Integrated Nature Conservation and Sustainable Resource Management in the Hin Nam No Region

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for Natural Resources and Environment
P.O.Box 555, Thakhek, Khammouane, Lao PDR

On behalf of:

Monitoring of Plant diversity in the Hin Nan No National Protected Area: Botanical Report




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Executive summary

Background: Biodiversity Conservation is the most important goal of the Hin Nam No National Protected Area (NPA). It is also the main goal of the German supported project to promote co-management by surrounding communities and the area management authorities there. The Hin Nam No NPA covers approximately 82.000 ha of predominantly karst/ limestone ecosystems with primary forest of mixed deciduous forest and limestone semi evergreen forest. It is situated in Bualapha district of Khammouane Province and its landscape is contiguous with the similar landscape across the Vietnamese border, covered by the Phong Nha-Ke Bang National Park.

The NPA management unit needs mechanisms that allow it to measure whether the biodiversity values of the NPA are getting better or worse. Villager's participation is essential as there is not enough staff to work on monitoring. For wildlife, a participatory monitoring strategy was prepared by consultants in October 2013 (Berkmueller, 2013) and is being implemented now.

For plant resources, only a checklist of 521 species exists (Walston 1999). Some Forest types were described, but little is known about their conservation status or the extent of surface area covered by each forest type. To set a baseline for monitoring, a list of key plant species to be protected and a smaller list of indicator species are needed. A team of botany experts from the National University of Laos implemented a rapid botany survey in the village of Ban Chalou from 24/03/2014 to 05/04/20124 and 27–30/4/ 2014 to develop these baseline lists.

Objectives: the aim of the survey was to assess what plant species should be prioritized for conservation as key species and to define a shorter list of indicator species for monitoring. A secondary goal was to strengthen the capacity of the biodiversity monitoring and livelihood unit to do assessments of plant diversity, especially working with women.

Methods: A rapid survey was made at Ban Chalou, N 17° 17' 08.5" E 105° 56' 51.6", Boualapha district, Khammouane province, in the Hin Nam No NPA. In this botanical survey, ground transect walks were combined with and walking with semi-structured interviews to record local names, use and conservation status of plant species. Samples were collected photographed and field identification was made by using the knowledge of botanical experts. All selected plant species were recorded and analyzed according to the Red list of IUCN and List of CITES for finding to threat levels and option for future monitoring and developing to sustainable harvesting.

Findings on Forest Types: Six types of forest were recognized in Hin Nam No NPA: (1) *Semi-evergreen forest, (2 Mixed deciduous forest, (3) Degraded forest, (4) Bamboo forest, (5)*

Riverine/Riverside forest and (6) Karst forest. Each type was described and more than 182 species of plants were recorded.

Inside the Hin Nam NO NPA core zone called Kouan Ka Ane zone (a large flat area along the Houay Ka Ane river and along the foot of limestone mountains), the main forest type is Semi-evergreen forest. This forest is a prime habitat for wildlife. Bear claw marks were seen, Douc langurs, black langurs and a great hornbill were encountered. The semi-evergreen forest is dominated by large trees belonging to the Dipterocarp family.

Small patches of Bamboo Forests are found in areas of degraded evergreen forest just north of the village on the slopes leading up to the Phou Chang King Mountain range.

On the top of these mountains there are the karst forests with *Diospyros curranii* Merr.; *D. variegata* Kurz and *D. wallichii* King & Camble ex King (Ebenaceae) and *Dracaena loureiri* (Agavaceae). This is a unique vegetation type that needs to be conserved. It is characterized by trees growing on bare rocks with very little soil.

The Mixed Deciduous Forest occurs mainly to the south of the village, at slopes of the non-limestone mountain of Phou Louang. It is dominated by large trees such as *Lagerstroemia calyculata* and *L. floribunda* (Lythraceae). This area is important for NTFP collection. It also harbors a large stand of 'Mak Tao' sugar palms (Arenga westerhoutti) which has economic potential for sustainable harvesting. This forest type is the most vulnerable to agricultural expansion and many trees were recently felled for the electricity power line. Two types of disturbed forests at the foot hill of Phou Louang were classified as the pure stand of tall grass of *Thysanolaena latifolia* (Poaceae), the old disturbed area (more than 5 years after slush and burn) and the disturbed forest for 3-5 years ago. These are also important NTFP collection areas.

The Riverine Forest along the Xe Bang Fai river is characterized by "mai ka ma" *Saraca indica* and *Homonoia ripari*. The name "Kouan Ka Ane" is derived from the word "Ka Ma". These trees protected the river side with their large spread fibrous roots, they are useful and should be protected.

Findings on species listing for conservation and monitoring:

Herbarium vouchers were collected for 166 species and stored in the University Herbarium. They are still being analyzed and are likely to contain new species and new species records for Laos. There may be a need to add these to the list of key species as well as to propose these for IUCN red-listing.

A set of eight criteria (FAO, 2002) were used to rank these species into order of conservation need. Some species are already on CITES list and Red List of IUCN of threatened species. A set of 124 ***Key species*** of plants (included 45 species of Orchid) were thus prioritized in need of

conservation. The top 22 woody species on the list as well as all 45 orchid species (total 67 species) were selected as ***Indicator species*** (Table 3). They are classified into four groups:

(a) **5 Karst Species**: *Cycas simplicipinna, Dracaena loureiri, Diospyros* cf. *curranii*, *Diospyros* cf. *variegate and Diospyros* cf. *wallichii*. The first two are screw-palms, the other three belong the the "mai moun" group of rare and valuable ebony wood.

(b) **12 Evergreen Forest Species:** 4 rosewood relatives: *Dalbergia cultrate, Dalbergia tonkinensis, Pterocarpus macrocarpus and Erythrophleum fordii* , 5 Dipterocarp timber species: Dipterocarpus alatus, *Dipterocarpus costatus*, *Dipterocarpus retusus, Hopea ferrea, and Shorea thorelii* and three others: *Fagraea fragrans, Nageia wallichiana and Sindora laotica*.

(c) **5 Non-Timber Forest Species:** *Arenga westerhoutii*, the forest sugar palm, *Daemonorops jenkinsiana,* a rattan, *Cansjera rheedii*, a medicinal plant, *Dialium indicum*, a fruit tree and Gnetum montanum, an ornamental.

(d) **45 Orchid Species:** *Dendrobium anosmum, Dendrobium aphyllum, Dendrobium capillipes,Dendrobium chrysotoxum, Dendrobium crystallinum, Dendrobium fimbriatum, Dendrobium gratiosissimum, Dendrobium lindleyi,Dendrobium primulinum,Dendrobium pulchellum, Dendrobium signatum, Aerides houlletianum, Aerides falcatum, Bromheadia aporoides, Acriopsis indica,Acampe rigida, Acriopsis indica, Agrostophyllum planicaule, Apostasia wallichii, Arundina graminifolia, Calanthe veratrifolia, Cephalantheropsis obcordata, Cleisostoma birmanicum, Cleisostoma simondii,Coelogyne fimbriata, Eria lasiopetala, Eria ornate, Eria pannea, Eria tomentosa, Liparis viridiflora, Pholidota imbricate, Renanthera coccinea, Rhynchostylis retusa, Thrixspermum centipeda, Thrixspermum leucarachne, Vandopsis lissochiloides, Zeuxine affinis, Panisea albiflora, Phalaenopsis gibbosa, Pteroceras simondianum, Thrixspermum fleuryi, Anoectochilus calcareus, Mischobulbum longiscapum and Rhomboda petelotii*.

Other observations and Recommendations

Threats are illegal logging of valuable timber trees inside the NPA and clearing forest for agricultural purposes, mainly outside the NPA at the foot of Phou Louang close to the village. Another threat to biodiversity at the Hin Nam No is the forest fires which seem to occur each year during the dry season over much of Kouan Ka Ane. Almost all these fires are set by people for clearing land and probably for providing grazing and facilitate hunting.

