand it is very good for the maintenance of soil fertility and this can be seen from its long time plantation with little soil fertility decline.

In general, *P.s caribae* plantation forest now is at the maturation regeneration stage, intensification, high efficiency should be taken into account for the regeneration. To combine the good ecological and economic benefits of coniferous tree species with the local site conditions, it is suggested that native fast-growing coniferous tree species can be used for the intensive cultivation.

(3) Rubber plantation

The rubber plantation was planted in 2005 and at half-mature stage, although some of the plant can be harvested but not yet started for rubber tapping. Based on the investigation of the forest communities, it is found that the species diversity is low; especially the species are less in tree layer.

Now because of the large space and not tapping yet, the range of tending is mainly around the plants within the scope of the 1.5m, so there are a certain number of small trees, shrubs and herbaceous plants growing between the wide row spacing. Negative effects started to appear at middle-aged plantation, such as soil erosion caused by intertillage tending, soil compaction due to fertilization and decreased soil nutrient.

The problem need to be solved in rubber plantation is to increase the output, at the same time, to reduce the negative effects of the environment, and then to develop environmentally friendly rubber plantation. The species diversity could be increased by making full use of the wide row space.

(4) *Mytilaria laosensis* and *Choerospondias axillaris* mixed plantation

M. laosensis, *C. axillaris* mixed forest is an useful afforestation model explored in tropical Yunnan. The plantation surveyed is mature forest with uniform forest form and high volume, which shows strong carbon sequestration capacity and ability to maintain soil fertility. The mature mixed forest has not been thinned yet, so forest canopy density is very high, which results in relatively less species, but tree seedlings of natural regeneration and nearby plantation tree species still can be seen in the forest, the humidity in the forest is high, shrubs and herbs are mainly shade-tolerant species. There are two reasons to keep this two experimental stands. One is to be observed as experimental plantation. The other is because the trees are already very big, it can be cultivated further for big timber with a high value. The main problem of *M. laosensis*, *C. axillaris* mixed plantation at present is to realize economic output without destroying the forest and get income in short time to cover the investment. Understory cultivation can be used to explore the new method for such kind of plantation.

(5) *Parashorea chinensis* and *Pometia tomentosa* mixed plantation

Parashorea chinensis and *Pometia tomentosa* mixed plantation, as rainforest restoration experimental plantation is growing well with a high volume and uniform forest form, which shows strong carbon sink capacity and ability to maintain soil fertility. The rationality of mixing the two species are proved . Now the crown density is very high, however the seedlings of *P.a chinensis* and *P. tomentosa* still can be seen under the forest. The humidity in the forest is high, shrubs and herbs are mainly shade-tolerant species. *P.a chinensis* and *P. tomentosa* mixed forest, as rainforest restoration experimental forest, still need to be kept and observed. The main problem is its economic output is low , how to increase economic output without destroying the forest is a challenge for the project.

(6) *Betula alnoides* plantation forest

Betula alnoides is a local fast-growing precious timber species in tropical Yunnan, and planted in a large area in tropical Yunnan. Although the age for *B. alnoides* plantation investigated is relatively young, but high growth index and good ecological effects already observed. Species survey also find out that middle-aged *B. alnoides* plantation has high species diversity, natural regeneration of the species is high, shrub layer and herb layer are more developed. And it has many interlayer plants. Soil nutrient indexes surveyed also show that *B. alnoides* plantation has high soil nutrients with good soil fertility marinating function, which fully demonstrates the main characteristics of native tree species. For the plantation of *B. alnoides* cultivated for large diameter wood, the main problem is how to generate economic income and compensate the input in forest land before final logging.

(7) Dai home garden

Because the commercialization and modernization of the local communities ,the following observations of the Daihomegarden were gained from the survey.

- ★ Size becoming smaller from around 0.2-0.3 ha in 2000 to 0.1ha or less now in Puwen
- ★ Going towards more commercial production, less species managed
- ★ Willingness to maintain traditional homegarden is decreasing

Measures should be taken to make the traditional production system more economically competitive, so that the locals will be willing to maintain home garden.

*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 Forest Assessment of Dehong Site

Yunnan Academy of Forestry

Kunming Yunnan, China

June.2013

1 The general forest situation in Dehong Prefecture

Dehong prefecture is situated in Yunnan Province, southwest of China. Its geographical location is between $23^{\circ} 50' \sim 25^{\circ} 20'$ north latitude and $97^{\circ} 31' \sim 98^{\circ} 43'$ east longitude, sharing border with Myanmar in southwest part. It has the typical semi-evergreen monsoon rainforest of China with south subtropical monsoonal climate and rich biodiversity. 6,032 advanced plant species belong to 1,886 genus and 318 families distributed in Dehong prefecture, 159 species of them are protected species on national or provincial level such as *Taxus chinensis*, *Taiwania flousiana*, *Shorea assamica*, *Dipterocarpus turbinatus*, *Platynerium bifurcatum* etc.

The forest coverage of Dehong prefecture is 67.07 %, is much higher than the average forest cover rate in Yunnan province or nationwide. As other provinces, the natural forest in Dehong prefecture ever been heavily destroyed since the PRC was built, due to the huge demand of natural resources to speed up the national development. In the past decades of years, in order to protect ecological environment and recover vegetation, Chinese government carried out a series of measures to enhance the forest coverage, including convert cultivated land into forests, forestation in barren lands, closing hillsides to facilitate afforestation, forest tenure reform etc. Under the strong enforcement of forestry policies, the forest coverage has been improved obviously. In comparison with other high-cold mountainous districts, Dehong prefecture has better natural condition to fast recover the vegetation, it is seldom to find the waste lands without vegetation, except where is suffering continuous artificial disturbance such as mining.

The only forest coverage can not indicates whether the ecosystem service is health or not, actually large area of pure artificial forest led to biodiversity loss and ecosystem integrated function degradation. Thus in this area, forest coverage is not the point to evaluate the ecosystem health, sustainable forest management and rehabilitation means we need not only forest coverage but also reasonable forest structure and suitable management.

2 The typical problems need to be solved related to sustainable forest management and rehabilitation in Dehong Prefecture

2.1 Sustainable bamboo forest management

There are more than 30 minorities in Dehong Prefecture, such as Dai, Jingpo, Achang, Lisu, Deang, ect. Among them, Dai people are the most famous ethnic group due to the influence of its traditional culture. Local **Dai people** account for 1/3 of the total population of Dehong Prefecture. In history, Dai people lived in the basin area and other ethnic groups lived in the mountain area due to their respective traditional customs and other reasons, the obvious landscape in Dai peoples's residential area is bamboo forest. Bamboo is a very important plant for Dai people, it supply shoot for their food, bamboo timber is a very common material for their house, furniture, facilities, handicrafts, etc. In the past decades, local government inspired local people to develop bamboo industry which with noteworthy ethnic characteristics. At present, there are more than 30,000 ha bamboo forest in Dehong Prefecture, and 1/3 of which is artificial bamboo forest. In recent years, some negative aspects happened from the large bamboo area, **most of the bamboo forests are suffering predatory harvesting and rare management, leading to bamboo forest degradation such as productivity decline, biodiversity loss, local villagers can not benefit from the bamboo forest sustainably** any more.

2.2 Sustainable natural forest management

In the context of high speed economic development in China, it is difficult to limit the expanding area of economic plantation, especially in places nearby the cities. Nature reserve establishment is a successful experience to avoid biodiversity loss and protect the valuable ecosystem in Dehong prefecture. In 2011, six important protected original forest located in Ruili City, Yingjiang County and Longchuan County were combined into **Tongbiguan Provincial Nature Reserve** which covers 51650.5 hm², lies in the boundary between China and Myanmar as an ecological security green belt. This Nature Reserve has very important significance for Irrawaddy River system, since the main rivers such as Jieyang River, Nanben River, Dayingjiang River, Nanwan River and Hongben River in the Nature Reserve flow into Irrawaddy River in Myanmar section.

However, outside the Natural Reserve, mature natural forest with high carbon stock potential, high biodiversity, and lots of other ecological benefits is pretty rare, this type of forest is facing the degradation of logging and changing to artificial pure economic forest.

To avoid those degradations and get economic benefit from it, the possible measures are **selective cutting common trees, tending and replanting rare and endangered trees species, afforesting in open forest land, and understory planting.**

2.3 Economic plantation

The common economic arbor tree plantation are promoted by market demand, local people have enough motive to plant economic arbor tree plantation such as rubber trees, under this situation, few barren land can be left, so that making forestation in barren or open land is not the primary task of this project. The more important point is improving the comprehensive ecological benefit of the standing forests, but this does not meet the demand of the owner of the common economic tree plantation; they pay more attention on short-term benefit rather than biodiversity conservation and ecosystem services. It is difficult to change this situation unless driving by very strong market demand, for example, to meet the certification requirement of Rainforest Alliance, some large size tea plantation in Simao prefecture, Yunan Province, had to improve the comprehensive ecological benefit through planting indigenous trees in the plantation, improving the soil quality, using green pesticide etc, so that

they can provide material to Lipton Black Tea.

3 The forest resources assessment of two demonstration sites

Selecting the demonstration sites are based on two principles, one is the places can reflect the typical problems need to be solved related to sustainable forest management and rehabilitation, the other is the location should be convenient to be managed and monitored.

The two demonstration sites are located in **Long Chuan County** and **Ruili City** (as shown in Fig 1), where with the typical conflict of forest resources needed to be solved, and the co-operation organization of this project ---Dehong Prefecture is also located in Ruili city, around 30km away from Long Chuan County.

3.1 Longchuan site for sustainable bamboo forest management

3.1.1 The general forest resources situation around Longchuan pilot site

The total area of Longchuan County is 187,295 ha, and the land used for forestry is 121,243.3 ha, account for 64.7% of the total land area, the other land for other uses is 66051.7 ha, account for 35.3% of total land area.



Figure 1 The locations of the two demonstration sites

To get the information about the current forest resources situation and its changes in the past few year, this project use the satellite images in different stage (2007 and 2012) to analyzed the area around the bamboo forest demonstration site, which covers 4764.91ha (as shown in Fig 2), this area include the demonstration site and a part of city area, so that to evaluate the trend of land changes under the background of fast economic development.

Table 1 shows the basic land types and their area in 2007 and in 2012. Table 2 shows that the basic change trend is 1) 5.8ha farm land changed into bamboo forest, 0.89 ha farm land changed into building land. 2) 49.64ha forest changed into young pure artificial forest (*Betula alnoides*), 12.59 ha forest changed into economic forest, and 3.27ha forest changed into farmland (as shown in table 2).

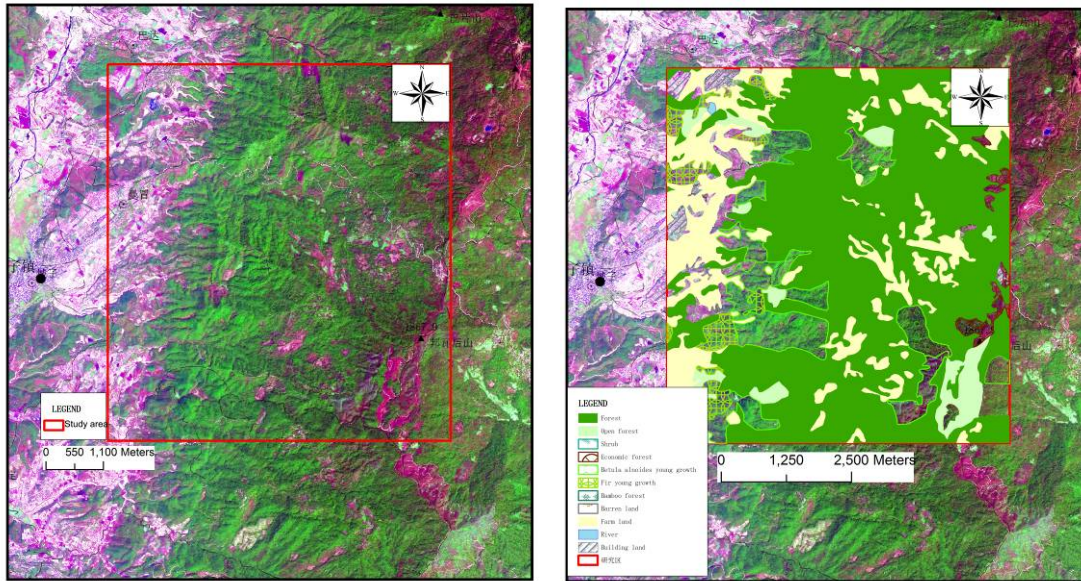


Fig 2 The area used to analyze the different land types and its changes from 2007-2012 in Longchuan County

Table 1 Area change of different land types from 2007-2012 (ha)

	BL	EF	FL	FYG	OF	WB	BAYG	F	BF
2007	45.45	50	833.12	156.72	216.82	2.63	494.87	2832.61	132.69
2012	46.34	62.59	829.7	156.72	216.82	2.63	544.51	2767.11	138.49

Note:

BL--Building land; EF--Economic forest; FL--Farm land; FYG--Fir young growth; OF--Open forest; WB--Water body; BAYG--*Betula alnoides* young growth; F--Forest; BF--Bamboo forest

Table 2 The changes of land types from 2007 to 2012 (Unit: ha)

		Land types in 2012									Area
		BL	EF	FL	FYG	OF	WB	BAYG	F	BF	
Land types in 2007	BL	45.45									45.45
	EF		50								50
	FL	0.89		826.43						5.8	833.12
	FYG				156.72						156.72
	OF					216.82					216.82
	WB						2.63				2.63
	BAYG							494.87			494.87
	F		12.59	3.27				49.64	2767.11		2832.61
	BF									132.69	132.69
Area		46.34	62.59	829.7	156.72	216.82	2.63	544.51	2767.11	138.49	4764.91

Note:

BL--Building land; EF--Economic forest; FL--Farm land; FYG--Fir young growth; OF--Open forest; WB--Water body; BAYG--*Betula alnoides* young growth; F--Forest; BF--Bamboo forest

The basic changes fit local situation of economic development.

3.1.2 General bamboo resources and management around demonstration site

(1) The bamboo forest in Longchuan county

Until 2012, the area of bamboo forest in Longchuan County reached to 15866.7 ha, artificial bamboo forest is 13466.7 ha, and natural bamboo forest is 2400ha. More than half of the artificial bamboo forest is *Dendrocalamus Latiflorus* (8466.7 ha) which has high yield of bamboo shoot and bamboo timber. Longchuan County has the largest area of *Dendrocalamus Latiflorus* plantation in Yunnan Province.

In analysis area, in 2012, the area of bamboo forest is nearly twice as the area of economic forest (as shown in table 1), similar with this situation, at county level, the area of bamboo forest is much larger than economic forest area, as the statistical data shown in 2008, the total bamboo forest area of Longchuan County was 4157.4 ha, the economic forest was 1123.9 ha. The situation indicates that bamboo resource still play an important role in making a living for local people.

(2) The problems in bamboo forest management

● Predatory exploitation and rare management

Although bamboo can be harvested in a short time, it needs scientific management regularly, actually the local villagers usually ignore the importance of bamboo forest tending, and some degradation resulted from this reason. In some large area bamboo forest, villagers harvest all the bamboo shoots or leave the shoots irrationally, so that the bamboo forest can not renew its sustainable age structure, if the bamboo culms are also be harvested, the sustainability of bamboo forest will get worse. After several years even more than ten years' harvest, the soil fertility fail continuously, the diameter of bamboo shoots or culms are becoming more and small correspondingly, soil fertility loss already became another important cause to hinder the sustainable bamboo forest management.

● Technical difficulties in bamboo forest management

With the development of bamboo intensive management, numerous old bamboo stakes left in the bamboo forest waste much forest space, since the old stake is too hard to rot, the stake and the root connecting it form a block of hard entanglement which restrict the new bamboo shoot grow up through it, other plant species also can not survive in the same location, year by year, the old stakes accumulated and account for a certain proportion of the bamboo forest. Meanwhile, the bamboo stake is pretty difficult to be dug out by manual power; local people ever revised the digging tools but were of little consequence. In order to use the bamboo forest space adequately, it's very necessary to move away the old bamboo stakes; however, the labor cost is pretty high.

Bamboo leaves is almost the only groundcover in large bamboo forest and rot very slowly, in mature bamboo forest, the bamboo leaves usually accumulate on the ground, herb and arbor saplings can not grow in such habitat.

● Biodiversity loss

Low soil fertility and high canopy density lead to biodiversity loss in bamboo forest with large size area, and it is hard to improve the biodiversity in such condition, but bamboo forest still has multiple values in fast carbon sink, conservation of water and soil, and commercial use.

3.2 Ruili site for sustainable natural forest management

3.2.1 The general forest resources situation around Ruili pilot site

The total area of Ruili City is 102,000 ha, the area of land used for forestry is 47603.5ha, and the forest coverage is 55.02%. There are very rich natural forest types and biodiversity due to large range elevation from 700~2019m.

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 (the specific information please see annex 2), some of them are rare and endangered species under provincial and national protection (please see annex 1).

This project took a square area with 223.12 ha around the pilot site in Ruili City as the object to research the land use changes from 2007 to 2012(as shown in Fig 3).

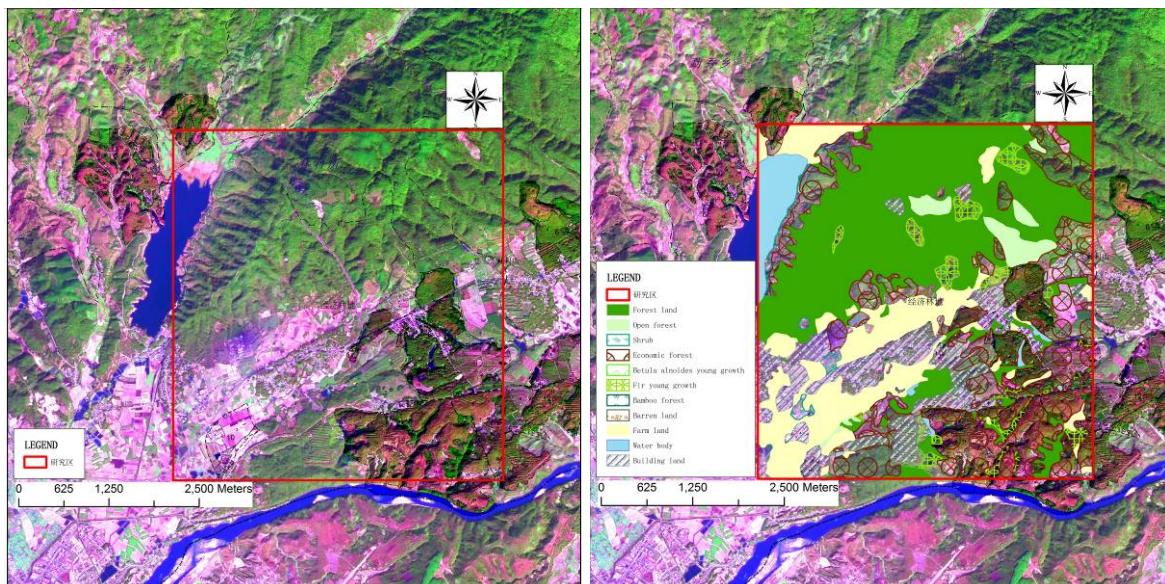


Fig 3 The area used to analyze the different land types and its changes from 2007-2012 in Ruili City

The obvious change is that the area of building area and economic forest expanded while the area of some types of forest land narrowed down. Table 4 shows that building land is the most important factor occupied nearly all the other land types, this trend still continue with the progress of urbanization.

Table 3 Area change of different land types from 2007-2012 (ha)

	SL	BL	EF	FL	FYG	OF	WB	BAYG	UL	F	BF
2007	27.76	126.4	590.17	306.9	71.88	56.29	74.67	46.1	10.33	867.6	45.02
2012	27.76	237.77	633.55	311.2	75.46	54.62	74.67	18.6	7.24	743.1	39.17

BL--Building land; EF--Economic forest; FL--Farm land; FYG--Fir young growth; OF--Open forest; WB--Water body; BAYG--Betula alnoides young growth; F--Forest; BF--Bamboo forest; SL--Shrubland; UL--Uncultivated land

Table 4 The changes of land types from 2007 to 2012 in Ruili City (Unit: ha)

		Land types in 2012											Area
		SL	BL	EF	FL	FYG	OF	WB	BAYG	UL	F	BF	
Land types in 2007	SL	27.76											27.76
	BL		126.4										126.4
	EF		28.81	561.36									590.17
	FL		14.78		292.15								306.93
	FYG		1.77			70.11							71.88
	OF			1.67			54.62						56.29
	WB							74.67					74.67
	BAYG		27.54						18.57				46.11
	UL		3.09							7.24			10.33
	F		29.53	70.52	19.08	5.35					743.1		867.56
	BF		5.85									39.17	45.02
		27.76	237.77	633.55	311.23	75.46	54.62	74.67	18.57	7.24	743.1	39.17	2223.12

BL--Building land; EF--Economic forest; FL--Farm land; FYG--Fir young growth; OF--Open forest; WB--Water body; BAYG--Betula alnoides young growth; F--Forest; BF--Bamboo forest; SL--Shrubland; UL--Uncultivated land

3.1.2 The challenge in sustainable natural forest management

(1) Large area of natural forest converts to economic forest

After forest tenure reform in past few years, in project area, farmers have more freely rights to manage their own forest. Promoted by the rapid economic development, natural forest with rich biodiversity and high carbon sink capacity nearly can not survive, large area natural forest converted to economic forest, which lead to some negative results such as biodiversity loss, carbon stock decreasing, alien invasive plants flooding.

(2) Natural forest need multiple protection channels

Chinese government inspires natural forest protecting, and the owners of natural forest can get subsidy for sustainable forest management from government. But the farmers usually do not care to the economic

comprehensive benefits of natural forests; they pay more attention on short term economic benefits. The subsidy from government for local people to manage natural forest is less than 10 RMB/mu (0.067ha), it is difficult to protect natural forest by local peoples' own wills.

As for the standing natural forest, it is necessary to get multiple protection channels to keep its economic comprehensive benefits and show its demonstration value.

Annex 1 List of protected species in project area

No.	Family	Chinese name	Scientific name	Protection level
1	Cycadaceae	篦齿苏铁	<i>Cycas pectinata</i> Griff	National I
2		华南苏铁	<i>Cycas rumphii</i> Mip.	National I
3	Dicksoniaceae	金毛狗	<i>Cibotium barometz</i> (L) J. Sm.	National II
4	Cyatheaceae	桫欏	<i>A. spinulosa</i> (Wall. ex Hook.) Tryon	National II
5	Ceratopteridaceae	水蕨	<i>Ceratopteris thalictroides</i> (L.) Brongn	National II
6	Blechnaceae	苏铁蕨	<i>Brainea insignis</i> (Hook.) J. Sm.	National II
7	Taxodiaceae	秃杉	<i>Taiwania flousiana</i> Gaussen	National II

8	Cupressaceae	翠柏	<i>Calocedrus macrolepis</i> Kurz	National II
9	Cephalotaxaceae	海南粗榧	<i>Cephalotaxus hainninanensis</i> Li	National II
10	Magnollaceae	大果木莲	<i>Manglietia grandis</i> Hu et Cheng.	National II
11		红花木莲	<i>M. insignis</i> (Wall.) Blume	National II
12		假含笑	<i>Paramichelia baillonii</i> (Pierre) Hu	National II
13	Tetracentraceae	水青树	<i>Tetracentron sinense</i> Oliv. in Hook	National II
14	Lauraceae	樟	<i>Cinnamomum camphora</i> (L.) Presl	National II
15		滇楠	<i>Phiebe nanmu</i> (Oliv.) Gamble in Sarg.	National III
16		毛尖树	<i>Actinodaphne forrestii</i> (Allen) Kosterm	Yunan provincial III
17		长柄油丹	<i>Alseodaphne petiolaris</i> (Meissn.) Hook. f.	Yunan provincial III
18		沧江新樟	<i>Neocinnamomum mekongense</i> (Hand. -Mazz.) Kosterm	Yunan provincial II
19	Theaceae	野茶树	<i>Camellia sinensis</i> O. Ktze. var. <i>assamica</i> (Mastrs) Kitamura	National II
20	Hypericaceae	铁力木	<i>Mesua ferrea</i> L.	National II
21	Sterculiaceae	滇桐	<i>Craigia yunnanensis</i> W. W. Smith & W. E. Eavans	National II
22		云南梧桐	<i>Firmiana major</i> (W. W. Smith) Hand. -Mazz	National II
23	Meliaceae	红椿	<i>Toona ciliata</i> Roem.	National II
24	Lythraceae	西南紫薇	<i>Lagerstroemia intermedia</i> Koehne	National III
25	Proteaceae	瑞丽山龙眼	<i>Helicia shweliensis</i> W. W. Smith	National III
26		假山龙眼	<i>Heliciopsis terminalis</i> (Kurz) Sleum	National III
27	Leguminosae	顶果树	<i>Acrocarpus fraxinifolius</i> Arn. Ex Wight	National III
28	LEGUMINOSAE	厚果鸡血藤	<i>Millettia pachycarpa</i> Benth	Yunan provincial III
29	Sapindaceae	龙眼	<i>Dimocarpus longan</i> (Lour.) Steud	National III
30	Hippocastanaceae	云南七叶树	<i>Aesculus wangii</i> Hu	National III
31	Agavaceae	小花龙血树	* <i>Dracaena cambodiana</i> Pierre ex Gagnep.	National III
32	Schisandraceae	全缘五味子	<i>Kadsura interior</i> A. C. Smith	Yunan provincial II
33	Rosaceae	冬樱花	<i>Prunus cerasoides</i> ("ceraseidos") D. Don	Yunan provincial II
34	Styracaceae	茉莉果	<i>Parastyrax lacei</i> (W. W. Smith) W. W. Smith	Yunan provincial II

35	Myristicaceae	小叶红光树	<i>Knema globularia</i> (Lam.) Warbg.	Yunan provincial III
36	Proteaceae	潞西山龙眼	<i>Helicia tsaii</i> W. T. Wang	Yunan provincial III
37	Tiliaceae	镰叶扁担杆	<i>Grewia falcata</i> C. Y. Wu	Yunan provincial III
38	Malvaceae	枣叶翅麻果	<i>Kydia jujubifolia</i> Griff.	Yunan provincial III
39	Hippocastanaceae	澜沧七叶树	<i>Aesculus lantsangensis</i> Hu et Fang	Yunan provincial III
40	Juglandaceae	云南山核桃	<i>Carya tonkinensis</i> H. Lec.	Yunan provincial III
41	Rubiaceae	裂果金花	<i>Schizomussaenda dehiscens</i> (Craib) Li	Yunan provincial III
42	Carlemanniaceae	四角果	<i>Carlemannia tetragona</i> Hook. f.	Yunan provincial III

Annex 2 Plant species in project area

No.	Chinese Name	Scientific Name
叉苔科 Metzgeriaceae		
1	平叉苔	<i>Metzgeria conjugata</i> Lindb.
南溪苔科 Makinoaceae		
2	南溪苔	<i>Makinoa crispata</i> (Steph.) Miyake
曲尾藓科 Dicranaceae		
3	曲背藓	<i>Oncophorus</i> (Brid) Brid.
凤尾蕨科 Pteridaceae		
4	卷叶凤尾蕨	<i>Fissidens dubius</i> P. Beauv.
大帽藓科 Encalyptaceae		
5	陕西大帽藓(高山大帽藓)	<i>Encalypta giraldii</i> C.Mull
丛藓科 Pottiaceae		
6	墙藓	<i>Tortula muralis</i> Hedw.
7	小石藓	<i>Weisia controversa</i> Hedw.

No.	Chinese Name	Scientific Name
真藓科 Bryaceae		
8	丛生真藓	<i>Bryum caespiticium</i> Hedw.
9	悬藓	<i>Barbella flagellifera</i> (Card.) Nog.
松萝科 Usneaceae		
10	破茎松萝（云雾草、松萝）	<i>Usnea diffracta</i> vain.
金发藓科 Polytrichaceae		
11	波叶仙鹤藓	<i>Atrichum undulatum</i> (Hedw.) P. Beauv.
12	疣金发藓	<i>Pogonatum urnigerum</i> (Hedw.) P. Beauv.
石松科 Lycopodiaceae		
13	石松	<i>Lycopodium japonicum</i> Thunb. f. japonicum
14	垂穗石松	<i>Palhinhaea cernua</i> (L.) Vasc. et Franco
3 卷柏科 Selaginellaceae		
15	翠云草（蓝地柏）	<i>Selaginella uncinata</i> (Desv.) Spring
16	蔓出卷柏	<i>Selaginella davidii</i> Franch
11 莲座蕨科 Angiopteridaceae		
17	云南莲座蕨	<i>Angiopteris yunnanensis</i> Hieron.
18	披针莲座蕨	<i>Angiopteris caudatifomis</i> Hieron.
15 里白科 Gleicheniaceae		
19	芒萁（铁狼萁）	<i>Dicranopteris pedata</i> (Houtt.) Nakaike
17 海金沙科 Lygodiaceae		
20	曲轴海金沙	<i>Lygodium flexuosum</i> (L.) Sw.
21	海金沙（蛤蟆藤）	<i>Lygodium japonicum</i> (Thunb.) Sw.
19 蚌壳蕨科 Dicksoniaceae		
22	金毛狗（金毛狗脊）	<i>Cibotium barometz</i> (L.) J. Sm.
20 桫欏科 Cyatheaceae		
23	桫欏（树蕨）	<i>Alsophila spinulosa</i> (Wall. ex Hook.) Tryon

No.	Chinese Name	Scientific Name
23 鳞始蕨科 Lindsaeaceae		
24	乌蕨	<i>Sphenomeris chinensis</i> (L.) Maxon
26 蕨科 Pteridiaceae		
25	蕨 (蕨菜、如意蕨)	<i>Pteridium aquilinum</i> (L.) Kuhn var. <i>latiusculum</i> (Desv.) Underw. ex Heller
27.凤尾蕨科 Pteridaceae		
26	凤尾蕨	<i>Pteris nervosa</i> Thunb.
27	傅氏凤尾蕨	<i>Pteris fauriei</i> Hieron.
28	溪边凤尾蕨	<i>Pteris excelsa</i> Gaud.
29	蜈蚣草 (长叶甘草蕨)	<i>Pteris vittata</i> L.
31.铁线蕨科 Adiantaceae		
31	团羽铁线蕨 (乌脚芒猪毛七)	<i>Adiantum capillus-junonis</i> Rupr.
32	扇叶铁线蕨	<i>Adiantum flabellulatum</i> L.
33	铁线蕨	<i>Adiantum capillus-veneris</i> L.
34	普通铁线蕨	<i>Adiantum edgeworthii</i> Hook.
33.裸子蕨科 Hemionitidaceae		
35	普通凤丫蕨	<i>Coniogramme intermedia</i> Hieron.
36.蹄盖蕨科 Athyriaceae		
36	光蹄盖蕨	<i>Athyrium otophorum</i> (Miq.) Koidz.
38.金星蕨科 Thelypteridaceae		
37	红色新月蕨	<i>Pronephrium lakhimpurens</i> (Rosenst.) Holtt.
38	金星蕨	<i>Parathelypteris glanduligera</i> (Kunze) Ching
39.铁角蕨科 Aspleniaceae		
39	巢蕨	<i>Neottopteris nidus</i> (L.) J. Sm.
43.乌毛蕨科 Bechnaceae		
40	乌毛蕨 (贯众)	<i>Blechnum orientale</i> L.

No.	Chinese Name	Scientific Name
45. 鳞毛蕨科 Dryopteridaceae		
41	大叶贯众	<i>Cyrtomium macrophyllum</i> (Makino) Tagawa
42	中华鳞毛蕨	<i>Dryopteris chinensis</i> (Bak.) Koidz.
46. 叉蕨科 Aspidiaceae		
43	虹鳞肋毛蕨	<i>Ctenitopsis rhodolcpis</i> (Clark) Ching
48. 藤蕨科 Lomariopsidaceae		
44	长叶实蕨 (鸭公尾)	<i>Bolbitis heteroclita</i> (Presl) Ching in C. Chr.
55. 水龙骨科 Polypodiaceae		
45	阔叶瓦韦	<i>Lepisorus tosaensis</i> (Makino) H. Ito
46	瓦韦	<i>Lepisorus tosaensis</i> (Makino) H. Ito
56. 槲蕨科 Drynariaceae		
47	中华槲蕨	<i>Drynaria sinica</i> Diels
48	槲蕨	<i>Drynaria fortunei</i> (Kunze ex Mett.) J. Sm.
49	石莲姜槲蕨 (石莲姜)	<i>Drynaria propinqua</i> (Wall. ex Mett.) J. Sm. ex Bedd.
60. 蘋科 Marsileaceae		
50	蘋	<i>Marsilea quadrifolia</i> L.
1 苏铁科 Cycadaceae		
51	华南苏铁	<i>Cycas rumphii</i> Mip.
3. 南洋杉科 Araucariaceae		
53	南洋杉 (尖叶南洋杉)	<i>Araucaria cunninghamii</i> Sweet
4. 松科 Pinaceae nom. conserv.		
54	雪松	<i>Cedrus deodara</i> (Roxb.) G. Don
55	思茅松 (白松、黄皮松)	<i>Pinus kesiya</i> Royle ex Gord. var. <i>langbianensis</i> (A. Chev.) Gaussen
56	湿地松	<i>Pinus elliottii</i> Engelm.
57	桐棉松	

No.	Chinese Name	Scientific Name
5.杉科 Taxodiaceae nom.conserv.		
58	柳杉 (长叶孔雀松)	<i>Cryptomeria fortunei</i> Hooibrenk ex Otto et Dietr.
59	杉木	<i>Cunninghamia lanceolata</i> (Lamb.)Hook.
60	秃杉	<i>Taiwania flousiana</i> Gausson
6.柏科 Cupressaceae		
61	侧柏 (扁柏)	<i>Platycladus orientalis</i> (Linn.)Franco
8.三尖杉科(粗榧科) Cephalotaxaceae		
62	粗榧 (中国粗榧)	<i>Cephalotaxus sinensis</i> (Rehd.et Wils.)Li
11.买麻藤科(倪藤科) Gnetaceae		
63	买麻藤(小水子果)	<i>Gnetum montanum</i> Markgr.
木兰科 Magnoliaceae		
64	鹅掌楸 (马褂木)	<i>Liriodendron chinense</i> (Hemsl.) Sargent
65	白兰花	<i>Michelia alba</i> DC.
66	黄兰	<i>Michelia champaca</i> L.
2a.八角茴香科 Illiciaceae nom. conserv.		
67	八角 (大茴香)	<i>Illicium verum</i> Hook. f.
3.五味子科 Schisandraceae nom. conserv.		
68	五味子	<i>Schisandra chinensis</i> (Zhurcz.) Baill.
8.番荔枝科 Annonaceae nom. conserv.		
69	番荔枝 (麻窝楂)	<i>Annona squamosa</i> L.
70	黑风藤	<i>Fissistigma polyanthum</i> (Hook. f. et Thoms.) Merr.
11.樟科 Lauraceae		
71	毛叶油丹	<i>Alseodaphne andersonii</i> (King ex Hook.f.) Kosterm.
72	无根藤	<i>Cassytha filiformis</i> Linn.
73	大叶桂	<i>Cinnamomum iners</i> Reinw.ex Bl.