For follow-up it is recommended to do more detailed forest inventories to develop baseline data on the densities of indicator species. Secondly, satellite image interpretation could be combined with field observations to determine the distribution of the six forest types throughout the Hin Nam No NPA. Thirdly, more botany surveys are desired to capture all the unknown plant species likely to be hiding inside Hin Nam No NPA. Lastly, resource inventories of NTFPs like Mak Tao would be useful.

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List of acronyms

NPA National Protected Area
CITES Convention on International Trade in Endangered Species
FAO Food and Agriculture Organization of the United Nations
GIZ Deutsche Gesellschaft fuer Internationale Zusammenarbeit
GPS Global Positioning Satellite
IUCN International Union for Conservation of Nature
MAF Ministry of Agriculture and Forestry
MONRE Ministry of Natural Resources and Environment
NBCA National Biodiversity Conservation Area (old term, now: NPA)
NHL National Herbarium of Laos
NTFP Non-Timber Forest Product
NUOL National University of Laos
PDR People's Democratic Republic
PRA Participatory Rural Appraisal
SNV The Netherlands Development Organization
STEA Science, Technology and Environment Agency (old term, now: MONRE)

Monitoring of Plant diversity in the Hin Nan No National Protected Area

Botanical Report

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1 Introduction

Biodiversity Conservation is the most important goal of the Hin Nam No NPA and also of the German supported project. The NPA management unit needs mechanisms that allow it to measure whether the biodiversity values of the NPA are getting better or worse. Villager's participation is essential as there is not enough staff to work on monitoring. For Plant diversity, only a checklist of 521 species exists (Walston 1999). Six forest types were distinguished: (1) Evergreen forest, (2) Mixed Deciduous Forest, (3) Deciduous Forest, (4) Secondary Forest, (5) Fallow land after shifting cultivation and (6) Bamboo Forest[1]. Little is known about the extent of surface area covered by each forest type. One resource assessment was made on bamboo for handicraft production (Ketphanh, 2013).

From previous surveys it seems likely that NTFPs like forest Orchids, mainly *Dendrobium* and *Paphilopedum spp*. (coming from Karst forest), eaglewood, "ketsana", *Aquilaria sp*. and wild sugarpalms "mak tao", *Arenga westerhoutii* (from Semi-evergreen forests) are in danger of overharvesting. In and around the NPA, illegal logging of rare hardwood species such as mai kayoung, *Dalbergia sp*., striped rosewood, "mai dou", *Pterocarpus macrocarpus*, mostly from Mixed Deciduous Forest and ebony "mai moun", *Diospyros sp.* (from Hill limestone semi evergreen Forest) are the most sought after and in need of protection and "Mai kacha" *Erythrophleum fordii* Oliv. mostly from Semi evergreen forest.

The role of the botanical survey specialist was to accompany on 24/03/2012 to 05/04/2012

[1] *The 1999 Walston report used an older typology of forest types. The 1999 Walston report did not distinguish Karst Forest, which was found to be a key forest type, characteristic for Hin Nam No NPA in the present survey. In the present survey, all Deciduous Forests encountered were in fact Mixed Deciduous Forests, so the category of Deciduous Forests was scrapped. Secondary Forest and Fallow land were lumped into a category "Degraded Forest" and the category of Riverine Forest was added.*

and on 27–30/4/ 2014 with field-work at Ban Chalou in order to: 1) Identify the major forest and vegetation types present in Phou Changking and Kouan Ka An of Hin Nam No NPA. 2) Record daily GPS track logs and GPS waypoints of major forest types, forest-type transitions, and areas with economically important species (e.g., "Mai moun" *Diospyros mun*) during all expedition days. 3) Identify dominant tree and higher plant species associated with the major forest and vegetation types 4) Collect herbarium quality specimens of botanical interest including any unidentified or potentially un-described taxa; record GPS position for all collections and 5) Train at local staffs and villagers in basic plant identification, botanical collection and vegetation surveying.

2 An overview of botanical diversity and forest ecosystems in Laos

Under the rapid loss of plant diversity driven by land use change, climate change, and other anthropogenic pressures, we urgently need to develop policies and design plans that contribute to reduce the plant diversity loss. A database of plant species and their distribution including Red Lists and Hot Spot Maps is a prerequisite for designing better policies for plant conservation. In Laos, the Checklist of Vascular Plants of Lao PDR was published in 2007 in which 4850 species of 231 families were recorded with some distribution records. However, collection density of herbarium specimens collected in Laos remains the least among Indochinese countries.

Forest ecosystems are generally classified according to altitude (e.g. riverine, slope/hill montane), dominant species of trees, types of plant communities (the composition of plant species), and whether the majority of canopy tree species are deciduous or evergreen. In 1999, Rundel presented the forest habitats and flora in Lao PDR, Vietnam and Cambodia and reported that forest habitats in the Lao PDR can be broadly divided into three groups, lowland, montane and a-zonal habitats. Communities in lowland and montane habitats respond to broad patterns of climatic regimes, while communities in azonal habitats[2], in their evolution and distribution, respond and develop under highly specialized conditions of soil

[2] *"Azonal habitats are those where specific local environmental conditions override the broader climatic regime to produce specific types of communities. The most typical of azonal communities are wetlands where soil moisture conditions are seasonally or perennially flooded (…) Specialized edaphic regions where soil substrate has a dramatic effect on plant community structure and composition would also be treated as azonal habitats. Many Lao plant species do show specific ranges associated with granitic soils in northeastern Lao, limestone soils in the Annamite Range of central Lao, or volcanic clay soils derived from basalts on the Bolovens Plateau. The community structures in these areas of specific soil characteristics are sufficiently distinct to be considered as azonal forest communities." (Rundel, 1999, p. 51)*

characteristics or water regimes. The karst vegetation in Hin Nam No could be defined as an azonal habitat in this sense.

However, The Forest ecosystems of Lao PDR (MAF & STEA, 2003) were generally classified to: Lowland forest habitats are those generally below 800-1,000 m elevation where tropical floristic elements predominate in forest structure and diversity. These lowland habitats are primarily distributed in scattered areas of northern Lao PDR, along the Mekong river valley in central Lao PDR, and along the foothills of the Annamite range in southern Lao PDR and montane forest habitat are above about 800-900 m elevation, forests structure and species composition undergo rapid changes from lowland forest type to montane forest communities that may generally be called montane evergreen forest, hill evergreen forest.

The montane forest habitats comprise transitional, montane forests, open montane forests, open montane conifer forests, evergreen forests of Fagaceae and Lauraceae, mixed hardwood-conifer forests, dense montane conifer forests, Ericaceous cloud forest and degraded montane forests. Large areas of northern Lao PDR with low mountains and narrow valleys support forest associations that have been described as "subtropical broadleaf forest".

These associations extend across northern Myanmar, the Lao PDR and Vietnam into southern China. (MAF & STEA, 2003) These subtropical broadleaf forests are structurally related to the lower montane forests of the Annamite range. Floristically, these forests show stronger relationships to similar forests associations in southern China (Nguyen Nghai Thin 1998, cited in Rundel 1999) than to the Annamite Range. The Annamite Range was originally covered largely by hill and montane evergreen forest, with extensive pine forests on the Nakai Plateau and in the upper Xe Kong catchment further to the south. (Duckworth et al. 1999).

In Laos, eight type of forest were classified based on floristic structure and species composition and according their distribution in different altitude range within southern, central and northern region. Dry Dipterocarp forest, lower dry evergreen, upper evergreen, lower mixed deciduous, upper mixed deciduous, Gallery forest, coniferous and mixed conifer/broadleaf forest were described (MAF & STEA, 2003). Structural and floristic difference within individual forest associations in mainland Southeast Asia have often been recognized by designations of subdivisions of forest types with distinctive structural and floristic characteristics. These subdivisions generally have been described for most forest associations, but these descriptions are reasonably specific to some of the better studied areas of northern Thailand and Burma, and are of less value in describing habitats in Lao, Cambodia and Vietnam. (Rundel. 1999). Four of the Eco-regions occur in the Lao PDR and its NBCAs: Annamite Range Moist Forests; Indochina Dry Forests; Northern Indochina Sub-tropical Moist Forests and Mekong River and its catchment. (MAF & STEA, 2003). Evergreen Forests of the Annamite Mountains and foothills is considered the most

biologically distinct ecosystem.