No.	Chinese Name	Scientific Name
74	细毛樟	<i>Cinnamomum tenuipilum</i> Kosterm.
75	牛筋树	<i>Lindera glauca</i> (Sieb et Zucc) Bl
76	假柿子姜子 (假沙梨)	<i>Litsea monopetala</i> (Roxb.) Pers.
77	假桂钓樟	<i>Lindera tonkinensis</i> Lec.
78	潺槁木姜子 (粘香树、潺槁树)	<i>Litsea glutinosa</i> (Lour.) C.B.Rob.
79	披针叶楠	<i>Phoebe lanceolata</i> (Wall.ex Nees) Nees
15. 毛茛科 Ranunculaceae		
80	虎掌草 (草玉梅)	<i>Anemone rivularis</i> Buch. -Ham. ex DC.
81	威灵仙	<i>Clematis chinensis</i> Osbeck
82	盘柄铁线莲	<i>Clematis trullifera</i> (Franch.) Finet et Gagnep.
83	茴茴蒜	<i>Ranunculus chinensis</i> Bunge
84	石龙芮	<i>Ranunculus sceleratus</i> L.
17. 金鱼藻科 Ceratophyllaceae nom.conserv.		
85	金鱼藻	<i>Ceratophyllum demersum</i> L.
18. 睡莲科 Nymphaeaceae nom.conserv.		
86	莲 (荷花)	<i>Nelumbo nucifera</i> Gaertn.
23. 防己科 Menispermaceae		
87	西南轮环藤	<i>Cyclea wattii</i> Diels
88	细圆藤	<i>Pericampylus glaucus</i> (Lam.) Merr.
89	汉防己	<i>Sinomenium acutum</i> (Thunb.) Rehd.et Wils.
90	粪箕笃	<i>Stephania longa</i> Lour.
91	青牛胆 (山慈姑)	<i>Tinospora sagittata</i> (Oliv.) Gagnep.
92	波叶青牛胆 (千里找根、隔夜找娘)	<i>Tinospora crispa</i> (Linn.) Miers ex Hook.f.et Thoms.
24. 马兜铃科 Aristolochiaceae nom. conserv.		
93	马兜铃 (青木香)	<i>Aristolochia debilis</i> Sieb. Et Zucc.

No.	Chinese Name	Scientific Name
94	卵叶马兜铃	<i>Aristolochia ovalifolia</i> S. M. Hwang
28. 胡椒科 Piperaceae nom. conserv.		
95	卵叶胡椒	<i>Piper attenuatum</i> Buch. -Ham. ex Miq.
96	蒺藜	<i>Piper betle</i> Linn.
97	山蒟 (海风藤)	<i>Piper hancei</i> Maxim.
98	细叶青蒺藜	<i>Piper kadsura choisy ohwi</i>
99	荜拔	<i>Piper longum</i> Linn.
100	草胡椒 (透明草)	<i>Peperomia pellucida</i> (Linn.) Kunth
101	豆瓣绿	<i>Peperomia tetraphyllum</i> (Forst. f.) Hoo k. f. et Arn.
102	齐头绒	<i>Zippelia begoniaefolia</i> Bl.
29. 三白草科 Saururaceae		
103	蕺菜 (鱼腥草)	<i>Houttuynia cordata</i> Thunb.
36. 白花菜科 (山柑科) Capparidaceae		
104	野香橛花	<i>Capparis bodinieri</i> Levi.
105	皱子白花菜	<i>Cleome rutidosperma</i> DC.
39. 十字花科 Cruciferae nom. conserv.		
106	卵叶鼠耳芥	<i>Arabidopsis wallichii</i> (Hook. f. et Thoms.) N. Busch
107	芥	<i>Capsella bursa-pastoris</i> (L.) Medic.
108	碎米芥	<i>Cardamine hirsuta</i> L.
109	单茎碎米芥	<i>Cardamine simplex</i> Hand.-Mazz.
110	弯曲碎米芥	<i>Cardamine flexuosa</i> With.
111	花椰菜	<i>Brassica oleracea</i> var. <i>botrytis</i> L.
112	白菜	<i>Brassica pekinensis</i> (Lour.) Rupr.
113	芥蓝菜	<i>Brassica alboglabra</i> Bailey
114	甘蓝 (擘蓝)	<i>Brassica caulorapa</i> Pasq.
115	青菜 (小白菜)	<i>Brassica chinensis</i> L.

No.	Chinese Name	Scientific Name
116	卷心菜 (莲华白)	<i>Brassica oleraca</i> var. <i>capitata</i> L.
117	油菜 (芸苔)	<i>Brassica campestris</i> L.
118	苦菜	<i>Brassica integrifolia</i> (West) O.E.Schulz ex Urb.
119	箭干白	<i>Brassica parachinensis</i> Bailey
120	萝卜 (莱菔)	<i>Raphanus sativus</i> L.
121	萝卜	<i>Raphanus sativus</i> L. var. <i>staiivus</i>
122	蔊菜 (野油菜)	<i>Rorippa indica</i> (L.) Hiern
40. 堇菜科 <i>Violaceae</i> nom. conserv.		
123	犁头草 (如意草)	<i>Viola hamiltoniana</i> D. Don
124	早开堇菜	<i>Viola prinantha</i> Bunge
125	紫花地丁 (锯花堇菜)	<i>Viola philippica</i> Cav.
42. 远志科 <i>Polygalaceae</i>		
126	肾果山桂花	<i>Polygala didyma</i> C.Y.Wu
127	金不换	<i>Polygala glomerata</i> Lour.
128	瓜子金	<i>Polygala japonica</i> Houtt.
129	齿果草	<i>Salomonina cantoniensis</i> Lour.
45. 景天科 <i>Crassulaceae</i>		
130	落地生根	<i>Bryophyllum pinnatum</i> (L. f.) Oken
131	石莲花	<i>Sinocrassula secunda</i>
132	大苞景天	<i>Sedum amplibracteatum</i> K. T. Fu
48. 茅膏菜科 <i>Droseraceae</i> nom. conserv.		
133	锦地罗 (落地金钱)	<i>Drosera burmanni</i> Vahl
52. 沟繁缕科 <i>Elatinaceae</i> num.		
134	田繁缕 (假水苋菜)	<i>Bergia ammannioides</i> Roxb.
53. 石竹科 <i>Caryophyllaceae</i> nom. conserv.		
135	蚤缀	<i>Arenaria serpyllifolia</i> L.

No.	Chinese Name	Scientific Name
136	簇生卷耳	<i>Cerastium fontanum</i> Baumg.ssp.triviale (Link) J alas var.angustifolium (Franch.) Hara
137	缘毛卷耳	<i>Cerastium furcatum</i> Cham.et schlecht.
138	荷莲豆草 (月亮草)	<i>Drymaria diandra</i> Bl.
139	牛繁缕 (鹅儿肠)	
140	繁缕 (鸡肠草)	<i>Stellaria media</i> (L.) Cyrillus
54. 粟米草科 Molluginaceae, nom.fam.conserv.		
142	粟米草	<i>Mollugo pentaphylla</i> Linn.
56. 马齿苋科 Portulacaceae nom. conserv.		
143	马齿苋	<i>Portulaca oleracea</i> L.
144	大花马齿苋(草杜鹃)	<i>Portulaca grandiflora</i> Hook.
145	日中花	<i>portulaca pilosa</i> L.
146	土人參	<i>Talinum portulacifolium</i> (Forssk.) Aschers. & Schweinf.
57. 蓼科 Polygonaceae		
147	篇蓄	<i>Plygonum aviculare</i> L.
148	丛枝蓼	<i>Polygonum posumbu</i> Buch. -Ham. ex D. Don
149	宽叶火炭母	<i>Polygonum chinense</i> var. ovalifolium Meisn. in Wall.
150	分枝火炭母	<i>Polygonum chinense</i> Linn.Var.brachiatum(Poir.)Meism.in Wall
151	火炭母	<i>Polygonum chinense</i> L.
152	金荞麦	<i>Fagopyrum dibotrys</i> (D. Don) Hara
153	水蓼	<i>Polygonum hydropiper</i> L.
154	长戟叶蓼	<i>Polygonum maackianum</i> Regel
155	红蓼	<i>Polygonum orientale</i> L.
156	粘毛蓼	<i>Polygonum viscosum</i> Buch. -Ham. ex D. Don

No.	Chinese Name	Scientific Name
157	箭叶蓼	<i>Polygonum sieboldii</i> Meisn.
158	蟹甲状酸模	<i>Rumex cacaliformis</i> Levl.
59. 商陆科 <i>Phytolaccaceae</i> nom. conserv.		
159	商陆 (萝卜参)	<i>Phytolacca acinosa</i> Roxb.
61. 藜科 <i>Chenopodiaceae</i> nom. conserv.		
161	苜蓿菜 (牛皮菜)	<i>Beta vulgaris</i> L. var. <i>cicla</i> L.
162	藜	<i>Chenopodium album</i> L.
163	灰绿藜	<i>Chenopodium glaucum</i> L.
164	土荆芥	<i>Chenopodium ambrosioides</i> L.
165	菠菜	<i>Spinacia oleracea</i> L.
63. 苋科 <i>Amaranthaceae</i> nom. conserv.		
166	牛膝	<i>Achyranthes bidentata</i> Blume
167	土牛膝	<i>Achyranthes asper</i> Linn.
168	绢毛苋	<i>Aerva sanguinolenta</i> (Linn.) Blume
169	莲子草	<i>Alternanthera sessilis</i> (L.) R. Br
170	苋	<i>Amaranthus tricolor</i> Linn.
171	刺苋	<i>Amaranthus spinosus</i> Linn.
172	繁穗苋	<i>Amaranthus paniculatus</i> L.
173	凹头苋	<i>Amaranthus lividus</i> Linn.
174	千日红	<i>Gomphrena globosa</i> .
64. 落葵科 <i>Basellaceae</i>		
175	落葵 (滑菜)	<i>Basella alba</i> L.
176	藤三七	<i>Boussingaultia gracilis</i> Miers
67. 牻牛儿苗科 <i>Geraniaceae</i> nom. conserv.		
177	天竺葵	<i>Pelargonium hortorum</i> Bailey
69. 酢浆草科 <i>Oxalidaceae</i> nom. conserv.		
178	酢浆草	<i>Oxalis corniculata</i> L.

No.	Chinese Name	Scientific Name
179	铜锤草 (红花酢浆草)	<i>Oxalis corymbosa</i> DC.
71. 凤仙花科 <i>Balsaminaceae</i>		
180	锐齿凤仙花	<i>Impatiens arguta</i> Hook. f. et Thoms.
181	凤仙花 (指甲花)	<i>Impatiens balsamina</i> L.
182	华凤仙	<i>Impatiens chinensis</i> L.
72. 千屈菜科 <i>Lythraceae</i>		
183	紫薇	<i>Lagerstroemia indica</i> Linn.
184	节节菜	<i>Rotala indica</i> (Willd.) Koehne in Engl.
185	圆叶节节菜	<i>Rotala rotundifolia</i> (Roxb.) Koehne
74. 海桑科 <i>Sonneratiaceae</i>		
186	八宝树	<i>Duabanga grandiflora</i> (Roxb. ex DC.) Walp.
75. 石榴科 <i>Punicaceae</i>		
187	石榴	<i>Punica granatum</i> L.
77. 柳叶菜科 <i>Onagraceae</i> nom. conserv.		
188	丁香蓼	<i>Ludwigia prostrata</i> Roxb.
189	水龙	<i>Ludwigia adscendens</i> (L.)Hara
190	粉花月见草	<i>Oenothera rosea</i> L'Hér.ex Ait
78. 小二仙草科 <i>Haloragidaceae</i> nom. conserv.		
191	轮叶狐尾藻	<i>Myriophyllum verticillatum</i> L.
83. 紫茉莉科 <i>Nyctaginaceae</i> nom. fam. conserv.		
192	光叶子花	<i>Bougainvillea glabra</i> Choisy in DC.
193	砖红叶子花	<i>Bougainvillea spectabilis</i> Willd.
194	紫茉莉	<i>Mirabilis jalapa</i> L.
94. 天料木科 <i>Samydaceae</i> nom. conserv.		
195	红花天料木	<i>Homalium hainanensis</i> Gaynep.
101. 西番莲科 <i>Passifloraceae</i> nom. conserv.		

No.	Chinese Name	Scientific Name
196	蒴莲	Adenia Chevalieri Gagnep.
197	鸡蛋果 (西番莲)	Passiflora caerulea L.
103. 葫芦科 Cucurbitaceae nom. conserv.		
198	冬瓜	Benincasa cerifera Savi
199	西瓜	Citrullus lanatus (Thunb.) Matsum. et Nakai
200	黄瓜	Cucumis sativus L.
201	南瓜	Cucurbita moschata (Duch. ex Lam.) Duch. ex Poiret
202	缅甸绞股蓝	Gynostemma burmanicum King ex Chakr.
203	油渣瓜	Hodgsonia macrocarpa (Bl.) Cogn. in DC.
204	十棱瓜	Luffa acutangula (Linn.) Roxb.
205	丝瓜	Luffa cylindrica (Linn.) Roem.
206	大萼赤	Thladiantha grandisepala A.M. Lu et Z.Y. Zhang
207	马儿 (老鼠拉冬瓜)	Zehneria japonica (Thunb.) S. K. Chen, comb. Nov.
208	毛花马儿 (野苦瓜、云南马儿)	Zehneria marginata (Bl.) Keraudren in Aubrèv. et Leroy (
209	钮子瓜 (野牡丹)	Zehneria maysorensis (Wight et Arn.) Arn. in Hook.
210	苦瓜	Momordica charantia Linn.
211	佛手瓜 (洋丝瓜)	Sechium edule (Jacq.) Swartz
212	叉指叶栝楼 (山苦瓜、土花粉、云南趾叶栝楼)	Trichosanthes pedata Merr. et Chun
104. 秋海棠科 Begoniaceae nom. conserv.		
213	秋海棠 (八月春)	Begonia grandis Dry.
214	秋海棠变种斑叶	Begonia evansiana var.
215	裂叶秋海棠 (红孩儿)	Begonia palmata D. Don
106. 番木瓜科 Caricaceae nom. conserv.		

No.	Chinese Name	Scientific Name
216	番木瓜	<i>Carica papaya</i> Linn.
107. 仙人掌科 Cactaceae		
217	仙人球	<i>Echinopsis tubiflora</i>
218	令箭荷花	<i>Epiphyllum ackermannii</i> Haw.
219	仙人掌	<i>Opuntia dillenii</i> (Ker-Gawl).Haw.
108. 山茶科 Theaceae		
220	茶梨	<i>Anneslea fragrans</i> Wall.
221	莲蕊茶	<i>Camellia cuspidata</i> (Kochs) Wright ex Hort.
222	茶	<i>Camellia sinensis</i> (L.) O.Kuntze
223	大理茶	<i>Camellia taliensis</i> (W.W.Smith) Melchior in Engl.
224	岗矸	<i>Eurya groffii</i> Merr.
225	银木荷	<i>Schima argentea</i> Pritz.
226	滇木荷	<i>Schima noronhae</i> Reinw.ex Bl.
227	西南木荷 (红木荷、峨眉木荷)	<i>Schima wallichii</i> (DC.) Korthals
113. 水东哥科 Saurauiceae		
228	水东哥	<i>Saurauia tristyla</i> DC.
229	红果水东哥	<i>Saurauia erythrocarpa</i> C. F. Liang et Y. S. Wang
116. 龙脑香科 Dipterocarpaceae		
230	盈江龙脑香	<i>Dipterocarpus gracilis</i> Blume
231	大叶婆罗双	
232	云南婆罗双 (黄云香、阿萨姆婆罗双)	<i>Shorea assamica</i> Dyer in Hook.f.
118. 桃金娘科 Myrtaceae		
233	柠檬桉	<i>Eucalyptus citriodora</i> Hook.f.
234	白千层	<i>Melaleuca leucadendron</i> (L.) L.
235	番石榴	<i>Psidium guajava</i> Linn.

No.	Chinese Name	Scientific Name
236	蒲桃	<i>Syzygium jambos</i> (L.) Alston
237	纤花蒲桃	<i>Syzygium leptanthum</i> (Wight) Nied.
238	怒江蒲桃	<i>Syzygium salwinense</i> Merr.et Perry
120. 野牡丹科 Meastomataceae		
239	展毛野牡丹	<i>Melastoma normale</i> D. Don
240	多花野牡丹	<i>Melastoma polyanthum</i> Blume
241	北酸脚杆	<i>Medinilla septentrionalis</i> (W. W. Smith) H. L. Li
242	金锦香 (大香炉)	<i>Osbeckia chinensis</i> Linn.
243	蚂蚁花 (窄腰泡)	<i>Osbeckia nepalensis</i> Hook f.
244	尖子木	<i>Oxyspora paniculata</i> (D. Don) DC.
245	毛叶地胆	<i>Sonerila yunnanensis</i> J. F. Jeffrey
246	三蕊草	<i>Sonerila tenera</i> Royle
122. 红树科 Rhizophoraceae		
247	锯叶竹节树	<i>Carallia lanceaefolia</i> Roxb.
123. 金丝桃科 Hypericaceae		
248	苦丁茶 (红眼树)	<i>Cratoxylum formosum</i> (Jack) Dyer subsp. <i>pruniflorum</i> (Kurz) Gogelein (
249	滇金丝桃	<i>Hypericum delavayi</i> Thanch
250	地耳草	<i>Hypericum japonicum</i> Thunb. ex Murray
128. 椴树科 Tiliaceae nom.conserv.		
251	一担柴	<i>Colona floribunda</i> (Wall. ex Kurz) Craib
252	扁担杆	<i>Grewia biloba</i> G. Don
253	长钩刺蒴麻	<i>Triumfetta pilosa</i> Roth.
254	毛刺蒴麻 (山麻黄)	<i>Triumfetta tomentosa</i> Boj.
255	刺蒴麻 (獼头婆)	<i>Triumfetta rhomboidea</i> Jacq.
128a. 杜英科 Elaeocarpaceae nom.conserv.		

No.	Chinese Name	Scientific Name
256	薯豆 (胆八树)	<i>Elaeocarpus japonicus</i> Sieb. et Zucc.
130. 梧桐科 Sterculiaceae		
257	西蜀苹婆	<i>Sterculia lanceaefolia</i> Roxb.
131. 木棉科 Bombacaceae		
258	瓜哇木棉 (吉贝)	<i>Ceiba pentandra</i> (Linn.) Gaertn.
259	瓜栗	<i>Pachira macrocarpa</i> (Cham. et Schlecht.) Walp. (
132. 锦葵科 Malvaceae		
260	木芙蓉	<i>Hibiscus mutabilis</i> Linn.
261	朱槿	<i>Hibiscus rosa-sinensis</i> Linn.
262	野葵	<i>Malva verticillata</i> Linn.
263	赛葵 (黄花草)	<i>Malvastrum coromandelianum</i> (Linn.) Garcke
264	黄花稔	<i>Sida acuta</i> Burm. f.
265	白背黄花稔 (菱叶拔毒散)	<i>Sida rhombifolia</i> Linn. (1753); Cavan.
266	肖梵天花 (地桃花)	<i>Urena lobata</i> L.
267	波叶梵天花	<i>Urena renpanda</i> Roxb. Ex J.E. Smith
136. 大戟科 Euphorbiaceae		
268	二药五月茶	<i>Antidesma acidum</i> Retz.
269	重阳木	<i>Bischofia javanica</i> Bl.
270	巴豆	<i>Croton tiglium</i> Linn.
271	变叶木 (洒金榕)	<i>Codiaeum variegatum</i> (Linn.) A Juss.
272	铁海棠 (麒麟花)	<i>Euphorbia milii</i> Ch. des Moulins
273	飞扬草	<i>Euphorbia hirta</i> Linn.
274	地锦 (红丝草)	<i>Euphorbia humifusa</i> Willd. ex Schlecht.
275	算盘子 (金骨风)	<i>Glochidion puberum</i> (Linn.) Hutch. in Sarg.
276	毛果算盘子	<i>Glochidion eriocarpum</i> Champ. ex Benth.

No.	Chinese Name	Scientific Name
277	中平树	<i>Macaranga denticulata</i> (Bl.) Muell. Arg. in DC.
278	刺野桐 (印度血桐)	<i>Macaranga indica</i> Wight
279	粗糠柴 (红果果、菲律宾桐)	<i>Mallotus philippensis</i> (Lam.) Muell. Arg.
280	叶下珠	<i>Phyllanthus urinaria</i> Linn.
281	余甘子 (橄榄)	<i>Phyllanthus emblica</i> Linn.
282	蓖麻	<i>Ricinus communis</i> Linn.
283	山乌柏	<i>Sapium discolor</i> (Champ. ex Benth.) Muell. Arg.
284	叶底珠	<i>Flueggea suffruticosa</i> (Pall.) Baill.
285	白饭树	<i>Flueggea virosa</i> (Roxb. ex Willd.) Voigt
139a. 鼠刺科 Iteaceae nom. conserv.		
285	大叶鼠刺	<i>Itea macrophylla</i> Wall. in Roxb.
142. 绣球花科 Hydrangeaceae		
286	绣球 (八仙花)	<i>Hydrangea macrophylla</i> (Thunb.) Ser. in DC.
143. 蔷薇科 Rosaceae		
287	龙芽草	<i>Agrimonia pilosa</i> Ldb.
288	冬樱花	<i>Cerasus cerasoides</i> (D. Don) Sok.
289	云南柃 (楂子果)	<i>ocynia delavayi</i> (Franch.) Schneid. in Fcdccc
290	蛇莓	<i>Duchesnea indica</i> (Andr.) Ficke in Engl. et Prantl
291	腾冲枇杷	<i>Eriobotrya tengyuehensis</i> W. W. Smith
292	麻栗坡枇杷	<i>Eriobotrya malipoensis</i> Kuan
293	枇杷	<i>Eriobotrya japonica</i> (Thunb.) Lindl.
294	凤梨草莓	<i>Fragaria ananassa</i> Duch.
295	水杨梅	<i>Geumalaleppicum</i> Jacq.
296	勐海桂樱	<i>Laurocerasus menghaiensis</i> Yu et Lu

No.	Chinese Name	Scientific Name
297	蛇含委陵菜	Potentilla kleiniana Wight
298	李	Prunus salicina Lindl.
299	桃 (毛桃)	Amygdalus persica L. (
300	山桃	Amygdalus davidiana (Carr.) C. de Vos ex Henry
301	川梨 (棠梨刺)	Pyrus pashia Buch.-Ham. ex D. Don
302	沙梨	Pyrus pyrifolia (Burm. f.) Nakai
303	月季花	Rosa chinensis Jacq.
304	栽秧泡 (黄泡)	Rubus ellipticus Smith var. obcordatus (Franch.) Focke
305	灰毛果莓(覆盆子)	Rubus foliolosus D.Don
306	覆盆子	Rubus idacus L.
307	大乌泡	Rubus multibracteatus levl. et Vant.
308	梨叶悬钩子	Rubus pirifolius Smith
309	红腺悬钩子	Rubus sumatranus Miq.
146. 苏木科 Caesalpiniaceae nom.conserv		
310	顶果木(柃叶豆)	Acrocarpus fraxinifolius Wight ex Arn.
311	羊蹄甲 (紫羊蹄甲)	Bauhinia purpurea L.
312	铁刀木	Cassia siamea Lam.
313	望江南	Cassia occidentalis L.
314	含羞草决明	Cassia mimosoides L.
315	豆茶决明	Cassia nomame (Sicb)Honda
316	光叶决明	Cassia floribunda Cavan
317	含羞云实	Caesalpinia mimosoides Lam.
318	酸角	Tamarindus indica L.
147. 含羞草科 Mimosaceae		
319	阔荚合欢	Albizia lebbeck (Linn.) Benth.
320	台湾相思	Acacia confusa Merr.

No.	Chinese Name	Scientific Name
321	藤金合欢	<i>Acacia concinna</i> (Willd.) DC.
322	皂荚藤	<i>Acacia intsia</i> (Linn.) Willd
323	白花合欢	<i>Albizia crassiramea</i> Lace
324	楹树	<i>Albizia chinensis</i> (Osb.) Merr.
325	象耳豆	<i>Enterolobium cyclocarpum</i> (Jacq.)griseb.
326	银合欢	<i>Leucaena leucocephala</i> (Lam.) de Wit.
327	含羞草	<i>Mimosa pudica</i> Linn.
328	无刺含羞草	<i>Mimosa invisa</i> Mart. var. <i>inermis</i> Adelb.
329	猴耳环(围涎树)	<i>Abarema clypearia</i> (Jack) Kosterm.
148. 蝶形花科 Papilionaceae		
330	落花生	<i>Arachis hypogaea</i> Linn.
331	马鹿花	
332	响铃豆	<i>Crotalaria albida</i> Heyne
333	条叶猪屎豆	<i>Crotalaria linifolia</i> Linn. f.
334	猪屎豆	<i>Crotalaria mucronata</i> Desv.
335	假地蓝	<i>Crotalaria ferruginea</i> Grah. ex Benth.
336	钝叶黄檀	<i>Dalbergia obtusifolia</i> (Baker) Prain
337	秧青	<i>Dalbergia assamica</i> Benth.
338	小叶三点金	<i>Desmodium microphyllum</i> (Thunb.) DC.
339	排钱草	<i>Desmodium pulchellum</i> (L.)Benth
340	假地豆	<i>Desmodium heterocarpon</i> (Linn.) DC.
341	假木豆(野蚂蝗)	<i>Dendrolobium triangulare</i> (Retz.) Schindl.
342	葫芦茶	<i>Tadehagi triquetrum</i> (Linn.) Ohashi
343	扁豆	<i>Lablab purpureus</i> (Linn.) Sweet
344	圆叶野扁豆	<i>Dunbaria rotundifolia</i> (Lour.) Merr.
345	雀舌豆	<i>Dumasia forrestii</i> Diels

No.	Chinese Name	Scientific Name
346	猪仔笠	<i>Eriosema chinense</i> vog.
347	劲直刺桐	<i>Erythrina stricta</i> Roxb.
348	球穗千斤拔	<i>Flemingia strobilifera</i> (Linn.) Ait.
349	大豆 (黄豆)	<i>Glycine max</i> (Linn.) Merr.
350	木蓝 (小青)	<i>Indigofera tinctoria</i> L.
351	夜关门 (截叶胡枝子)	<i>Lespedeza cuneata</i> G.Don
352	褐毛黎豆 (牛豆)	<i>Mucuna castanea</i> merr.
353	野苜蓿	<i>Medicago falcata</i> L.
354	大叶千斤拔 (皱面树)	<i>Flemingia macrophylla</i> (Willd.) Prain
355	地瓜 (土瓜、豆薯)	<i>Pachyrhizus erosus</i> (Linn.) Urb.
356	多花菜豆 (荷包豆)	<i>Phaseolus coccineus</i> Linn.
357	菜豆 (四季豆)	<i>Phaseolus vulgaris</i> Linn.
358	绿豆	<i>Vigna radiata</i> (Linn.) Wilczek
359	山绿豆 (贼小豆)	<i>Vigna minima</i> (Roxb.) Ohwi et Ohashi
360	豌豆	<i>Pisum sativum</i> Linn.
361	西南宿苞豆	<i>Shutteria vestita</i> wight et Arn.
362	蔓茎葫芦茶	<i>Tadehagi pseudotriquetrum</i> (DC.) Yang et Huang
363	短萼灰叶 (山毛豆)	<i>Tephrosia candida</i> Dc.
364	灰叶	<i>Tephrosia purpurea</i> (L.) Pers
365	兔尾草 (狸尾草、狸尾豆)	<i>Uraria lagopodioides</i> (Linn.) Desv. ex DC.
366	小巢菜 (雀野豆)	<i>Vicia hirsuta</i> (Linn.)
367	豇豆 (豆角)	<i>Vicia hirsuta</i> (Linn.)
368	蚕豆 (胡豆、南豆)	<i>Vicia faba</i> Linn.
369	广布野豌豆 (草藤、细叶落豆秧、肥田草)	<i>Vicia cracca</i> Linn.
370	救荒野豌豆	<i>Vicia sativa</i> Linn.

No.	Chinese Name	Scientific Name
371	山野豌豆 (豆豆苗)	<i>Vicia amoena</i> Fisch.
372	木荚豆 (丙格堵)	缅甸柚木林中伴生种
151. 金缕梅科		
373	米老排 (壳菜果、三角枫)	<i>Mytilarila laosensis</i> Lecte.
152. 杜仲科		
374	杜仲	<i>Eucommia ulmoides</i> Oliv.
156. 杨柳科		
375	垂柳	<i>Salix babyionica</i> Linn.
376	四籽柳	<i>Salix tetrasperma</i> Roxb.
377	腾冲柳	<i>Salix tengchongensis</i> C. F. Fang
161. 桦木科		
378	西桦 (西南桦木、桦桃树)	<i>Betula alnoides</i> Buch.-Ham.ex D.Don
379	桤木 (水冬瓜)	<i>Alnus cremastogyne</i> Burk.
163. 壳斗科		
380	短刺栲	<i>Castanopsis cchidnocarpa</i> A.DC.
381	思茅栲	<i>Castanopsis ferox</i> (Roxb.) Spach
382	刺栲	<i>Castanopsis hystriis</i> A.DC.
383	全苞石栎	<i>Lithocarpus cleistocarpus</i> Rehd. et Wils.
384	麻栎 (青冈)	<i>Quercus acutissima</i> Carr.
385	杯状栲	<i>Castanopsis calathiformis</i> (Skan) Rehd. et Wils.
165. 榆科 Ulmaceae		
386	山黄麻	<i>Trema tomentosa</i> (Roxb.) Hara
387	山油麻 (山脚麻)	<i>Trema dielsiana</i> Hand-Mazz.
388	狭叶山黄麻 (麻脚树)	<i>Trema angustifolia</i> (Planch.) Bl.
167. 桑科 Moraceae		

No.	Chinese Name	Scientific Name
389	木菠萝（牛肚子果、 树菠萝、菠萝蜜）	<i>Artocarpus heterophyllus</i>
390	白桂木	<i>Artocarpus hypargyreus</i> Hance
391	野菠萝蜜	<i>Artocarpus chama</i> Buch. -Ham.
392	环纹榕	<i>Ficus annulata</i> Bl.
393	高山榕（大青树）	<i>Ficus altissima</i> Bl.
394	垂叶榕(细叶榕)	<i>Ficus benjamina</i> L.
395	钝叶榕	<i>Ficus curtipes</i> Corner
396	印度胶树（印度榕）	<i>Ficus elastica</i> Roxb.
397	黄毛榕	<i>Ficus esquiroliana</i> Lévl.
398	斜叶榕	<i>Ficus gibbosa</i> (Bl.) Corner
399	三指佛掌榕（薄毛粗 叶榕）	<i>Ficus hirta</i> var. <i>imberbis</i> Gagnep.
400	对叶榕	<i>Ficus hispida</i> L. f.
401	思维树（菩提树）	<i>Ficus religiosa</i> Linn.
402	歪叶榕	<i>Ficus cyrtophylla</i> Wall. ex Miq.
403	苹果榕（大石榴、狗 木瓜、小木瓜果）	<i>Ficus oligodon</i> Miq.
404	梨果榕	<i>Ficus pyriformis</i> Hook. Et Arn
405	豆果榕	<i>Ficus pisocarpa</i> Bl.
406	鸡嗉子榕（酸把、山 枇杷果）	<i>Ficus semicordata</i> Buch. -Ham. ex J. E. Sm
407	异叶榕	<i>Ficus heteromorpha</i> Hemsl.
408	棒果榕（棒榕）	<i>Ficus subincisa</i> J. E. Sm
409	地瓜（地果、地石榴、 地枇杷）	<i>Ficus tikoua</i> Bur.
410	变叶榕（常绿天仙果）	<i>Ficus variolosa</i> Lindl. ex Benth.
411	桑（家桑）	<i>Morus alba</i> L.
412	鸡桑	<i>Morus australis</i> Poir.in Lam.