3 Methods

3.1 Locality

The Area of Bane Chalou, Boualapha district, Khammouane province. At range 200-500 m elevation the names of survey localities, way points with elevation and general of habitat and ecosystems were recorded. Coordinates of representative vegetation types and general habitats obtainment with a GPS meter (Garmin 12XL) were taken.

3.2 Sampling

Semi-structured interviews (interview with a fairly open framework) were used to identify local name, use and conversation status of plant species. Forest walks were undertaken with women from Chalou village trough each forest type. Samples were collected and photographs taken. Where possible, species were identified on the spot relying on the scientific knowledge of the experts, in other cases samples needed to be analysed in the National Herbarium. Typical information on biodiversity, ecosystems and habitat types of the survey sites were noted, the composition of each habitat types of forest were observed. In the herbarium, samples were matched with type specimens to know their taxon as scientific family, genera and species name. This specific rapid observing method was used to document the different groups of forest types, local name of plants species, their abundances and their use.

3.3 Herbarium specimen collections

One to three duplicates/sets of plants specimens were collected by use alcohol method and herbarium vouchers were prepared through drying, classifying, identifying. They will be mounted, labeled, entered into the Herbarium data-base and stored ta the herbarium of the Biology Department, Faculty of Natural Science, National University of Laos, Vientiane. Also, lists of species were created in Excel files. The herbarium vouchers will be distributed to the National Herbarium of Laos (NHL). However, for some specimens additional field work may be needed to improve both quality and quantity.

3.4 Plant species identification

The activity of matching a specimen plant that were collected from survey sites to a known their taxon as scientific family, genera and species name were conducted by use the dichotomous keys to species. The key systems use morphological characteristics included general characters, structures of life-modes, habits, stems, leaves, flowers, fruits. The main botanical literature that was used for checking and correcting scientific names is a checklist of the vascular plant of Lao PDR (Newman, M. et al. 2007). Some samples that turned out to be incomplete may need more analysis and additional field work. Also, collaboration was

sought with other botanical specialist for species identification.

3.5 Team Composition

The survey was led by Dr. Vichit Lamxay and Mr. Soulivanh Lanosavanh from the Faculty of Science, National University of Laos. Two lady students from Biology Department Ms. Sanikhone Nevankham and Ms. Bounsouan Thongsavanh, one Staff of GIZ Mr. Houankham and one lady Ms. Mikta Mouksasy, provincial staff of Department of Natural resource and environment have been participated since the beginning of botanical survey to the end of this expedition. They are very active to learn and practice on plant sample collection and species field identification. At least 10 villagers included 4 women have been very nice local guides and the best informants.

4 Results

4.1 Study site

The main sites visited around Ban Chalou consisted of (1) Say Phou Chang King and (2) Kouan Ka Ane valley inside Hin Nam No NPA, north of Chalou village, (3) the range of Phou Louang south of the village and (4) the disturbed forest riverine forest and bamboo forest in the valley around the Xe Bang Fai river close to the village (see Maps & Fig. 1-3). GPS data points of all study sites are presented in the Table 1.

4.2 Samples collections

A total of 182 samples were collected and their voucher herbarium vouchers were prepared, identified and stored at Herbarium of Biology Department, Faculty of Science, National University of Laos. Some samples may turn out to be new species or new records for Laos, which may be used for future scientific publishing.

4.3 Habitat types

Forest types have been defined based on species composition. Six types of forest were recognized in Hin Nam No NPA: (1) Degraded Forest, (2) Semi-Evergreen Forest, (3) Mixed Deciduous Forest, (4) Bamboo Forest, (5) Riverine Forest and (6) Karst Forest. All habitat types were described and classified belong their flora composition and different elevation from 200-500 m. Mixed Deciduous, Semi-Evergreen and Karst are the dominant forest types.

1) Degraded Forest

At the foot hill of Phou Louang mountains near the village is very serious disturbed by agriculture develop land. Two subtypes of disturbed habitats were recorded. The minor localities, waypoints, location names, habitat types and their floristic compositions at foot hill

of phou louang mountain where are disturbed areas were presented (Table 1 & Fig. 2):

1.1) The Pure stand of Tall grass (Fig. 4) is composed of tall grass *Thysanolaena latifolia* c. 4-5 m tall as a pure stand of dominant broom grass species with small trees c. 3-4 m tall as *Peltophorum dasyrrhachis* (Miq.) Kurz, (Leguminosae) *Cratoxylum formosum* (Jack) Dyer, (Guttiferae), *Triadica cochinchinensis* Lour. *Mallatus barbatus, Macaranga denticulate* (Euphorbiaceae), *Trema orientalis* (Ulmaceae) and *Phoebe lanceolata* (Lauraceae).

1.2) The Old Disturbed Area (more than 5 years) (Fig. 5) is composed of deciduous and evergreen trees c. 8-10 m tall. The upper dominant canopy trees are *Peltophorum dasyrrhachis* (Miq.) Kurz, (Leguminosae) *Cratoxylum formosum* (Jack) Dyer, (Gutteferae), *Triadica cochinchinensis* Lour. *Mallatus barbatus, Macaranga denticulate* (Euphorbiaceae). The middle storey is dominated by evergreen small trees c. 5 m tall *Antidesma* spp., *Aporosa villosa, Baccaurea ramiflora, Breynia glauca, Glochidion sphaerogynum* (Euphorbiaceae), *Phoebe lanceolata* (Lauraceae), *Trema orientalis* (Ulmaceae), *Maesa ramentacea, Ardisia* spp. (Myrsinaceae). The liana *Acacia* spp. (Fabaceae) *Smilax* spp. (Smilacaceae), *Dioscorea* spp. (Dioscoreaceae). And *Combretum* spp. (Combretaceae). Lower storey is dominated by herbs that are *Alpinia* sp., *Amomum* sp. and *Etlingera* sp. Zingiber sp. (Zingiberaceae), *Tacca integrifolia* (Taccaceae), palm are *Rhapis laosensis, Caryota mitis* and *Daemonorop* sp.

2) Semi-evergreen forest: (Fig. 6)

Semi-evergreen forest occurs on the slopes of Phou Chang King mountains in the Hin Nam No NPA area, at range 250-500 m elevation (Table 1). The floristic composition of the semi-evergreen forest is composed of the mixture of large evergreen and some deciduous trees c. 40-45 m in height and c. 80-100 cm in diameter. This forest consist of three layers:

The ***upper storey*** is dominated by evergreen trees of Dipterocarpaceae species c. 25-40 m tall as *Anisoptera costrata, Dipterocarpus retusus*; *D. costatus, Hopea ferrea, Shorea thorelii* (Dipterocarpaceae), *Bischoffia javanica* (Euphorbiaceae), *Alstonia costratas* (Apocynaceae), *Mangifera caloneura and M. sylvatica* (Anacardiaceae) and the large Fabaceous tree *Erythrophleum fordii* mixed with large deciduous trees as *Tetrameles nudiflora* (Datiscaceae), *Largestroemia* spp. (Lythraceae) and *Peltophorum dasyrrhachis* (Miq.) Kurz, (Leguminosae).

The ***middle storey*** is composed of evergreen trees c. 10-20 m in height as *Barringtonia longipes* (Lecythidaceae), Saraca indica (Fabaceae), *Baccaurea ramiflora* (Euphorbiaceae),*Castranopsis* sp. and *Lithocarpus* sp. (Fagaceae), *Cinnamonum* spp., *Phoebe lanceolata* (Lauraceae). *Diospiros* spp. (Ebenaceae), *Canthium umbellatum* (Rubiaceae), Sysygium sp. (Myrtaceae),

The ***lower storey*** is composed of small trees c. 5 m tall *Aralia chinensis, Trevesia palmata* (Araliaceae), *Memecylon* sp. (Melastomaceae), *Antidesma* spp., *Bacaurrea ramiflora, Breynia glauca* (Euphorbiaceae), *Dillenia ovata* (Dilleniaceae), *Knema* sp. (Myristicaceae), *Chassalia curviflora* var. *ophioxyloides*, *Chassalia curviflora* var. *longifolia*, *Gardenia sootepensis, Hedyotis capitellata, Hedyotis elegans, Ixora javanica, Ixora fusca, Lasianthus hirsutus, Oxyceros horridus, Pavetta petiolaris, Prismatomeris* sp. , *Psychotria* sarmentosa, *Schizomussaenda dehiscens, Uncaria macrophylla* (Rubiaceae), *Goniothalamus* spp., *Artabotrys* spp., *Polyalthia* spp. (Annonaceae), *Pandanus fibrisus* (Pandanaceae).