No.	Chinese Name	Scientific Name
413	榕属一种	Ficus sp.
169. 荨麻科 Urticaceae		
414	序叶苎麻	Boehmeria clidemioides Miq. var. Diffusa (Wedd.) Hand.-Mazz.
415	长叶水麻 (麻叶树)	Debregeasia longifolia (Burm. f.) Wedd.
416	蝎子草	Girardinia diversifolia (Link) Friis
417	水丝麻 (翻白叶)	Maoutia puya (Hook.) Wedd.
418	糯米团 (糯米草)	Memorialis hirta Wedd.
419	歪叶冷水花	Pilea cordistipulata C.J.Chen
420	大叶冷水花	Pilea martinii (Lévl.) Hand.-Mazz.
421	红雾水葛 (青白麻叶)	Pouzolzia sanguinea (Bl.) Merr.
422	全缘叶紫麻 (白叶子)	Oreocnide integrifolia (Gaud.) C.J.Chen
170. 大麻科 Cannabis		
423	大麻	Cannabis sativa L.
171. 冬青科 Aquifoliaceae		
424	毛冬青 (茶叶冬青)	Ilex pubescens Hook. et Arn
185. 桑寄生科 Loranthaceae		
425	桑寄生	Taxillus nigrans (Hance) Danser
426	梨果寄生	Scurrula philippensis (Cham. et Schlecht.) G. Don
427	龙陵寄生	Taxillus sericus Danser
428	麻栎寄生	Viscum articulatum Burm. f.
429	鞘花	Macrosolen cochinchinensis (Lour.) Van Tiegh.
190. 鼠李科 Rhamnaceae		
430	咀 (皱叶枣、弯腰树)	Gouania leptostachya DC.
431	皱枣 (皱叶枣、皱皮枣、弯腰树)	Ziziphus rugosa Lam. (1780); Laws in Hook. f.

No.	Chinese Name	Scientific Name
432	緬棗 (滇刺棗)	<i>Zizphus mauritiana</i> Lam.
191. 胡頹子科 <i>Elaeagnaceae</i>		
433	密花胡頹子 (羊奶果)	<i>Elaeagnus conferta</i> Roxb.
193. 葡萄科 <i>Vitaceae</i>		
434	蛇葡萄 (山葡萄)	<i>Ampelopsis brevipedunculata</i> (Maris) Trautv
435	三裂葉蛇葡萄 (三裂蛇葡萄)	<i>Ampelopsis delavayana</i> Planch. in DC.
436	花斑葉 (青紫葛)	<i>Cissus javana</i> DC.
437	白粉藤	<i>Cissus repens</i> Lamk.
438	翅序火筒樹 (皺波火筒樹)	<i>Leea crispa</i> Linn.
439	扁担藤	<i>Tetrastigma planicaule</i> (Hook.) Gagnep. in Lecomte
440	崖爬藤	<i>tetrastigma obtectum</i> (Wall.) Planch. in DC.
441	葡萄 (草龙珠)	<i>Vitis vinifera</i> L.
442	秋葡萄 (黑葡萄)	<i>Vitis romanetii</i> Roman
164. 芸香科 <i>Rutaceae</i>		
443	來檬 (白檸檬)	<i>Citrus aurantifolia</i> (Christm.) Swingle
444	檸檬	<i>Citrus limon</i> (L.) Burm.f.
445	雲南野香橼	<i>Citrus medica</i> var. <i>ethrong</i> Enyl
446	柚	<i>Citrus.maxima</i> (Burm.) Merr.
447	桔	<i>Citrus reticulata</i> Blanco
448	橙 (甜橙)	<i>Citrus sinensis</i> (L.) Osb.
449	三桠苦	<i>Euodia lepta</i> (Spreng.) Merr.
450	扁枝三桠苦	<i>Euodia lepta</i> (Spreng.) Merr. var. <i>cambodiana</i> (Pierre) Huang
451	九里香	<i>Murraya paniculata</i> (Linn.) Jack
452	枸桔 (枳)	<i>Poncirus trifoliata</i> (L.) Raf.

No.	Chinese Name	Scientific Name
453	飞龙掌血	<i>Toddalia asiatica</i> (L.) Lam.
196. 橄榄科 Burseraceae		
454	橄榄 (青果)	<i>Canarium album</i> (Lour.) Rauesch.
455	滇榄	<i>Canarium strictum</i> Roxb.
197. 楝科 Meliaceae		
456	碧绿米仔兰	<i>Aglaia perviridis</i> Hiern in Hook. f.
457	灰毛浆果楝	<i>Cipadessa cinerascens</i> (Pellegr.) H. - M.
458	川楝	<i>Melia toosendan</i> Sieb. et Zucc.
459	非洲桃花心木 (西非桃花心木、非洲楝)	<i>Khaya ivorensis</i> Chev.
460	大叶桃花心木	<i>Swietenia macrophylla</i> King
461	香椿 (红椿、椿树)	<i>Toona sinensis</i> (A. Juss.) Roem.
198. 无患子科 Sapindaceae		
462	倒地铃 (鬼灯笼)	<i>Cardiospermum halicacabum</i> L.
463	龙眼 (桂圆、圆眼)	<i>Dimocarpus longan</i> Lour.
464	滇赤才	<i>Lepisanthes senegalensis</i> (Poir.) Leenh.
465	荔枝	<i>Litchi chinensis</i> Sonn.
201. 清风藤科 Sabiaceae		
466	柠檬清风藤	<i>Sabia limoniacea</i> Wall.Cat.no.
467	小花清风藤	<i>Sabia parviflora</i> Wall.in Roxb.
468	圆锥清风藤	<i>Sabia paniculata</i> Edgew.ex Hook.f.et Thoms.
469	单叶泡花树	<i>Meliosma simplicifolia</i> Walp.
205. 漆树科 Anacardiaceae		
470	杧果	<i>Mangifera indica</i> L.
471	长梗杧果	<i>Mangifera longipes</i> Griff.
472	林生杧果	<i>Mangifera sylvatica</i> Roxb.

No.	Chinese Name	Scientific Name
473	盐肤木(五倍子树)	<i>Rhus chinensis</i> Mill
474	漆	<i>Toxicodendron vernicifluum</i> (Stokes) F. A. Barkley
207. 胡桃科 Juglandaceae		
475	毛叶黄杞(胖婆娘树)	<i>Engelhardtia colebrookiana</i> Lindl. ex Wall.
476	云南黄杞(穗序黄杞)	<i>Engelhardtia spicata</i> Lesch. ex Bl.
210.八角枫科 Alangiaceae		
477	八角枫	<i>Alangium chinense</i> (Lour.) Harms
478	长毛八角枫	<i>Alangium kurzii</i> Craib
479	云南八角枫	<i>Alangium yunnanense</i> C. Y. Wu ex Fang et al.
212. 五加科 Araliaceae		
480	刺五加	<i>Acanthopanax senticosus</i> (Rupr. et Maxim.) Marms.
481	云南楸木	<i>Aralia thomsonii</i> Seem.
482	掌叶柏那参	<i>Brassaiaopsis Palmata</i> (Roxb.) Kurz
483	多蕊木	<i>Tupidanthus calyptratus</i> Hook. f. et Thoms.
213. 伞形科 Umbelliferae		
484	芹菜(伞芹、旱芹)	<i>Apium graveolens</i> L.
485	积雪草(马蹄草)	<i>Centella asiatica</i> (L.) Urban
486	芫荽	<i>Coriandrum sativum</i> L.
487	刺芫荽(缅甸芫荽)	<i>Eryngium foetidum</i> L.
488	茴香	<i>Foeniculum vulgare</i> Mill.
489	密伞天胡荽	<i>Hydrocotyle pseudo-conferta</i> Masamune
490	天胡荽	<i>Hydrocotyle sibthorpioides</i> Lam.
491	红马蹄草	<i>Hydrocotyle nepalensis</i> Hook.
492	中华水芹	
493	水芹	<i>Oenanthe javanica</i> (Bl.) DC.

No.	Chinese Name	Scientific Name
494	杏叶防风 (杏叶茴芹)	<i>Pimpinella candolleana</i> Wight et Arn.
216. 越桔科 Vacciniaceae		
495	红花树萝卜	<i>Agapetes hosseana</i> Diels
221. 柿树科 Ebenaceae		
496	柿	<i>Diospyros kaki</i> Thunb.
221. 山榄科 Sapotaceae		
497	蛋黄果	<i>Lucuma nervosa</i> A.DC
498	人心果	<i>Manilkara zapota</i> (Linn.) Van Royen
223. 紫金牛科 Myrsinaceae		
499	红凉伞	<i>Ardisia crenata</i> Sims var. <i>bicolor</i> (Walker) C. Y. Wu et C. Chen
500	扭子果	<i>Ardisia virens</i> Kurz
501	硃砂根	<i>Ardisia crenata</i> Sims
502	白花酸藤果 (打枪果)	<i>Embelia ribes</i> Burm. f.
503	网脉叶酸藤果	<i>Embelia rudis</i> Burm.f.
504	矩叶酸藤果	<i>Embelia oblongifolia</i> Hemsl.
505	当归藤	<i>Embelia parviflora</i> Wall.
506	密齿酸藤子 (打虫果、米汤果)	<i>Embelia vestita</i> Roxb.
507	鲫鱼胆	<i>Maesa Perlaris</i> (Lour.) Merr.
224. 野茉莉科 (安息香科) Styracaceae		
508	郁香野茉莉	<i>Styrax odoratissima</i> Champ.
228. 马钱科 Loganiaceae		
509	驳骨丹 (七里香)	<i>Buddleja asiatica</i> Lour.
229. 木樨科 Oleaceae		
510	岭南茉莉 (桂叶素馨)	<i>Jasminum laurifolium</i> Roxb.
511	女贞 (白蜡树)	<i>Ligustrum lucidum</i> Aiton

No.	Chinese Name	Scientific Name
512	小叶青藤仔	<i>Jasminum nervosum</i> var. <i>Elegans</i> (Hemsl.) Chia
513	青藤仔 (鸡骨香、蟹鱼胆藤)	<i>Jasminum nervosum</i> Lour.
514	多花素馨	<i>Jasminum polyanthum</i> Franch.
515	大叶素馨	<i>Jasminum robustifolium</i> Kobuski
516	滇南素馨	<i>Jasminum wangii</i> Kobuski
517	茉莉花	<i>Jasminum sambac</i> (L.)Aiton
230. 夹竹桃科 Apocynaceae		
518	长春花	<i>Catharanthus roseus</i> (L.) G.Don
519	扇形狗牙花	<i>Ervatamia flabelliformis</i> Tsiang
520	鸡蛋花	<i>Plumeria rubra</i> Linn.cv. <i>Acutifolia</i>
231. 萝藦科 Asclepiadaceae		
521	刺瓜 (小刺瓜、野苦瓜)	<i>Cynanchum corymbosum</i> Wight
522	青洋参 (青羊参)	<i>Cynanchum otophyllum</i> Schneid.
523	催乳藤 (奶汁藤)	<i>Heterostemma oblongifolium</i> Cost.
524	澜沧球兰	<i>Hoya lantsangensis</i> Tsiang et P.T.Li
525	大白药 (小白前)	<i>Marsdenia griffithii</i> Hook.f.
526	催吐鲫鱼藤	<i>Secamone szechuanensis</i> Tsiang et P.T.Li
527	须药藤 (香根藤)	<i>Stelmatocrypton khasianum</i> (Benth.) H.Baill.
232. 茜草科 Rubiaceae		
528	团花 (大叶黄梁木)	<i>Neolamarckia cadamba</i> (Roxb.) J. Bosser
529	猪肚木	<i>Canthium horridum</i> Bl.
530	小果咖啡	<i>Coffea arabica</i> Linn.
531	梔子 (黄梔子)	<i>Gardenia jasminoides</i> Ellis
532	小叶猪殃殃	<i>Galium trifidum</i> Linn.
533	耳草	<i>Hedyotis auricularia</i> Linn.

No.	Chinese Name	Scientific Name
534	脉耳草	<i>Hedyotis costata</i> (Roxb.) Kurz.
535	纤花耳草	<i>Hedyotis tenelliflora</i> Bl.
536	粗叶耳草	<i>Hedyotis verticillata</i> (Linn.) Lam.
537	白花蛇舌草	<i>Hedyotis diffusa</i> Willd.
538	白花龙船花 (小仙丹花)	<i>Ixora henryi</i> Lévl.
539	玉叶金花	<i>Mussaenda pubescens</i> Ait. f.
540	大叶白纸扇 (白扇空心)	<i>Mussaenda esqirolii</i> Vevl
541	大叶玉叶金花	<i>Mussaenda macrophylla</i> Wall.
542	红脉玉叶金花	<i>Mussaenda treutleri</i> Stapf
543	异性玉叶金花 (白纸宝)	<i>Mussaenda anamala</i> Li.
544	山石榴	<i>Catunaregam spinosa</i> (Thunb.) Tirveng.
545	茜草	<i>Rubia corifolia</i> Linn.
546	大叶茜草	<i>Rubia schumanniana</i> Pritz.
547	鹰爪风	<i>Uncaria wangi</i> How
548	钩藤	<i>Uncaria rhynchophylla</i> (Miq.) Miq. ex Havil.
549	白钩藤	<i>Uncaria sessilifructus</i> Roxb.
550	华钩藤	<i>Uncaria sinensis</i> (Oliv.) Havil.
551	广西水锦树	<i>Wendlandia aberrans</i> How
233. 忍冬科 Caprifoliaceae		
552	血满草	<i>Sambucus adnata</i> Wall.
553	接骨木	<i>Sambucus williamsii</i> Hance
235. 败酱科 Valerianaceae		
554	蜘蛛香 (马蹄香)	<i>Valeriana jatamansi</i> Jones
238. 菊科 Compositae		
555	胜红蓟 (藿香蓟、藿)	<i>Ageratum conyzoides</i> L.

No.	Chinese Name	Scientific Name
	香菊)	
556	黄花蒿 (臭蒿)	<i>Artemisia annua</i> Linn.
557	艾蒿	<i>Artemisia lavandulaefolia</i> DC.
558	宽叶山蒿	<i>Artemisia stolonifera</i> (Maxim.) Kom
559	艾纳香 (冰片草)	<i>Blumea balsamifera</i> (L.) DC.
560	金盏银盘 (铁笔箭)	<i>Bidens biternata</i> (Lour.) Merr. et Sherff
561	鬼针草 (婆婆针)	<i>Bidens pilosa</i> L.
562	三叶鬼针草	
563	六耳铃 (吊钟黄)	<i>Blumea laciniata</i> (Wall. ex Roxb.) DC.
564	翠菊 (江西腊)	<i>Callistephus chinensis</i> (L.) Nees
565	茼蒿 (南茼蒿)	<i>Chrysanthemum coronarium</i> L. var. <i>spatiosum</i> Bailey
566	苦蒿 (熊胆草)	<i>Conyza blinii</i> Levl.
567	小白酒草 (小飞蓬)	<i>Conyza canadensis</i> (L.) Cronq.
568	白酒草	<i>Conyza japonica</i> (Thunb.) Less.
569	白花白酒草 (粘毛白酒草)	<i>Conyza leucantha</i> (D. Don) Ludlow et Raven
570	滇川还阳参	<i>Crepis rigescens</i> Diels
571	菊花	<i>Dendranthema morifolium</i> (Ramat.) Tzvel.
572	大丽花 (洋芍药)	<i>Dahlia pinnata</i> Cav.
573	鱼眼草	<i>Dichrocephala integrifolia</i> (L. f.) O. Ktze.
574	小鱼眼草	<i>Dichrocephala benthamii</i> C. B. Clarke
575	鳢肠 (旱莲草)	<i>Eclipta prostrate</i> (L.) L.
576	地胆草	<i>Elephantopus scaber</i> L.
577	一点红 (羊蹄草)	<i>Emilia sonchifolia</i> (L.) DC
578	鹅不食草 (球菊)	<i>Epaltes australis</i> Less.

No.	Chinese Name	Scientific Name
579	一年蓬 (治痢草)	
580	飞机草	<i>Eupatorium odoratum</i> Linn
581	紫茎泽兰 (败马草)	<i>Ageratina adenophora</i> (Spreng.) R. M. King et H. Robinso
582	泽兰 (白头婆)	<i>Eupatorium japonicum</i> Thunb.
583	鼠曲草	<i>Gnaphalium affine</i> D. Don
584	秋鼠曲草 (天水蚊草)	<i>Gnaphalium hypoleucum</i> DC.
585	多茎鼠曲草 (田艾、白花艾、老鼠艾)	<i>Gnaphalium multicaule</i> Willd.
586	野苘蒿 (革命菜)	<i>Crassocephalum crepidioides</i> (Benth.) S. Moore
587	田基黄 (荔柱草)	<i>Grangea maderaspatana</i> (L.) Poir.
588	辣子草	<i>Galinsoga parviflora</i> Cav.
589	向日葵	<i>Helianthus annuus</i> L.
590	兔苣 (兔子菜)	<i>Lagoseris sancia</i> (L.) K. Maly
591	多头苦苣 (苦苣菜)	<i>Ixeris polycephala</i> Cass.
592	莴苣	<i>Lactuca sativa</i> L.
593	六棱菊 (臭灵丹)	<i>Laggera alata</i> (D. Don) Sch. -Bip. ex Oliv.
594	齿翼臭灵丹	<i>Laggera pterodonta</i> (DC.) Benth.
595	锯叶千里光	<i>Scnecio prionohyllas</i> Franch
596	千里光属一种	
597	滇苦菜	<i>Picris divaricata</i> Vant.
598	褐毛毛连菜	<i>Picris hieracioides</i> L. ssp. <i>fuscipilosa</i> Hand. -Mazz.
599	豨薟 (粘糊菜)	<i>Siegesbeckia orientalis</i> L.
600	金钮扣	<i>Spilanthes paniculata</i> Wall.
601	白花蒲公英	<i>Taraxacum leucanthum</i> (Ledeb.) Ledeb.
602	白缘蒲公英	<i>Taraxacum platyepidum</i> Diets
603	斑鸠菊 (鸡菊花)	<i>Vernonia esculenta</i> Hemsl.

No.	Chinese Name	Scientific Name
604	展枝斑鸠菊	<i>Vernonia extensa</i> DC.
605	柳叶斑鸠菊	<i>Vernonia saligna</i> (Wall.) DC.
606	大叶斑鸠菊	<i>Conyza volkameriifolia</i> Wall.
607	异叶黄鹤菜	<i>Crepis heterophylla</i> Hemsl.
608	黄鹤菜	<i>Youngia japonica</i> (L.) DC.
242. 车前科 Plantaginaceae		
609	平车前	<i>Plantago depressa</i> Willd.
610	大车前	<i>Plantago major</i> L.
243. 桔梗科 Campanulaceae		
611	变种金钱豹 (土党参)	<i>Campanumoea javanica</i>
612	蓝花参	<i>Wahlenbergia marginata</i> (Thunb.) A. DC.
244. 半边莲科		
613	大将军	<i>Lobelia clavata</i> E. Wimm.
614	铜锤玉带草 (小铜锤)	<i>Pratia nummularia</i> (Lam.) A. Br. et Aschers.
249. 紫草科 Boraginaceae		
615	琉璃草 (猪尾巴)	<i>Cynoglossum zeylanicum</i> (Vahl)Thunb.
616	小花琉璃草 (小花倒提壶)	<i>Cynoglossum lanceolatum</i> Forsk.
250. 茄科 Solanaceae		
617	地海椒	<i>Archiphysalis sinensis</i> (Hemel.) Kuang
618	小米辣 (辣椒)	<i>Capsicum frutescens</i> Linn.
619	五色椒 (五彩椒)	<i>Capsicum frutescens</i> Var. <i>Cerasiforme</i> Bailey (<i>C.annuum</i> var. <i>Cerasiforme</i> . Irish)
620	朝天椒 (指天椒)	<i>Capsicum frutescens</i> Linn. var. <i>conoides</i> Bailey
621	小朝天椒	<i>Capsicum frutescens</i> var. <i>Parvoacuminatum</i> Makino
622	涮涮辣	

No.	Chinese Name	Scientific Name
623	树番茄	<i>Cyphomandra betacea</i> Sendtn.
624	曼陀罗	<i>Datura stramonium</i> Linn.
625	番茄 (西红柿)	<i>Lycopersicon esculentum</i> Mill.
626	樱桃番茄	<i>Lycopersicon esculentum</i> Mill. Var. <i>cerasiforme</i> Alef
627	红丝线 (十萼茄)	<i>Lycianthes biflora</i> (Lour.) Bitt.
628	假酸菜 (冰粉)	<i>Nicotina physalodes</i> (L.) Gaerin
629	红茄 (苦茄)	<i>Solanum integrifolium</i> Poir.
630	喀西茄	<i>Solanum khasianum</i> C. B. Clarke in Hook. f.
631	茄 (茄子)	<i>Solanum melongena</i> Linn.
632	龙葵 (苦圈圈)	<i>Solanum nigrum</i> Linn.
633	少花龙葵 (苦圈圈)	<i>Solanum photeinocarpum</i> Nakamura et Odashima
634	珊瑚豆 (辣子花)	<i>Solanum. capsicastrum</i> Link.
635	马铃薯	<i>Solanum tuberosum</i> Linn.
636	水茄	<i>Solanum torvum</i> Swartz
637	假烟叶树	<i>Solanum verbascifolium</i> Linn.
251. 旋花科 Convolvulaceae		
638	头花银背藤	<i>Argyreia capitata</i> (Vah.) Arn. ex Choisy
639	叶苞银背藤	<i>Argreia roxburghii</i> (Wall.) Arn. ex Choisy var. <i>ampla</i> (Wall.) C. B. Clarke in Hook. f.
640	大叶银背藤	<i>Argyreia wallichii</i> Choisy
641	细毛银背藤	<i>Argyreia strigillosa</i> C. Y. Wu
642	帽苞薯藤 (盘苞薯藤)	<i>Ipomoea Pileata</i> Roxb.
643	空心菜(蕹菜)	<i>Ipomoea aquatica</i> Forsk.
644	甘薯 (红薯、白薯、红苕)	<i>Ipomoea batatas</i> (L.) Lam.
645	三裂叶薯	<i>Ipomoea tritoba</i> Linn.
646	茛萝	<i>Quamoclit pennata</i> (Desr.) Bo
647	菟丝子 (金丝藤、豆寄)	<i>Cuscuta chinensis</i> Lam.

No.	Chinese Name	Scientific Name
	生、无根藤	
252. 玄参科 Scrophulariaceae		
618	球花毛麝香	<i>Adenosma indianum</i> (Lour.) Merr.
619	蛇眼	<i>Dopatrium juncetum</i> (Roxb.) Buch.-Ham. ex Benth.
620	长果母草	<i>Ruellia anagallis</i> Burm. f.
621	中华石龙尾	<i>Limnophila chinensis</i> (Osborn) Merr.
622	石龙尾 (菊藻)	<i>Limnophila sessiliflora</i> (Vahl) Bl.
623	旱田草	<i>Lindernia ruellioides</i> (Colson) Pennell
624	钟萼草	<i>Lindenbergia philippensis</i> (Cham. et Schlechtendal) Benth.
625	野地钟萼草	<i>Lindenbergia muraria</i> (Roxb. ex D. Don) Bruhl
626	通泉草	<i>Mazus japonicus</i> (Thunberg) O. Kuntze
627	野甘草	<i>Scoparia dulcis</i> L.
628	毛叶翼萼	<i>Torenia benthamiana</i> Hance
629	柳穿鱼属一种	<i>Linaria</i> Mill.
253. 列当科 Orobanchaceae		
630	野菰 (僧帽花)	<i>Aeginetia indica</i> L.
256. 苦苣苔科 Gesneriaceae		
631	大花芒毛苣苔	<i>Aeschynanthus mimetes</i> B. L. Burtt
632	线柱苣苔	<i>Rhynchocheum obovatum</i> (Griff.) B. L. Burtt
257. 紫葳科 Bignoniaceae		
633	火烧花	<i>Mayodendron igneum</i> (Kurz) Kurz
634	木蝴蝶 (千张纸)	<i>Oroxylum indicum</i> (L.) Vent.
635	炮仗花	<i>Pyrostegia venusta</i> (Ker) Miers
636	小萼菜豆树	<i>Radermachera microcalyx</i> C. Y. Wu et W. C. Yin
637	粘毛泡桐	<i>Paulownia kawakamii</i> Ito
638	羽叶楸	<i>Stereospermum tetragonum</i> (Wall.) DC.

No.	Chinese Name	Scientific Name
259. 爵床科 Acanthaceae		
639	假杜鹃	<i>Barleria cristata</i> L.
640	小驳骨	<i>Gendarussa vulgaris</i> Nees
641	三花枪刀药	<i>Hypoestes triflora</i> Roem. et Schult.
642	齿叶鳞花草	<i>Lepidagathis fasciculata</i> (Retz.) Nees in Wall.
643	鳞花草	<i>Lepidagathis incurva</i> Buch.-Ham. ex D. Don
644	野靛棵	<i>Mananthes patentiflora</i> (Hemsl.) Bremek.
645	瘤子草	<i>Nelsonia canescens</i> (Lam.) Spreng.
646	九头狮子草	<i>Peristrophe japonica</i> (Thunb.) Bremek.
647	肾苞草	<i>Phaulopsis dorsiflora</i> (Retz) Santapau
648	爵床 (六角类)	<i>Rostellularia procumbens</i> (L.) Nees in Wall.
649	孩儿草	<i>Rungia pectinata</i> (L.) Nees in DC.
650	板蓝、马蓝(南板蓝根)	<i>Strobilanthes cusia</i> (Nees) O. Kuntze
263. 马鞭草科 Verbenaceae		
651	广东紫珠	<i>Callicarpa kwangtungensis</i> Chun
652	红紫珠	<i>Callicarpa rubella</i> Lindl.
653	西垂茉莉	<i>Clerodendrum griffithianum</i> C. B. Clarke in Hook. f.
654	垂茉莉	<i>Clerodendrum wallichii</i> Merr.
655	腺茉莉 (臭牡丹)	<i>Clerodendrum colebrookianum</i> Walp.
656	三对节, 三节树	<i>Clerodendrum serratum</i> (L.) Spreng
657	假连翘 (篱笆树)	<i>Duranta repens</i> L.
658	云南石梓	<i>Gmelina arborea</i> Roxb.
659	马缨丹 (黄花刺、五色梅)	<i>Lantana camara</i> L.
660	假败酱 (玉龙鞭、假马鞭)	<i>Stachytarpheta jamaicensis</i> (L.) Vahl
661	柚木 (胭脂树)	<i>Tectona grandis</i> Linn. f.

No.	Chinese Name	Scientific Name
662	马鞭草	<i>Verbena officinalis</i> L.
663	黄毛荆	<i>Vitex vestita</i> Wall.
664	蔓荆	<i>Vitex trifolia</i> L.
264. 唇形科 Labiatae		
665	肾茶 (猫须草)	<i>Clerodendranthus spicatus</i> (Thunb.) C. Y. W
666	风轮菜 (苦刀菜)	<i>Clinopodium chinense</i> (Benth.) O. Kuntze
667	水珍珠菜	<i>Pogostemon auricularia</i> (L.) Hassk.
668	野草香	<i>Elsholtzia cypriani</i> (Pavol.) C. Y. Wu
669	野坝子 (野拔子) 鸡骨柴	<i>Elsholtzia rugulosa</i> Hemsl.
670	夏至草 (白花益母草、白花夏至草)	<i>Lagopsis supina</i> (Steph.) Ik. - Gal. ex Knorr.
671	绉面草 (蜂窝草)	<i>Leucas zeylanica</i> (L.) R. Br.
672	野薄荷 (薄荷)	<i>Mentha haplocalyx</i> Briq
673	冠唇花	<i>Microtoena insuavis</i> (Hance) Prain ex Dunn
674	毛罗勒 (荆芥)	<i>Ocimum basilicum</i> L. var. <i>pilosum</i> (Willd.) Benth. in DC.
675	一串红 (西洋红)	<i>Salvia splendens</i> Ker. - Gawl.
676	荔枝草	<i>Salvia plebeia</i> R. Br.
266. 水鳖科 Hydrocharitaceae		
677	海菜花属一种	
678	黑藻 (轮叶水草)	<i>Hydrilla verticillata</i> (L. f.) L.
267. 泽泻科 Alismataceae		
679	野慈姑	<i>Sagittaria sagittifolia</i> Linn. var. <i>sinensis</i> (Sims.) Mak.
280. 鸭跖草科 Commelinaceae		
680	穿鞘花	<i>Amischotolype hispida</i> (Less. et A. Rich.) Hong
681	鸭跖草	<i>Commelina communis</i> Linn.
682	大苞鸭跖草 (大苞地地)	<i>Commelina paludosa</i> Bl.

No.	Chinese Name	Scientific Name
	藕)	
683	竹节草	<i>Commelina diffusa</i> Burm. f.
684	杜若	<i>Pollia japnica</i> Thunb.
685	川杜若	<i>Pollia omeiensis</i> Hong
686	孔药花	<i>Porandra ramosa</i> Hong
687	紫叶草	<i>Setcreasea purpurea</i>
黄眼草科 (黄谷精科)		
688	葱草、少花黄眼草	<i>Xyris pauciflora</i> Willd.
286. 谷精草科		
689	小谷精草	<i>Eriocaulon luzulifolium</i> Marl,
690	珍珠草	<i>Eriocaulon truncatum</i> Ham
286. 凤梨科		
691	凤梨 (菠萝)	<i>Ananas comosus</i> (Linn.) Merr.
287. 芭蕉科		
692	阿加蕉	<i>Musa acuminata</i> Colla
693	芭蕉	<i>Musa basjoo</i> Sieb. et Zucc.
694	香蕉 (矮脚蕉)	<i>Musa nana</i> Lour.
695	红香蕉	<i>Musa</i>
696	河口蕉	<i>Musa</i>
697	大蕉	<i>Musa speciosus</i> (Soenig) Simth
290. 姜科 Zingiberaceae		
698	草蔻	<i>Alpinia katsumadai</i> Hayata
699	红豆蔻	<i>Alpinia galanga</i> (L.) Swartz
700	砂仁 (阳春砂仁)	<i>Amomum villosum</i> Lour.
701	闭鞘姜 (水蕉花)	<i>Costus speciosus</i> (Koen.) Smith
702	莪术	<i>Curcuma zedoaria</i> (Christm.) Rosc.
703	姜黄	<i>Curcuma domestica</i> Valet

No.	Chinese Name	Scientific Name
704	郁金	<i>Curcuma aromatica</i> Salisb.
705	红姜花	<i>Hedychium coccineum</i> Buch.-Ham.
706	沙姜(山奈)	<i>Kaempferia galanga</i> L.
707	姜	<i>Zingiber officinale</i> Rosc.
708	囊荷	<i>Zingiber mioga</i> (Thunb.) Rosc.
291. 美人蕉科 Cannaceae		
709	黄花美人蕉	<i>Canna indica</i> Linn. var. <i>Flava</i> Roxb
292. 竹芋科 Marantaceae		
710	天鹅绒竹芋	<i>Galathea zebrina</i>
293. 百合科 Liliaceae		
711	卵叶蜘蛛抱蛋	<i>Aspidistra typica</i> Baill.
712	金边吊兰	<i>Chlorophytum comosum</i> cv. "Variegatum"
713	万寿竹(迎风不动草)	<i>Disporum cantoniense</i> (Lour.) Merr.
714	嘉兰	<i>Gloriosa superba</i> L.
715	多花沿阶草	<i>Ophiopogon tonkinensis</i> Rodrig.
294. 假叶树科 Ruscaceae		
716	文竹	<i>Asparagus setaceus</i> (Kunth) Jessop
296. 雨久花科 Pontederiaceae		
717	凤眼莲(水葫芦)	<i>Eichhornia crassipes</i> (Mart.) Solms
718	鸭舌草	<i>Monochoria vaginalis</i> (Burm. f.) C. Presl
297. 菝葜科 Smilacaceae		
719	尖叶菝葜	<i>Smilax arisanensis</i> Hayata
720	小叶菝葜	<i>Smilax microphylla</i> C. H. Wright
721	抱茎菝葜	<i>Smilax ocreata</i> A. DC.
302. 天南星科 Araceae		
722	菖蒲	<i>Acorus calamus</i> L.
723	海芋	<i>Alocasia macrorrhiza</i> (L.) Schott

No.	Chinese Name	Scientific Name
724	箭叶海芋	<i>Alocasia longiloba</i> Miq.
725	魔芋	<i>Amorphophallus rivierieri</i> Durieu
726	珠芽磨芋	<i>Amorphophallus bulbifer</i> (Roxb.) Blume
727	红浪花叶芋	<i>Calocasia</i> * "Crimson Wave"
728	芋	<i>Colocasia esculenta</i> (L.) Schott
729	野芋	<i>Colocasia esculentum</i> var. <i>antiquorum</i> (Schott) Hubbard et Rehder
730	滴水珠 (水半夏)	<i>Pinellia cordata</i> N.E.Brown
731	大藻	<i>Pistia stratiotes</i> Linn.
732	裂叶崖角藤 (爬树龙)	<i>Rhaphidophora decursiva</i> (Roxb.) Schott
733	泉七	<i>Stuednera colocasiaefolia</i> C. Koch
734	白蝶合果芋	<i>Syngonium podophyllum</i> cv. White Butterfly
石蒜科 Amaryllidaceae		
735	洋葱	<i>Allium cepa</i> L.
736	藠 (芥头)	<i>Allium chinense</i> G.Don
737	葱	<i>Allium fistulosum</i> L.
738	宽叶韭	<i>Allium hookeri</i> Thwaites
739	蒜	<i>Allium sativum</i> L.
740	韭菜	<i>Allium tuberosum</i> Roettler ex Sprengel
741	朱顶红	<i>Amaryllis vittata</i> L.
742	西南文殊兰	<i>Crinum latifolium</i> L.
743	大花君子兰	<i>Clivia miniata</i> Regel
744	大花油加律 (南美水仙、亚马逊百合)	<i>Eucharis grandiflora</i>
745	网球花	<i>Haemanthus multiflorus</i> Martyn
746	石蒜	<i>Lycoris radiata</i> (L'Her.) Herb.
747	葱兰 (玉帘、太阳花)	<i>Zephyranthes candida</i> (Lindl.) Herb
748	风雨花 (红花葱兰)	<i>Zephyranthes grandiflora</i> Lindl.