The liana that were found are *Acacia* spp., *Bauhinia scandens*., *Derris* sp., *Entada glandulosa* (Fabaceae), *Cnestis* sp., *Connarus* spp. (Connaraceae), *Ampelocissus martinitii, Tetrastigma leucostaphyllum* (Vitaceae), *Smilax* spp.(Smilaceae) but epiphytic fern, orchids, Araceae (e.g *Photos*), *Dischidia*, *Hoya* (Asclepiadaceae) and some parasitic Loranthaceae were found. Palm (Palmae) *Calamus* , *Areca triandra, Caryota mitis* and *Rhapis* are abundance species in the lower layer.

Epiphytic fern were also found such as: *Adiantum caudatum*, (Pteridaceae), *Pteridium aquilium* (Dennstaedtiaceae), *Hymenophyllum barbatum* (Hymenophyllaceae), *Diplazium esculentum* (Woodsiaceae) .

The Bamboo species *Dendrocalamus lonoifimbriatus, Kinabaluchloa wrayi, Schizostachum virgatum*, *Pseudostachyum polymorphum* and *Neohouzeana mekongensis* (Poaceae) were found as a dominant bamboo species in under shade of this forest.

At range of Phou Chang king mountain (Table 1), the forest structures and floristic composition undergo changes from lowland (200 m elevation) near the Xe Bang Fai river side to the top of mountains (c. 500 m elevation). The Hill Semi-evergreen Forest can be classified into two subtypes such as the (a) Semi Evergreen Hill Limestone forest with Bamboo population under shade of large trees and (b) Semi Evergreen Hill limestone forest without bamboo. In addition, differences could be observed in the dominant composition of of key species and indicator species. At lower elevations, we found the greatest significant population of the hard wood trees "Mai Kacha" *Erythrophleum fordii Oliv.* (between 200 m to 350 m). Higher up (300-450 m) we found dominant key species to be large trees belonging to the Dipterocarp family such as "Mai Ngang deng" *Dipterocarpus costatus* C.F.Gaertn. On the highest level, where bare rocks are mixed with sandy soil (Elevation 350-500 m) there was a concentration of "Mai Ken hin" *Hopea ferrea* (Dipterocarpaceae) presented. At the same altitude, where there were only rocks and very little soil, the forest type becomes more like Karst Forest and the dominant indicator tree species *Diospiros* spp., ebony, were found.

At the core zone of Kouan Ka Ane (the large flat area along the Houay Ka Ane river and along the foot of limestone mountains, see table 1), mostly Semi-Evergreen Forest was

presented. The floristic composition of the semi-evergreen forest here is composed of the mixture of large evergreen and deciduous trees c. 40-45 m in height and c. 80-150 cm in diameter. This forest also has three layers: The ***upper storey*** is dominated by evergreen trees of Dipterocarpaceous species c. 25-40 m tall as *Dipterocarpus retusus*; *D. costatus* (Dipterocapaceae), *Bischoffia javanica* (Euphorbiaceae), *Alstonia costratas* (Apocynaceae), *Mangifera caloneura and M. sylvatica* (Anacardiaceae), Pterocarpus macrocarpus Kurz (Leguminosae) and the large tree of *Callerya atropurpurea* (Wall.) Schot mixed with large deciduous trees as *Tetrameles nudiflora* (Datiscaceae), *Largestroemia* spp. (Lythraceae) and *Neonauclea purpurea* (Roxb.) Merr. (Rubiaceae) (Leguminosae). In addition there was also a large tree of *Ficus* spp. (Moraceae).

The ***middle storey*** is composed of evergreen trees c. 10-20 m in height as *Barrintonia longipes* (Lecythidaceae), Saraca indica (Fabaceae), *Baccaurea ramiflora* (Euphorbiaceae), *Cinnamonum* spp., *Phoebe lanceolata* (Lauraceae), Sysygium sp. (Myrtaceae), Streblus taxoides (Roth) Kurz (Moraceae).

The ***lower storey*** is composed of small trees c. 5 m tall *Aralia chinensis, Trevesia palmata* (Araliaceae), *Memecylon* sp. (Melastomaceae), *Antidesma* spp., *Bacaurrea ramiflora* (Euphorbiaceae), *Dillenia ovata* (Dilleniaceae), *Knema* sp. (Myristicaceae), *Psychotria* sarmentosa (Rubiaceae), *Goniothalamus* spp., *Artabotrys* spp., *Polyalthia* spp. (Annonaceae), *Pandanus fibrisus* (Pandanaceae). The liana that were found are *Acacia* spp., *Bauhinia scandens, Entada glandulosa* (Fabaceae), *Ampelocissus martinitii, Tetrastigma leucostaphyllum* (Vitaceae), *Smilax* spp.(Smilaceae) but epiphytic fern, orchids, Araceae (e.g *Photos*), *Dischidia, Hoya* (Asclepiadaceae) and some parasitic Loranthaceae were found. Palm (Palmae) three species of rattan *Calamus* spp., *Areca triandra, Caryota mitis* and two species of *Rhapis* as *Rhapis laosensis* Becc. and *Rhapis gracilis* Burret are abundance species in the lowest layer. Epiphytic fern and orchid were found. No Bamboo species were found.

3) Mixed Deciduous Forest (see Fig. 7)

Mixed deciduous forest that occurs in the flat land along Xe Bang Fai river and also in the lower Kouan Ka Ane area in the Hin Nam No NPA area, at range 250-350 m elevation (see Table 1). The floristic composition of the mixed deciduous forest is composed of the mixture of large deciduous trees c. 40-45 m in height and c. 50-100 cm in diameter on the top of canopy and some evergreen trees in the top and middle of canopy. This forest has three layers:

The ***upper storey*** is dominated by deciduous tree species c. 25-40 m tall as the large deciduous trees as "Mai Phoung" *Tetrameles nudiflora* (Datiscaceae), "Mai Peuay" *Largestroemia caliculata* and *L. floribunda* (Lythraceae), "Mai Houa Lone" *Parkia sumatrana* Miq. "Mai A Rang" *Peltophorum dasyrrhachis* (Miq.) Kurz, (Leguminosae), "Mai Ngen" *Terminalia bellirica* (Gaertn.) Roxb. (Combrataceae).

The ***middle storey*** is composed of evergreen trees c. 10-20 m in height as "Som hor" *Allospondias lakonensis* (Anacardaceae), "Ka Chian" Polyalthia cerasoides (Annonaceae), "Mai ngen" *Terminalia bellirica* (Combretaceae), "Mak San" *Dillenia ovata* (Dilleniaceae) "Ngang Khao" *Dipterocarpus alatus* (Dipterocarpaceae) "Nom Ngan" *Barrintonia longipes* (Lecythidaceae), "Mak Fai" *Baccaurea ramiflora* (Euphorbiaceae), "Khe hom" *Cinnamonum* spp., "Phai Ven" *Phoebe lanceolata* (Lauraceae). "Dang dam" *Diospiros* spp. (Ebenaceae), "Mak Mong" *Garcinia speciosa* (Guttiferae), "Ka bok" *Irvingia malayana* (Irvingiaceae) "Mak Had" *Artocarpus lakoocha and Ficus* spp. (Moraceae), "Tom" *Mitragyna rotundifolia* (Rubiaceae).