No.	Chinese Name	Scientific Name
307. 鸢尾科 Iridaceae		
749	射干	<i>Belamcanda chinensis</i> (L.) DC.
750	唐菖蒲	<i>Gladiolus gandavensis</i> van Houtte
311. 薯蓣科 Dioscoreaceae		
751	黄独 (黄药子)	<i>Dioscorea bulbifera</i> Linn.
752	薯蓣 (红孩儿)	<i>Dioscorea cirrhosa</i> Lour.
753	五叶薯蓣 (毛团子)	<i>Dioscorea pentaphylla</i> Linn.
754	褐苞薯蓣	<i>Dioscorea persimilis</i> Prain et Burkill
313. 龙舌兰科 Agavaceae		
755	龙血树	<i>Dracaena cochinchinensis</i> (Lour.) S. C. Chen.
756	香龙血树	<i>Dracaena fragrans</i> Ker
757	富贵树 (绿叶仙达龙血树、万年青)	<i>Dracaena sanderiana</i> var. "virescens"
758	金边虎尾兰 (变种)	<i>Sansevieria trifasciata</i> Prain var. <i>laurentii</i> (De Wildem.) N. E. Brown
314. 棕榈科 Palmaceae		
759	假槟榔	<i>Archontophoenix alexandrae</i> (F. Muell.) H. Wendl. et Drude
760	单穗鱼尾葵	<i>Caryota monostachya</i> Becc.
761	鱼尾葵	<i>Caryota ochlandra</i> Hance
762	椰树	<i>Cocos nucifera</i> Linn.
763	油棕	<i>Elaeis guineensis</i> Jacq.
764	蒲葵 (扇叶葵)	<i>Livistona chinensis</i> (Jacq.) R. Br.
765	棕榈 (棕树)	<i>Trachycarpus fortunei</i> (Hook.) H. Wendl.
315. 露兜树科 Pandanaceae		
766	分叉露兜 (山菠萝)	<i>Pandanus furcatus</i> Roxb.
318. 仙茅科 Hypoxidaceae		
767	仙茅	<i>Curculigo orchioides</i> Gaertn.

No.	Chinese Name	Scientific Name
768	头花仙茅 (大叶仙茅)	<i>Curculigo capitulata</i> (Lour.) O.Ktze.
321. 箭根薯科 Taccaceae		
769	箭根薯 (老虎花)	<i>Tacca chantrieri</i> André
323. 水玉簪科 Burmanniaceae		
770	水玉簪	<i>Burmannia disticha</i> Linn.
326. 兰科 Orchidaceae		
771	绿花安兰	<i>Ania hookeriana</i> (King et Panll.) Tang et wang ex Sumern.
772	花叶开唇兰 (金线兰)	<i>Anoectochilus roxburgii</i> (Wall.) Lindl.
773	白芨 (双肾草)	<i>Bletilla striata</i> (Thunb) .Rchh f.
774	靴底石斛 (大黄草、玫瑰石斛)	<i>Dendrobium crepidatum</i> Lindl. ex Paxt.
775	密花石斛	<i>Dendrobium densiflorum</i> Lindl. Ex Wall
776	串珠石斛 (盆黄草)	<i>Dendrobium falconeri</i> Hook.
777	重唇石斛 (网脉唇石斛)	<i>Dendrobium hercoglossum</i> Rchb. f.
778	阔叶沼兰	<i>Malaxis latifolia</i> J. E. Smith in Rees
779	云南齿唇兰	<i>Odontochilus yunnanensis</i> Rolfe
780	钗子股	<i>Luisia morsei</i> Rolfe
331. 莎草科 Cyperaceae		
781	近蕨藁草	<i>Carex subfilicinoides</i> Kükenth.
782	香附子	<i>Cyperus rotundus</i> Linn.
783	四棱穗莎草	<i>Cyperus tenuiculmis</i> Bockeler
784	异型莎草	<i>Cyperus difformis</i> Linn.
785	毛轴莎草	<i>Cyperus pilosus</i> Vahl
786	两歧飘拂草	<i>Fimbristylis dichotoma</i> (L.) Vahl
787	水虱草	<i>Fimbristylis miliacea</i> (Linn.) Vahl
788	单穗水蜈蚣	<i>Kyllinga nemoralis</i> (J. R. et G. Forst.) Dandy ex Hutch. et Dalziel

No.	Chinese Name	Scientific Name
789	湖瓜草	<i>Lipocarpa microcephala</i> (R. Brown) Kunth
790	砖子苗	<i>Mariscus sumatrensis</i> (Retz.) J. Raynal
791	红鳞扁莎	<i>Pycreus sanguinolentus</i> (Vahl) Nees
792	球穗扁莎	<i>Pycreus flavidus</i> (Retz.) T. Koyama
793	水毛花	<i>Schoenoplectus mucronatus</i> (Linn.) Palla
794	萤蔺	<i>Schoenoplectus juncooides</i> (Roxb.) Palla
795	小型珍珠茅	<i>Scleria parvula</i> Steud.
796	陆生珍珠茅	<i>Scleria terrestris</i> (L.) Fass.
332b. 竹亚科 Bambusoideae Nees		
797	缅甸竹	<i>Bambusa burmanica</i> Gamble
798	粉单竹	<i>Bambusa chungii</i> McClure
799	油竹	<i>Bambusa lapidea</i> McClure
800	车筒竹	<i>Bambusa sinospinosa</i> McClure
801	缅甸龙竹 (埋桑)	<i>Dendrocalamus birmanicus</i> A. Camus
802	粗穗大节竹	<i>Indosasa ingens</i> Hsueh et Yi
803	流苏梨藤竹	<i>Melocalamus fimbriatus</i> Hsueh et C.M. Hui
332b. 禾亚科 Agrostidoideae		
804	密序野古草 (孟加拉野古草)	<i>Arundinella bengalensis</i> (Spreng.) Druce
805	野古草	<i>Arundinella anomala</i> Steud.
806	野燕麦	<i>Avena fatua</i> Linn.
807	硬秆子草	<i>Capillipedium assimile</i> (Steud.) A. Camus
808	薏苡 (川谷)	<i>Coix lachryma-jobi</i> Linn.
809	狗牙根	<i>Cynodon dactylon</i> (Linn.) Pers
810	升马唐	<i>Digitaria ciliaris</i> (Retz.) Koel.
811	牛筋草	<i>Eleusine indica</i> (Linn.) Gaertn.
812	知风草	<i>Eragrostis ferruginea</i> (Thunb.) Beauv.

No.	Chinese Name	Scientific Name
813	白茅	<i>Imperata cylindrica</i> var. <i>major</i> (Nees) C. E. Hubb.
814	粗毛鸭嘴草	<i>Ischaemum barbatum</i> Retz
815	淡竹叶 (山鸡米)	<i>Lophatherum gracile</i> Brongn.
816	类芦	<i>Neyraudia reynaudiana</i> (Kunth) Keng ex Hitchc.
817	两耳草	<i>Paspalum conjugatum</i> Berg.
818	类雀稗	<i>Paspalidium flavidium</i> (Retz.) A. Camus
819	圆果雀稗	<i>Paspalum orbiculare</i> Forst. f.
820	象草(马鹿草)	<i>Pennisetum purpureum</i> Schum.
821	金色狗尾草	<i>Setaria pumila</i> (Poir.) Roem. et Schult.
822	狗尾草	<i>Setaria viridis</i> (Linn.) Beauv.
823	高粱 (蜀黍)	<i>Sorghum vulgare</i> Pers.
824	小麦	<i>Triticum aestivum</i> Linn.
825	棕叶芦	<i>Thysanolaena maxima</i> (Roxb.)O.Ktze.
826	苞子菅	<i>Themeda gigantea</i> var. <i>caudata</i> (Nees) Keng
827	玉蜀黍 (包谷)	<i>Zea mays</i> Linn.

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

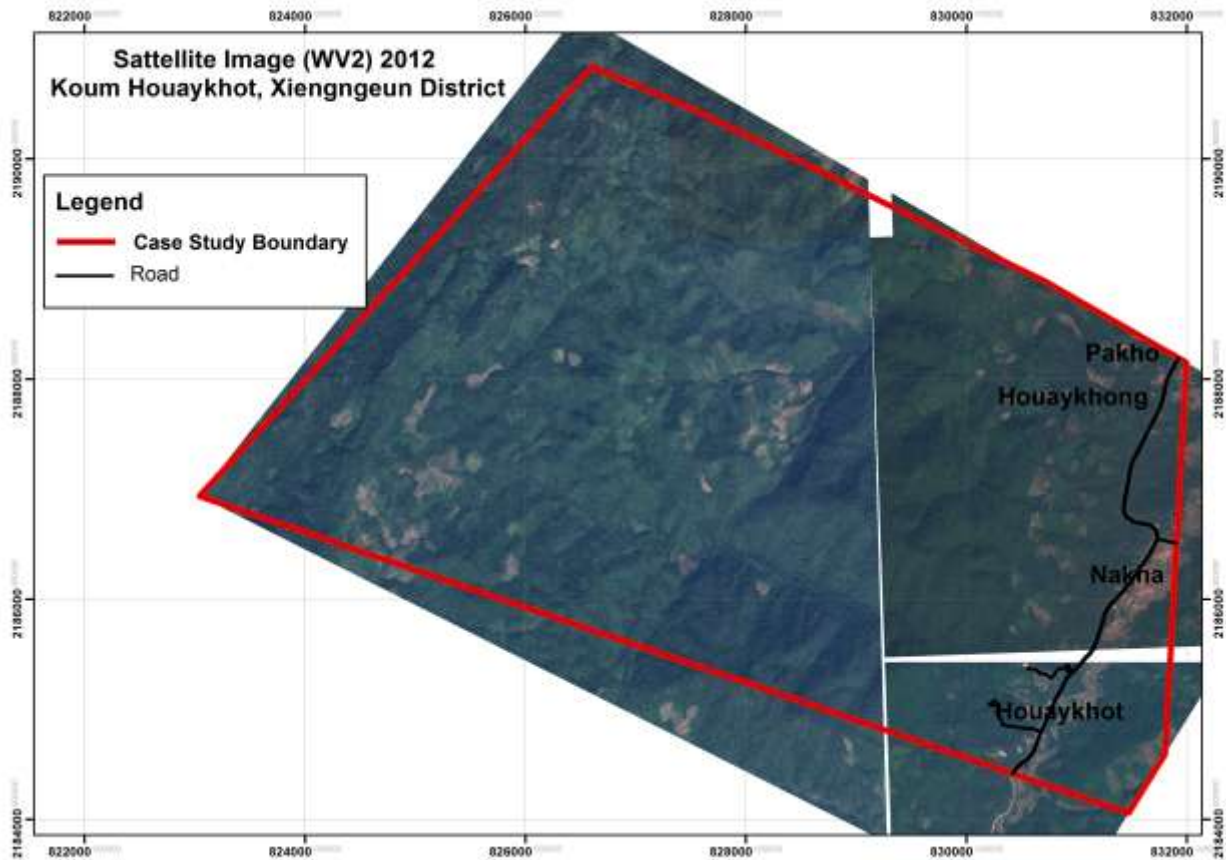
**Thematic report on field assessment of forest resources
for the project site in Laos**

November, 2013

Location of project site:

The project site is located at Longitude 2184000 - 2190000 E (UTM) and latitude 2184000 – 2190000 N (UTM), at Koum Houaykhot cluster villages, Xiengngeun district, Luangprabang province with an elevation of from 400 - 1200 m above sea level. The topography is classified as mountainous land with slope ranging from 25 % to more than 100%.

Picture 1: Satellite image of Houaykhot cluster village, Xiengngeun district Luangprabang province



Climatic feature:

Houaykhot cluster villages is located in humid-tropical and highland monsoon climate zone. Recorded data of climate stations near the project site shows specific climatic feature as below:

Temperature:

Generally, average temperature of the area is rather high. However, temperature difference between months and seasons is not significant. There is the trend that temperature is increase gradually from high land to low land areas. Specific of temperature is interpreted in brief as below:

- Mean temperature (min.): 10.C
- Mean temperature (max): 33.C

Rainfall:

In term of rain regime, the project site has two seasons evidently: rainy season starts in April and ends in October; dry season starts in November and ends in March of next year. Annual rainfall is 1,200-1500 mm but it is fluctuant yearly, lowest is 1,010.2 mm and highest is 1,515.9 mm. Rainfall is not distributed regularly between seasons.

+ Rainy season contributes 88 % of annual rainfall. Rain is intensive in this season. Rainfall from July to September contributes 48 % of annual rainfall.

+ Dry season has very low rainfall. This influences strongly to growth of crop, especially, to annual crops.

- Mean annual air moisture: 75%
- Air humidity (min): 35%
- Air humidity (max): 95%
- Annual rain fall: 1200 -1500 mm

In summary, rainfall and its distribution are relatively suitable for arranging cultivation seasons.

Soil:

- Major soil type: Luvisols (FAO)
- Surface soil texture: Loam – Clay loam
- Soil dept: medium to deep (70 to >100cm)
- pH: Slightly acidic to neutral (5.5 to 6.5)
- Cation Exchange capacity: > 24 me/100g clay
- Base saturation: >50%
- Soil fertility: Medium (%OM: > 2%)

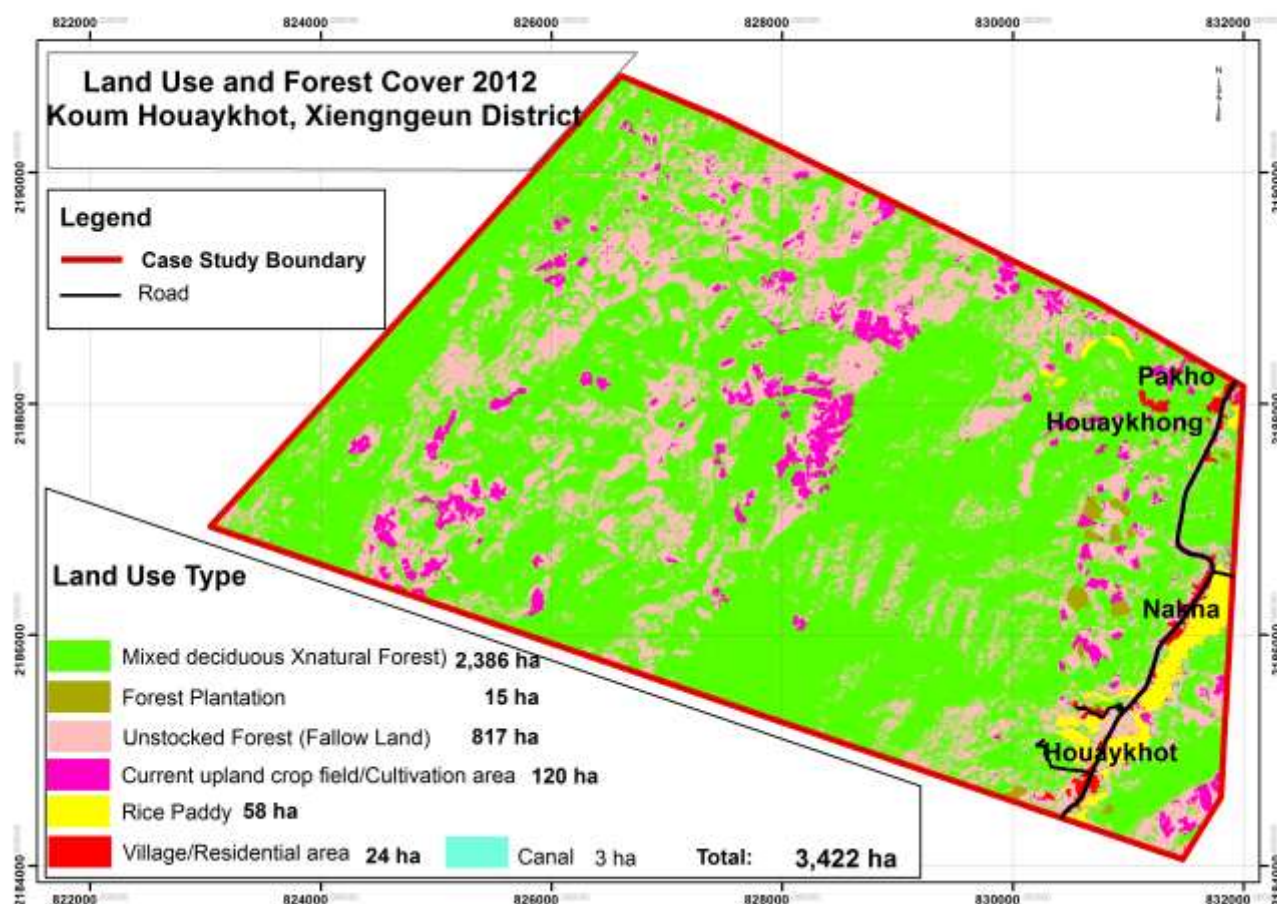
Land Use of Houaykhot cluster villages

In Houaykhot cluster villages, natural forest covers about 2386 ha or 70% of total land area, including mixed deciduous forest of bamboo predominant forest. Plantation forest included teak plantation of 15 ha , rotated fallow land 817 ha and upland field crops of upland rice, maize and jobs tears of 120 ha, paddy rice 58 ha and residential areas of 24 ha.