The ***lower storey*** is composed of small trees c. 5 m tall *Memecylon* sp. (Melastomaceae), *Antidesma* spp., *Bacaurrea ramiflora*, *Breynia glauca* (Euphorbiaceae), *Chassalia curviflora* var. *ophioxyloides, Chassalia curviflora* var. *longifolia*, *Gardenia sootepensis*, *Hedyotis capitellata*, *Hedyotis elegans*, *Ixora javanica, Ixora fusca, Lasianthus hirsutus, Oxyceros horridus*, *Pavetta petiolaris, Prismatomeris* sp. , *Psychotria* sarmentosa, *Schizomussaenda dehiscens* (Rubiaceae), (Rubiaceae), *Goniothalamus* spp., *Artabotrys* spp., *Polyalthia* spp. (Annonaceae), *Pandanus fibrisus* (Pandanaceae), *Alpinia* spp. *Amomum* spp. *Zingiber* spp. (Zingiberaceae).

The liana that were found are *Acacia* spp., *Bauhinia scandens*., *Entada glandulosa* (Fabaceae), *Connarus* spp. (Connaraceae), *Ampelocissus martinitii, Tetrastigma leucostaphyllum* (Vitaceae), *Smilax* spp. (Smilaceae) but epiphytic fern, orchids, Araceae (e.g *Photos scanden*), *Dischidia* sp., *Hoya* spp. (Asclepiadaceae) and some parasitic plants Loranthaceae were found. Palm (Palmae) *Calamus* spp., *Areca triandra, Caryota mitis* and *Rhapis gracilis* are abundance species in the lower layer.

Epiphytic fern *Adiantum caudatum*, (Pteridaceae), *Pteridium aquilium* (Dennstaedtiaceae), *Hymenophyllum barbatum* (Hymenophyllaceae), *Diplazium esculentum* (Woodsiaceae) were found. Bamboo species were not found in this forest.

4) Bamboo forest (see Fig. 8)

Almost pure stands of Bamboo were found in scattered area at Kouan Ka Ane and range of Phou Chang King (Table 1). They consisted of Dominant Bamboo species such as "Mai Sod" *Pseudostachyum polymorphum* and/or "Mai Hia" *Schizostachum virgatum* and/or "Mai Phang" *Dendrocalamus longifimbriatus* (Graminae) c. 10 tall as a pure stand of dominant bamboo species with an upper storey of some scattered large evergreen trees (20-25 m. high "Mai Ngang Deng" *Dipterocarpus costratus* (Dipterocarpaceae) and deciduous trees such as "Mai Phoung" *Tetrameles nudiflora* (Datiscaceae), "Mai Peuay" *Largestroemia caliculata* and *L. floribunda* (Lythraceae), "Mai Houa Lone" *Parkia sumatrana* Miq. The middle storey was dominated by one or two Bamboo species mixed with some smaller evergreen trees (5-10 m tall) such as "Mai A Rang" *Peltophorum dasyrrhachis* (Miq.) Kurz, "Mai Khi Mou"

Callerya atropurpurea (Leguminosae), "Ka bok" *Irvingia malayana* (Irvingiaceae), "Mak mong" *Garcinia speciosa*, (Gutteferae), "Mak Lam ngai pa" *Dimocarpus longan* (Sapindaceae), *Triadica cochinchinensis* Lour. *Mallatus barbatus, Macaranga denticulata* (Euphorbiaceae), *Trema orientalis* (Ulmaceae) and *Phoebe lanceolata* (Lauraceae). There are some NTFPs in the undergrowth in Bamboo forest, however, "San" Rhapis gracilis (Palmae), Goniothalamus spp. and Polyanthia spp. (Annonacea), "Nam Koi" *Streblus taxoides* (Moraceae) and "Mak Neng" *Amomum* spp. (Zingiberaceae).

5) Riverine/Riverside forest (See Fig. 9)

Along the rivers Xe Bang Fai, Houy Kai river and Houay Ka An (Table 1), the dominant key species were typical of riverine forest such as "Mai Ka Ma" *Saraca indica* (Leguminosae). The villagers explained that "Houay Ka Ma" is the old name of "Houay Ka Ane" so the area was called after that tree. The large trees of Mai Ka Ma are useful as they protect the riverside from erosion by their large spread and fibrous roots and large trunk at base. In doing so this tree is like a 'keystone' species, providing a habitat for other species such as "Mak Deua" *Ficus* spp. (Moraceae), "Mai Phoung" *Tetrameles nudiflora* (Datiscaceae) and "Mai Khom Phad" *Bischofia javanica* (Euphorbiaceae). The other riverine plant species are *Homonoia riparia*, *Trewia nudiflora* (Euphorbiaceae), *Crateva magna* (Capparidaceae), *Elaeocarpus stipularis* (Elaeocarpaceae) also the lage and long spread of climber *Acacia* spp.,"Keua siou" *Bauhinia scandens.*, " Keua Mak Ba" *Entada glandulosa* (Fabaceae), "Keua to tep" *Connarus* spp. (Connaraceae), *Ampelocissus martinitii, Tetrastigma leucostaphyllum* (Vitaceae). At Xe Bang Fai riverside the dominant tree species are "Mai Ka Ma" *Saraca indica* (Leguminosae), *Acer oblongum* (Aceraceae), *Syzygium mekongensis* (Gagnep.) Merr. & L.M.Perry (Myrtaceae) *Homonoia riparia* (Euphorbiaceae) and large trees of *Ficus* spp. (Moraceae).

6) Karst forest (Open area full light on limestone, Fig. 10)

Karst forest features are well developed in areas of limestone. Essentially no quantitative data exists on the community structure and species richness of limestone forests. Brief descriptions for such forests in the Hin Nam no NBCA of Khammouane Province in central Lao lists *Dracaena fragrans* (Agavaceae), *Arenga pinnata* (Arecaceae), and *Dendrocalamus* (Poaceae) as dominant species (Rundel, 1999).

However, in this survey, the floristic composition of karst forest was examined at Pha Koun Ka An (Table 1). The special dominant species in the karst forest are the ebony wood tree species from the *Diospyros* group or "Mai Moun" group eg. *Diospyros curranii, D. variegate* and *Diospyros wallichii* (Ebenaceae). Another typical karst species in the single stem dragon blood tree species *Dracaena loureiri* (Dracaenaceae). Other species also occur but remain small(3-7m) due to the stressed conditions of high temperature and lack of water.

They often have swollen trunks and large spread root systems, e.g. " Mai Nhom" Toona ciliate (Meliaceae), "Mai Po deng" *Sterculia pexa* and *S. urena* (Sterculiaceae), " Mak Hai" *Ficus* spp. and "Mai Nam Koi" *Streblus taxoides* (Moraceae), "Peuay dok khao" *Lagestroemia* sp. (Lythraceae), *Hymenodictyon orixense* (Rubiaceae), *Vitex* sp. (Verbanaceae). Some herbaceous species also seem to be able to survive on the rock surface, e.g. *Euphorbia antiquorum* (Euphorbiaceae) and *Raphidophora* spp. (Araceae), *Elatostema, Aganostemma, Begonia, Impatien, Peliosanthes, Amorphophallus, Steudnera, and Gesneriaceae* species. Last but not least, several species of Orchids eg. *Dendrobium* spp. and ferns are presented in Karst Forest.

5 Floristic Patterns in Hin Nam No NPA

5.1 Species richness

A list of 161 ***Selected Species*** is presented as ***Species Richness*** (see Table 2). This list shows all species that were found as a important and dominant species in this area. Some species are already on CITES list and Red List of IUCN of threatened species. Some are timber species and some are Non Timber Forest Products that are known under intense harvesting pressure. In addition, some are the important plant species for ecosystem and wildlife. In the table the scientific name, family name, Lao name, occurrence, Red List of IUCN, CITES, habit and their habitats were supplied.

5.2 Key Species for Conservation

The ***Key Species*** of plants are all species that were assessed to be rare and/or endangered, meaning that they need to be prioritized for conservation (see Table 3). This list contains 124 key species (including 45 species of Orchids). These species have small population, are small trees and/or seedling are very rare, high potential value, under high threat by fire forest and over-harvesting. These species should be put as high priority in any forest management system or biodiversity conservation management plans. The aim should be to reduce risks of losing their genetic variation.

5.3 Indicator species for monitoring plant biodiversity

A set of criteria from FAO were used to select a sub-set of **Indicator *species.*** These criteria were:

(1) The species is harvested and has high economic and potential value;
(2) The species is rare that means it has small population and habitat limited;
(3) The species has a spatial distribution;
(4) The reproductive niche of the species requires shade;
(5) The species is dioecious or monoecious that related to their pollinations;
(6) The species is ecologically valuable - it is a "keystone" species;

(7) The species flowers only after attaining a large size or advanced age and
(8) The pollinators/seed dispersers of the species are highly specific.
Four groups were classified as (1) Karst Species, (2) Evergreen Forest Species, (3) NTFPs and (4) the Orchid Group. Forest Species group were specified to three subgroups that are Gymnosperms, Fabaceous Species and Dipterocarpaceous Species (Table 3). Some high priority for indicator species are "Mai Moun" *Diospyros cf. curranii* Kurz (Ebenaceae); "Mai Chandeng" *Dracaena loureiri* Gagnep. (Dracaenaceae); "Mai Kacha" Erythrophleum fordii Oliv. and "Mai Dou" Pterocarpus macrocarpus Kurz (Leguminosae) and Dipterocarpaceous trees (*Dipterocarpus alatus* Roxb. ex G. Don; *D. costatus* C.F.Gaertn.; *D. retusus* Blume; *Hopea ferrea* Pierre and *Shorea thorelii* Pierre). They are the selections among the key species that represent the well-being of the ecosystem as same indicator as for the wellbeing of their habitat that is not only of plants but also creating a suitable habitat for wildlife.

According the result of this botanical survey, 22 woody plants and 45 orchids, all together 67 ***indicator* species** that occur in Hin Nam No NPA are needed for biodiversity conservation, for reduce risks to sustainability and for genetic resource conservation (Table 3). These plants should be preserved not only for the sake of plant diversity but also for wildlife habitat and for the maintenance of sustainable ecosystems and to support eco-tourism in this area. Some of them not yet in the red list of IUCN and not yet in the list of CITES but need to proposed to put in the list and/or to be needed to manage for sustainable use.

6 Non Timber Forest Products Patterns in Hin Nam No NPA

"Mai Moun" or "Mai Dam" (Fig. 11)

In this area, The Black wood "Mai Moun" has been collected for 5 years ago for trade purpose. This beautiful black and white annual ring of hard wood is the main texture for high price of furniture product that were made by this species. In this survey, It is unclear to identify to scientific name of "Mai Moun". For morphological identification, Its description that has recorded in Lecomte, 1930. Flore General de L'Indochine, Tome 3, Fasc. 7, pages 943-945, Fig 106 and 107 doesn't match with the collection that were collected in this area, therefore, it mains "Mai moun" is not *Diospyros mun* (A. Chev.) H. Lec. However, three species of *Diospyros* were found in this site as "Mai Moun" *Diospyros curranii, "*Mai Nangdam*" D. variegate* and "Mai Dangdam" *Diospyros wallichii* (Ebenaceae). Sixty species of *Diospyros* were described by C. Phengklai, 1981, in Flora of Thailand Vol 2 (4) but No record of *Diospyros Mun*. In this study site, all species occur in limited habitat as found only on karst forest and in the hill of limestone. In the study site, *Diospyros* were found at the other type of forest but it is very rare.

"Chane deng" *Dracaena loureiri* Gagnep. (Dracaenaceae) "Dragon blood Tree" (Fig. 12)

The red wood from old plant has trade and medicinal properties. Most of harvested products is export to Vietnam. The red wood probably supply to red dye and it straight single stem with narrow long leaves on the top and with its large inflorescence and their ornamental flowers is also planted for ornamental purpose. "Chane deng" were found only at the hill of limestone as a dominant species in the karst forest. Chane deng wood is collected from the old and died trunk by cutting the red part of wood. In this survey, one villager can collect and carry the red wood of "Chane deng" from limestone mountain that is far about 3Km from village around 20 to 30 Kg. Its primary price is 7,000 LAK/Kg. " Chane deng" can growth by stem cutting and small trees/ seedling that growth on the pods of rocks.

"Chane deng" is the indicator species for conserve and reduce the risks to sustainability of harvesting. "Chane deng" is presented in the limestone of HNN NPA areas.

"Orchids" Orchidaceae (Fig. 13)

In Laos, eighty five genera and around three hundred thirty five species have been identified (Greijmans et al. 2007). One hundred forty six orchids species were described according their collection samples that were taken around the country (Svengsuksa, B & Lamxay, V. 2005). The economically most important orchids in Laos are: *Aerides, Anoectochilus, Bulbophyllum, Coelogyne, Dendrobium, Eria, Flickingeria, Paphiopedilum, Rhynchostylis, Vanda* and *Vanilla* (Greijmans et al. 2007). Most of them that were found at Hin Nam No NPA are all epiphytic, saprophytic and terrestrials orchids at many types of habitats. In Laos, Orchids are mostly valued for their ornamental beauty, trade to Thailand, Vietnam and Chine and medicinal use. There are many species of orchids mainly in the *Anoectochilus, Dendrobium, Paphiopedilum* and *Rhynchostylis* genera are becoming rare due to habitat degradation, over harvesting and high marketing demand. All of them must be continue to study and improve quality and increase number of sample for describe into a new record from Laos and new species to Laos. In this survey, 45 orchid species were recorded, the species of genus *Dendrobium* are the dominant species that occur on the rocks in karst forest.

"Peuak Meuak" *Boehmeria malabarica* Webb. (Urticaceae) (Fig. 14)

"Peuakmeuak" fibers are used to make incense sticks, mosquito repellents and glue (NAFRI, NUoL & SNV, 2007). The whole plant is harvested for its bark. It is a shrub or climber that is presented in disturbed area along the river Houy Ka Ane. In this area, no body know about its economic value.

"Mai Ngang" Group. Dipterocapaceous trees (Dipterocarpaceae) (Fig. 15)

"Nam Man Ngang" The resin of Dipterocarpaceous tree serves as a varnish or lacquer. There are Five species of the family Dipterocarpaceae as *Dipterocarpus alatus* Roxb.

ex G.Don; *D. costatus* C.F.Gaertn.; *D. retusus* Blume; *Hopea ferrea* Pierre and *Shorea thorelii* Pierre are the big trees c. 25-30 m tall and trunk c. 150 cm in dbh. There are high quality of wood/timber. Their resin "Nam Man Gnang" of *Dipterocarpus* trees and their darmar resin "Khi si" from *Shorea* and *Hopea* trees are the high economic value and useful of non timber forest product for local people. In this survey, The most of Dipterocarpaceous trees were found in semi evergreen forest of Range of Phou Changking and in Bamboo forest at Nong Chong.

7 Limitations

- Incomplete collection are the main constraint for identifying species also, the new species and new record to Laos could be presented in the karst forest or in limestone areas.
- Language problems sometimes made it difficult to understand local people and limited the exchange of information on local knowledge
- On steep slopes in the karst forest we could not always observe species well or obtain specimens successfully.
- There was very little prior information on the botany of this area, we are starting from scratch, which limits the total amount of information we could collect in such a short time

8 Threats to plant biodiversity

Clearance for agriculture (Fig. 15)

In this area local people practice shifting cultivation thereby clearing forests for agricultural purposes, which puts pressure on forests in high biodiversity areas. Relatively Ban Chalou villages near Hin Nam No NPA maintain large resource-use areas within the national protected area eg. Kouan Ka An, and natural resource exploitation is concentrated close to villages eg. at Foot of range Phou Louang mountain. A major threat to biodiversity in the Hin Nam No NPA is primary forest being lost due to forest fire for example at Kouan Ka An. As the swidden will accordingly become an increasing threat. The loss and degradation of habitat due to the necessity to produce more income and food coupled with hunting many animals both for subsistence and trade.