Table1 Land use, forest cover of Houaykhot cluster villages

Type of Land Use	Area	
	ha	%
Natural forests (mixed deciduous)	2,386	69.50
Plantation forest (Teak)	15	0.45
Unstocked forest (fallow land)	817	24,15
Current upland crop fields	120	3.50
Paddy rice	58	1.70
Residential areas	24	0.70
Total Area	3,420	100

Picture 2: Land use and forest cover of Houaykhot cluster village



Demography of Houaykhot cluster village

Houaykhot cluster villages consisting of four villages, namely Houaykhong, Paktho, Nakha and Houaykhot. Houaykhot cluster village has a total of 281 households, with a total of population of 1463 persons, and can be divided in 3 groups as 25%, 12% and 63% are classified as Laolum, Hmong and Khmu groups respectively.

Table 3. Ethnic composition

Ethnic groups	Number of families	Total population	%
Lowland Lao	117	372	25
Hmong	31	182	12
Khmu	133	909	63
Total	281	1463	100

Occupation

The main occupation of villagers in Houaykhot cluster villages is farmers (shifting cultivators, small scale of tree planting, livestock raising, paddy rice growing,) consisting of 243 families or 86% , 9 families or 3.20% are vendors (traders, middle man), 19 families or 6.75% are labours, 10 families or 3.55% of total families in the village are government officials such as teachers, soldiers, police and others in government sectors, and the remaining involved in masonry, trading, handicraft. While a secondary occupation is gardening and labor.

Village economy

Houaykhot cluster village's economy is involved in a variety of on-farm and on farm activities. Annual cropping takes place within a rotational shifting cultivation system, and plots are now

commonly cultivated for one or two successive years before a two or three year fallow period. The main crops included upland rice for subsistence as well as maize and Job's tear sold. In addition to annual cropping, vegetable production for cash income (e.g. ginger, chilli, beans, lettuces, watercress and several grasses) based on a continuous cultivation system, collecting forest products (e.g. fuel wood, mushrooms, bamboo shoots, rattan, and wilde vegetable), livestock farming (e.g. poultry, pig, goats and cattle) and perennial tree production (mainly teak) also play very important role in contributing to household source of income. Off-farm activities such as small-scale trading, craftwork, broom grass making undertaken in the village and mainly laboring (daily and monthly paid workers in construction and company) to a minor extent, in Luang Prabang – contribute significantly to the livelihoods of many households.

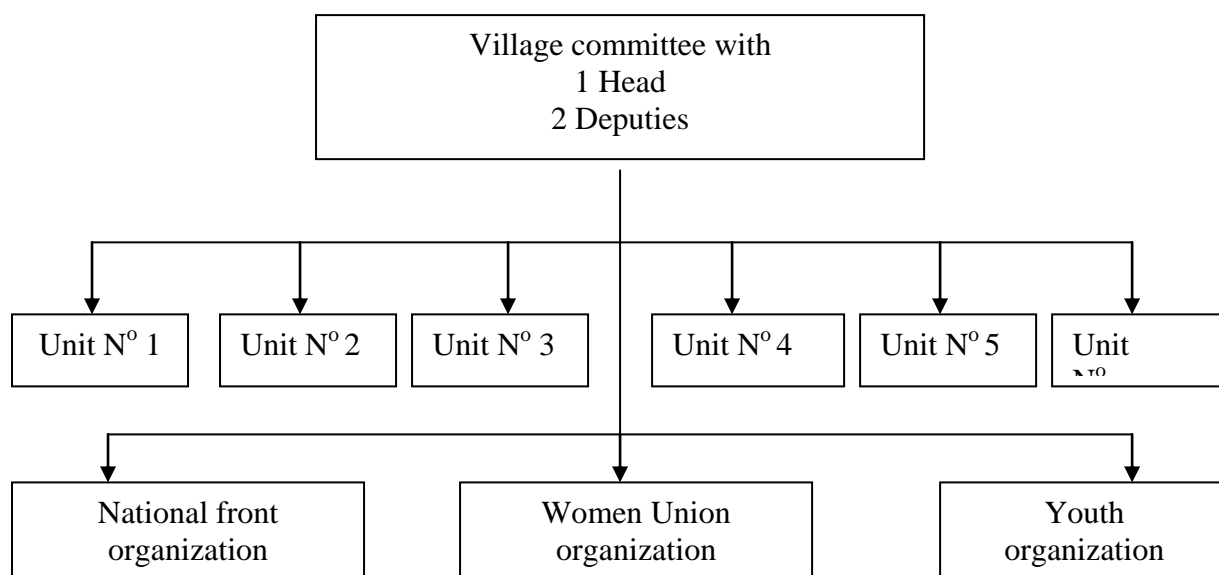
Culture and recreation of traditions,

Most of the villagers (75%) are animist and about (25%) are Buddhist. According to their religion, there are three big annual festival ceremonies in the villages that have been successively celebrated from generation to generation. The first annual festival ceremony is called “Boonkaleu” for Kmu, means festival for upland rice harvesting. The second annual festival ceremony, (Hmong new year) is called ‘ Kin Chiang” Both festivals “ Boonkaleu” and “ Kinchiang” were celebrated for three days after crops were completed havesting, from the first lunar calendar day of the first month (Deuan Chiang), it may be in late November or earlier December The third festival is called “Pimay Lao) Lao New Year festival. It celebrated for 3 days, it fall in middle of April. In addition to these big event festivals, there is a day off for them, two days per months, in the full moon day “ Kheun sipha Kham) and in the completed disappearance of moon, the last day of the month.

Social institutions .

Each village is run by a village committee represented by one head and two deputies elected by village members and it divides into households units of 10 –15 households per unit. Each unit has a leader and deputy leader. There are three major formal organizations: the women union organization, youth organization and national front organization (elder group), in which older people give guidance to the young (fig. 1)

Figure 1: Institutional diagram of villages wthin Houaykhot cluster villages.



Baseline assessment under different land use in the project area

1. Natural forests (mixed deciduous)

Natural forest has a total area of 2,386 hectare or covers nearly 2/3 or 70% of total areas. It is characterized by degraded forest

Wood species

There are 60 species of major woods out of which 3 species are classified as valuable timbers like Dalbergia Lanceolaria, Afzelia Xylocarpa and Pterocarpus macrocarpus, The majority of wood species available are တိမ်ထောင့် Aporosa villosa, မြေလဲ Albizia odoratissima, ခိုင်မာ Oroxylum indicum, တိမ်ထောင့်အိမ် Antidesma sp, မြေမေ့ တိမ်ရဲ Afzelia xylocarpa, မြေပိစမ Lagerstroemia sp, တိမ်ကော် Flacourtia indica, စာမာ Dalbergia cultrate, ကံဘေတော Nauclea orientalis, တိမ်ဗာကထောင့်, Antidesma bunius, တိမ်ပုံ Sterculia spp, ကာ့အော့ Millingtonia hortensis, မြေထောင့် Terminalia bellirica, မြေတရား Colona floribunda, မြေဂွံ Pterocarpus macrocarpus, မြေတိတ် Cratoxylum formosum, မြေတိမ်က, Alstonia rostrata, ကော့ကိုင် Ailanthus malabarica, ခိုင်အော့ Croton argyratus, ဝော့ထောင့် Markhamia stipulata, မြေခိုင်ဟေင် Mallotus paniculatus, မြေမာ့ Wrightia arborea, မြေထောင့် Polyalthia nemoralis, မြေပိစ Bauhinia spp, မေ့ရဲ Garuga pinnata, တိမ်ခိုင်မိုင်, တိမ်အော့ပိုင် Phyllanthus emblica, ကေပိုင် Dalbergia lanceolaria, မိမာ Dalbergia lanceolaria, မြေမေ့, Shorea siamensis, တိမ်ဝော့ဟော့, Bauhinia variegata, တိမ်ကော့ Spondias pinnata, ဝိုင်ထောင့် တိမ်ထောင့် Protium serratum, ဝိုင်ခိုင်အော့ Heteropanax fragrans, ပိုင်ထောင့် Pterygota alata, မြေခိုင်, မေ့ဟော့, ထောင့်ခိုင် Antidesma acidum, မြေခိုင်, မြေကိုင် Livistona speciosa.

It was found that valuable trees or rare native species like Pterocarpus macrocarpus and Afzelia xylocarpa are remaining very few in the areas due to over harvesting and illegal logging. Most of available trees are characterized by small trees with diameter less than 20 centimeters and low valuable trees like Helicteres lanceolata, Spondias pinnata and Cratoxylum formosum (see table 2)

.Table 2: Valuable VS poor valuable woods in degraded mixed deciduous forest

wood with D>20cm		wood with D<20cm	Regenerative wood
Species	tree/ha	tree/ha	Tree/ha
Helicteres lanceolata	-	5700	6400
Pterocarpus macrocarpus	-	6	11
Afzelia xylocarpa	-	-	-

Soil quality in natural forest

- Soils in natural or mixed deciduous forest, have silt or finer texture. The sand is about 30 - 52 %; silt is about 15 - 37 %; clay is around 20 - 42 %. Bulk density ranges from 1.20 - 1.39 g/cm³; particle density is about 2.36 - 2.73 g/cm³. Porosity in the soil surface horizon is about 48 - 52 %.

- These soils have a slightly acidity, pH_{H₂O}, ranging from 5.5 to 6.5 and pH_{KCl} from 5.1 to 6.3. CEC is quite high, about 19.25 - 35.24 meq/100g soil and 26.36 - 51.74 meq/100g clay. Sum of exchangeable cations is very high (In that Ca⁺⁺ and Mg⁺⁺ are dominant). BS is high, about 57 - 80 %.

- Soils have medium OC, total nitrogen and phosphorus contents; medium to rather high available phosphorus and potassium; medium to low total potassium. OC content is about 1.98 - 2.54 % OC. Total N is about 0.15 - 0.32 % N. Total phosphorus is from 0.10 to 0.28 % P₂O₅ and available phosphorus is from 6.15 to 18.56 mg P₂O₅/100g soil. Total potassium is about 0.31 - 1.96 % K₂O and available potassium is about 15.40 - 32.16 mg K₂O/100g soil. Generally, these soils have a high fertility

2. Fallow land or unstocked forest

Fallow land or unstocked forest has a total area of 817 hectares, it covers 24% of total natural land. It is characterized young fallow land with small trees, shrubs and various lianas and weed species. From field surveys, it was found that the numbers of NTFP is gradually reduced . The reduced number of NTFP including *Thysanolaena latifolia* (broom grass), *Calamus siamensis*, *Daemonorops jenkinsiana* and *Calosanthos indica* (Mak Linmay) due to over harvesting and high demand from markets.

Soil quality

- *Physical properties:* Soils have loam to clay texture. Ratio of particle size as follows: The clay content is 21.3 – 59.6%; silt occupies 13.6 – 23.8%; remainder is sand, mainly fine sand. These soils have bulk density ranges from 1.18 to 1.55 g/cm³. Porosity is around 51 - 54% in the topsoil. Ratio of fragment and stone is from 10 to 20% (by weight).

- *Chemical properties:* Soils have, slightly acidity, high CEC and medium BS. pHH₂O ranges from 5.3 to 6.4; pHKCl is about 5.7 - 6.8; CEC is from 13.8 to 23.6 meq/100g soil and 18.5 to 41.6 meq/100g clay. BS varies from 50 to 80%.

These soils have a quiet high OC; a medium to low total nitrogen and phosphorus content, total and available potassium content, low available phosphorus. OC content is about 1.4 - 2.15%OC in topsoil. Total N is low to medium, ranging from 0.04 to 0.17%N (some topsoil horizons reaches 0.22%N). Total phosphorus is about 0.04 - 0.18%P₂O₅ and available phosphorus is about 1.65 - 5.88 mg P₂O₅/100g soil. Total and available potassium are from 0.09 - 0.24 %K₂O and 8.65 - 20.00 mg K₂O/100g soil, respectively.

In general, soils have a medium fertility.

3. Current upland crop fields

Upland crop field has a total area of 120 hectares and covers 3.50% of total natural land. Main crops cultivated are upland rice, maize and jobs tear, almost, the cropping systems is monoculture. The yield of annual crops is low (maize yield is 2 tons per hectare), especially for upland rice yield (less than 1 ton per hectare) due to short fallow period (2-3 years) resulting in weed problems and poor soil fertility.

Soil quality

Physical properties: Soils have a texture of sandy clay loam. The clay content is about 35.0 – 43.0%; silt 11.0 – 29.0%; remained composes of sand. Specific characteristics of there soil are the rate of fragments and stones in soil is quite high, about 20 - 45% (by volume) in average. The depth of effective soil horizon is less than 70 cm in average. These soils have a bulk density is about 1.20 - 1.52 g/cm³. Porosity ranges around 50 - 53% in the topsoil.

- *Chemical properties:* Soils are slithly acidic, good medium CEC and low BS. pH_{H₂O} ranges from 5.4 to 6.0; pH_{KCl} ranges from 4.8 to 5.0. CEC ranges about 10.0 - 21.0 meq/100g soil and 18.25 - 35.49 meq/100g clay. BS is less than 30%.

- *Other properties:*, Soils have low total OC medium to low total phosphorus and total nitrogen content but available phosphorus is low; low total and available potassium. OC content is 1.41 - 1.76 %OC in the topsoil. Total N is from 0.07 - 0.17 %N. Total phosphorus is about 0.06 - 0.08 %P₂O₅ and available phosphorus is less than 5.0 mg P₂O₅/100g soil. Total potassium is about 0.17 - 0.45 %K₂O; available potassium from 7.20 to 12.00 mg K₂O/100g soil.

In general, soils under field crops have a medium to low fertility

4. Tree plantation (teak plantation)

Teak plantation has a total area of 15 hectares and covers around 0.50% of total natural land. From field survey, the densities of teak per unit areas is too high (more than 1000 trees per ha) resulting in poor quality of timber , there is no storey under teak due to shading of canopy, clearing and burning of crop residue , resulting in soil erosion occurred , Agro-techniques like thinning and pruning of teak plantation is needed to improve the condition both timber quality and soil erosion control

Soil quality

- These soils have a texture of sandy to sandy loam. The content of clay is about 8 - 25 % (mainly fine sand); silt is about 10 - 30 % and remainder composes of sand. Bulk density ranges from 1.22 to 1.37 g/cm³. Porosity in the topsoil is ranging from 49 to 53 %.

- Soils are acidic (Because of basic cation leaching), low CEC and BS. pH_{H₂O} varies from 4.6 to 5.7 and pH_{KCl} from 3.7 - 4.7. CEC is ranging around 5.12 - 11.28 meq/100g soil and 9.03 - 22.39 meq/100g clay respectively. Sum of exchangeable cations is low, varies from 1.04 to 3.25 meq/100g soil. BS is from 10 to 30 %.

- Almost soils have low OC, nitrogen, phosphorus and potassium contents. OC is about 0.51 - 1.67 %. Total N is about 0.05 - 0.15 %. Total phosphorus is ranging from 0.02 to 0.06 % P₂O₅ and available phosphorus from 1.11 to 6.10 mg P₂O₅/100g soil. Total potassium is about 0.05 - 1.07 % K₂O and available potassium is from 4.47 to 11.21 mg K₂O/100g soil.

Generally, soils under teak plantation have low fertility

5. Paddy rice field

Paddy rice field has a total area of 58 hectares, covers 1.70%, almost is irrigated rice field, the yield is quite high more 3 tons per hectares.

Soil quality

- *Physical properties:* soils have clay loam texture. Sand content is about 37 - 41%; silt is about 15 - 23%; clay is about 36 - 45%. In common, texture is lighter in topsoil than lower horizons. In sub soil horizon, the texture is heavier. Content of sand and clay varies without any law. These soils have a bulk density ranging from 1.21 to 1.53 g/cm³. Porosity in the soil surface horizon is around 55%.

- *Chemical properties:* The soil is acidity, have medium to quite high CEC and medium BS. pH_{H_2O} , ranges from 5.1 to 5.9 and pH_{KCl} from 4.1 to 4.9. CEC is about 11.20 - 23.20 meq/100g soil and 18.93 - 46.97 meq/100g clay. BS is about 14 - 38%.

- *Other chemical properties:* These soils have a low OC, total nitrogen is medium in topsoil; total phosphorus, available phosphorus, total potassium and available potassium content are low. OC content is about 0.55 to 1.46%OC. Total N is about 0.07 - 0.14%N. Total phosphorus is less than 0.06% P_2O_5 and available phosphorus is from 1.30 - 7.10 mg P_2O_5 /100g soil. Total potassium ranges about 0.11 - 0.18% K_2O and available potassium varies about 5.20 - 7.60 mg K_2O /100g soil.

Generally, these soils have medium fertility

Participatory assessment of locally preferred and rare native tree species Participatory assessment of locally preferred and rare native tree species

Based on participatory approach discussion with local people in the areas, there are more than 60 naturally growing tree species were found in the project site. Among them, 6 tree species are found to be endangered locally. There are altogether eight locally preferred species namely Dalbergia Lanceoraria, Afzelia Xylocarpa, Pterocarpus macrocarpus, Betula alnoides (Agarwood), Michelia baillonii, Bombax ceiba, Mangifera sp, Duabanga grandiflora.

Scientific assessment of locally preferred and rare native tree species

Based on Scientific assessment by provincial Forestry unit of Luangprabang and district forestry unit of Xiengneun. on the locally preferred and rare tree species. List of threatened species at the project area are, Dalbergia Lanceoraria, Afzelia Xylocarpa, Pterocarpus macrocarpus, Betula alnoides (Agarwood