Forest fire (Fig 16)

Forest fires were observed at: at N 17° 20' 29.6" E 105° 56' 24.7" to N 17° 20' 15.7" E 105° 56' 36.8" and at N 17° 19' 47.9" E 105° 58' 20.2" to N 17° 19' 44.0" E 105° 58' 29.1". Forest burning is annual event during the dry season over much of Khouan Ka An. In the survey, almost all fire are set by people for clearing land and for providing grazing and facilitate hunting. Currently, forest fires are a threat to biodiversity in many parts of the Khouan Ka An.

Logging (illegal and legal) (Fig. 17)

Near the village, almost of mixed deciduous forest area, in flat land along Xe Bang Fai river, the logging for agriculture is the main cause of deforestation. Also the logging creates easier access for disturb forest and wildlife. Villagers informed us that they regularly observe illegal loggers harvesting valuable timber like “mai moun” from inside Hin Nam No NPA.

9 Next steps:

1) PRA in all four village clusters to record geographical spread of key species.
2) Map forest types by combination of satellite image interpretation and field checks
3) Select 2-3 sites for plant population surveys and implement plot surveys
4) Develop participatory methods for monitoring trade in timber and other plant traceable to Hin Nam No NPA
5) For scientific research, improve quantity and quality of collection could be made for identify both taxonomy and useful value of key and indicator plant species in NHN NPA.

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Table 1 Minor Localities and Waypoints of Botanical Survey at Bane Cha Lou, Boualapha district

GPS code	Locality	Elevation/m	Longitude (N)	Latitude (E)	Forest type / Vegetation cover
Jalou	Bane Cha Lou	225	N 17° 17' 08.5"	E 105° 56' 51.6"	Village / didturbed forest and Mixed deciduous forest with Largestroemia spp.
167	Houay Cha Lou area	224	N 17° 17' 16.2"	E 105° 56' 38.4"	Distrubed forest and Mixed decidous forest/ Lagestroemia spp.
168	Houay La Mong area	224	N 17° 17' 20.9"	E 105° 56' 33.5"	Distrubed forest and Mixed decidous forest/ Lagestroemia spp.
169	Houay Keng Kor area	225	N 17° 17' 32.0"	E 105° 56' 29.8"	Distrubed forest and Mixed decidous forest/ Lagestroemia spp.
170	Xebangphai river side	222	N 17° 17' 31.1"	E 105° 57' 08.3"	River side forest with khai/Wa nam/winged fruit tree
177	Houay Threu	343	N 17° 18' 03.9"	E 105° 57' 10.9"	Semi Evergreen Hill limestone forest with bamboo/Hia & Mai thae / Rocky soil/ Mai Ka cha
179	Hom Pha chang king	463	N 17° 18' 48.6"	E 105° 57' 02.7"	Semi Evergreen Hill limestone forest without bamboo/Rocky soil/ Mai moun/ Mai kene hin
180	Hill of Pha Chang king	469	N 17° 18' 36.9"	E 105° 57' 13.0"	Hill limestone semi evergreen forest without bamboo/Rocky soil/ Mai moun/Mai Dan dam/Mai Ken hin
181	Dong Houay Threu	433	N 17° 18' 26.5"	E 105° 57' 11.9"	Hill limestone semi evergreen forest with bamboo/Hia & Mai thae / Rocky soil/ Mai ka cha/Mai Ngang deng
182	Dong Houay Threu	401	N 17° 18' 18.3"	E 105° 57' 13.3"	Hill limestone semi evergreen forest with bamboo/Hia & Mai thae / Mixed rocky and sandy soil/ Mai Ka cha
183	Houay Nam Lin	267	N 17° 16' 41.3"	E 105° 56' 57.7"	Distubed forest with leader and fast growth trees
184	Houay Nam Lin	311	N 17° 16' 36.2"	E 105° 56' 48.9"	Distubed forest with pure stand of Broom grass (Khaem)
185	Houay Nam Lin	313	N 17° 16' 36.0"	E 105° 56' 49.9"	Distubed forest with leader and fast growth trees
186	Houay Nam Lin	315	N 17° 16' 35.9"	E 105° 56' 49.7"	Semi Evergreen forest with deciduous trees and Mak Tao at along stream
187	Houay Nam Lin/ Foot of Phou Louang/ Sampling	344	N 17° 16' 30.7"	E 105° 56' 45.7"	Semi Evergreen forest with deciduous trees and Mak Tao at along stream
189	Houay Nam Lin/ Foot of Phou Louang/ Sampling	341	N 17° 16' 32.3"	E 105° 56' 48.1"	Semi Evergreen forest with deciduous trees and Mak Tao at along stream
190	Houay Nam Lin/ Foot of Phou Louang/ Sampling	345	N 17° 16' 31.5"	E 105° 56' 49.3"	Semi Evergreen forest with deciduous trees and Mak Tao at along stream
191	Houay Nam Lin/ Foot of Phou Louang/ Sampling	335	N 17° 16' 31.2"	E 105° 56' 48.2"	Semi Evergreen forest with deciduous trees and Mak Tao at along stream
192	Houay Nam Lin/ Foot of Phou Louang/ Sampling	344	N 17° 16' 34.9"	E 105° 56' 49.9"	Semi Evergreen forest with deciduous trees and Mak Tao at along stream
193	Hill of phou houaynamlin	346	N 17° 16' 34.9"	E 105° 56' 48.9"	Mixed deciduous forest with Largestroemia spp.
194	Phou Houaynamlin / San tin phou louang	376	N 17° 16' 37.1"	E 105° 56' 46.1"	Mixed deciduous forest with Largestroemia spp.
195	Phou Houay khi siet/San tin phou louang/ sampli	384	N 17° 16' 34.0"	E 105° 56' 39.5"	Mixed deciduous forest with Largestroemia spp. At along stream with Maktao trees and seddling
196	Houay Khi Siet	420	N 17° 16' 32.4"	E 105° 56' 39.5"	Mixed deciduous forest with Maktao at along stream
197	Sanphou Houay khi siet/ tin phou Louang	377	N 17° 16' 37.1"	E 105° 56' 42.7"	Disturbed forest with Maktao at along stream
198	Houay khi siet	348	N 17° 16' 42.9"	E 105° 56' 44.9"	Disturbed forest with Maktao at along stream but rare
199	Houay khi siet	334	N 17° 16' 49.9"	E 105° 56' 45.6"	Disturbed forest with Maktao at along stream but very rare
200	Border of B Chalou?	231	N 17° 18' 07.1"	E 105° 55' 21.1"	Limestone forest/ rocky soil/
201	Near Border of B. Chalou	241	N 17° 18' 06.9"	E 105° 55' 21.1"	Mixed deciduous forest/ Lagestroemia spp.
202	Disturbed forest/Ixora sp.	207	N 17° 19' 26.8"	E 105° 50' 38.0"	Disturbed forest
203	San Phou Chang king	467	N 17° 19' 08.7"	E 105° 57' 11.2"	Semi evergreen forest with Mai Kaen Hin
204	Hill of phou Chang King	458	N 17° 19' 10.4"	E 105° 57' 11.7"	Mixed decidous forest / sandy soil / mixed Bamboo forest
205	Foot Hill of Phou Chang King	393	N 17° 19' 19.0"	E 105° 57' 12.2"	Mixed decidous forest / sandy soil / mixed Bamboo forest
206	Along Houay Khai	343	N 17° 19' 24.4"	E 105° 57' 12.9"	Mixed deciduous forest with Bamboo
207	Along Houay Khai	261	N 17° 20' 04.5"	E 105° 56' 59.1"	Mixed deciduous forest with Bamboo
ANKOA	Ang Khouay at along Houay Ka Ane	255	N 17° 20' 01.3"	E 105° 57' 09.7"	River side forest of Houay Ka Ane
209	River side of Houay Ka Ane	235	N 17° 20' 14.0"	E 105° 56' 31.5"	River side forest of Houay Ka Ane
210	River side of Houay Ka Ane	248	N 17° 20' 23.3"	E 105° 56' 30.0"	River side forest of Houay Ka Ane and Mixed deciduous forest at foot hill
NONJON	Nong Chong	326	N 17° 21' 05.9"	E 105° 56' 27.8"	Small lac in the limestone forest
212	Dong Nong Chong	329	N 17° 21' 09.4"	E 105° 56' 01.5"	Semi evergreen forest with Mai dou and Mai Peuay
213	Dong Nong Chong	342	N 17° 21' 08.8"	E 105° 55' 58.2"	Semi evergreen forest with Mai dou and Mai Peuay
214	Dong Nong Chong	333	N 17° 21' 04.7"	E 105° 55' 47.5"	Bamboo forest mixed with deciduous trees
215	Dong Nong Chong	325	N 17° 21' 02.2"	E 105° 56' 14.0"	Bamboo forest mixed with deciduous trees
216	Dong Nong Chong	324	N 17° 21' 02.9"	E 105° 56' 15.3"	Semi evergreen forest with Mai Dou and Mai Peuay
217	Dong Nong Chong	301	N 17° 20' 29.6"	E 105° 56' 24.7"	Grass land/ disturbed forest/ fire forest
218	Along Houay Ka Ane	226	N 17° 20' 15.7"	E 105° 56' 36.8"	River side forest of Houay Ka Ane
219	the old village area	227	N 17° 19' 58.0"	E 105° 57' 44.0"	Disturbed forest
220	Pha Dang area	231	N 17° 19' 47.9"	E 105° 58' 20.2"	Disturbed forest
221	Dong Nong Chong	229	N 17° 19' 44.0"	E 105° 58' 29.1"	Semi evergreen forest with Mai Dou and Mai Peuay
222	Pha Tang area	243	N 17° 19' 12.7"	E 105° 58' 42.3"	Mixed decidous forest / sandy soil / flat land at foot of limestone mountain
223	Foot of Phou Chang King	252	N 17° 19' 07.3"	E 105° 58' 39.7"	Bamboo forest mixed with deciduous trees
224	Dong Nong Chong	251	N 17° 19' 06.0"	E 105° 58' 40.7"	Bamboo forest mixed with deciduous trees (Ngang deng)
225	Houay Keung - Houay Ka ane Junction	259	N 17° 19' 10.9"	E 105° 59' 25.0"	Mixed decidous forest / sandy soil / flat land at foot of limestone mountain
226	Foot hill of Pha Ngoua	263	N 17° 19' 01.4"	E 105° 59' 35.0"	Mixed decidous forest / sandy soil / flat land at foot of limestone mountain
KKAANI	Kouan Ka Ane / head water of Houay Ka Ane	266	N 17° 18' 59.5"	E 105° 59' 47.7"	Karzt forest
227	Pha Kouan Ka Ane	318	N 17° 18' 51.0"	E 105° 59' 46.0"	Karzt forest
228	Houay Nam Bor	288	N 17° 18' 47.1"	E 105° 59' 41.4"	Mixed decidous forest / sandy soil / flat land at foot of limestone mountain
229	Tham pha / hill of pha Tam pha	290	N 17° 19' 09.2"	E 105° 59' 33.4"	Mixed decidous forest / sandy soil / flat land at foot of limestone mountain
230	Slop of phou Chang King	323	N 17° 19' 22.6"	E 105° 57' 12.8"	Bamboo forest mixed with deciduous trees

Table 2. Richness or Selected species for Hin Nam No National Protected Area

SEF: Semi Evergreen Forest; MDF: Mixed Deciduous Forest; R: Riverine; DF: Degraded Forest; KF: Karst Forest; BF: Bamboo Forest

No	Latin Name	Family name	Lao Name	Hin Nam No	Phong Nha	Red list IUCN	CITES	Habit	Habitat
Gymnosperm									
1	*Cycas simplicipinna* (Smitinand) K.D.Hill	Cycadaceae	Pong	x		Near Threatened	II	Herb	SEF
2	*Gnetum montanum* Markgr.	Gnetaceae	Mouay	x		Least Concern	III	Climber	SEF
3	*Nageia wallichiana* (C.Presl) Kuntze	Podacarpaceae	?	x		Least Concern		Tree	SEF
Angynosperm									
4	*Acer oblongum* Wall.	Aceraceae	?	x				Tree	R
5	*Mangifera longipetiolata* King	Anacardaceae	Nam Kiang	x				Tree	SEF
6	*Mangifera caloneura* Kurz.	Anacardaceae	Mouang pa	x				Tree	SEF
7	*Allospondias lakonensis* (Pierre) Stapf	Anacardaceae	Som hor	x				Tree	SEF, MDF, R, DF
8	*Spondias pinnata* (L.f.) Kurz	Anacardaceae	Kok	x				Tree	MDF, R, DF
9	*Polyalthia cerasoides* Benth. & Hook.	Annonaceae	kha chian	x				Herb	SEF, MDF, R, DF
10	*Amorphophallus* sp.	Araceae	Douk deua	x				Herb	KF
11	*Agraonema* sp	Araceae	?	x				Herb	KF
12	*Bombax ceiba* L.	Bombacaceae	Ngiou Dok Deng	x				Tree	KF
13	*Terminalia bellirica* (Gaertn.) Roxb.	Combretaceae	Ngen	x				Tree	MDF
14	*Crateva magna* (Lour.) DC.	Capparidaceae	Koum nam	x				Tree	R
15	*Tetrameles nudiflora* R.Br.	Datiscaceae	Sa phoung	x		Lower Risk /Least Concern		Tree	SEF, MDF, R, DF
16	*Dillenia ovata* Wall. ex Hook.f. & Thomson	Dilleniaceae	San ton	x				Tree	MDF

17	*Dipterocarpus alatus* Roxb. ex G.Don	Dipterocarpaceae	Ng	x		Endangered A1cd+2cd, B1+2c		Tree	MDF
18	*Dipterocarpus costatus* C.F.Gaertn.	Dipterocarpaceae	Ngang khao	x		Endangered A1cd+2cd		Tree	SEF
19	*Dipterocarpus retusus* Blume	Dipterocarpaceae	Ngang dong	x		Vulnerable A1cd+2cd, B1+2c		Tree	SEF
20	*Hopea ferrea* Pierre	Dipterocarpaceae	Khaen hin	x		Endangered A1cd+2cd, B1+2c		Tree	SEF
21	*Shorea thorelii* Pierre	Dipterocarpaceae	Mai si dong	x		Critically Endangered A1cd		Tree	SEF
22	*Dracaena angustifolia* (Medik.) Roxb.	Dracaenaceae	Khon Khen	x				Palm	SEF, MDF, R, DF
23	*Dracaena loureiri* Gagnep.	Dracaenaceae	Chan deng	x		ns		Palm	KF
24	*Diospyros mun*	Ebenaceae	Mai moun		x	Critically Endangered A1cd	II	Tree	
25	*Diospyros malabarica*	Ebenaceae	Mai moun		x		II	Tree	
26	*Diospyros curranii* Merr.	Ebenaceae	Mai Moun	x			II	Tree	SEF
27	*Diospyros variegata* Kurz	Ebenaceae	Mai Nang dam	x			II	Tree	SEF
28	*Diospyros wallichii* King & Camble ex King	Ebenaceae	Dang dam	x			II	Tree	SEF
29	*Elaeocarpus stipularis* Blume	Elaeocarpaceae	Mai ka seo	x				Tree	SEF
30	*Baccaurea ramiflora* Lour.	Euphorbiaceae	Mak Fai	x				Tree	SEF, MDF
31	*Balakata baccata* (Roxb.) H.-J.Esser	Euphorbiaceae	Po	x				Tree	SEF, MDF, R, DF
32	*Bischofia javanica* Blume	Euphorbiaceae	Som phat	x				Tree	SEF, MDF, R, DF
33	*Euphorbia antiquorum* L.	Euphorbiaceae	Ka bong phet	x				Herb	KF
34	*Homonoia riparia* Lour.	Euphorbiaceae	Khai nam	x		Least Concern		Tree	R
35	*Macaranga kurzii* (Kuntze) Pax & K.Hoffm.	Euphorbiaceae	Po Hou chang	x				Tree	DF
36	*Trewia nudiflora* L.	Euphorbiaceae	Pop	x				Tree	R, DF
37	*Fagraea fragrans* Roxb.	Gentianaceae	Man pa	x				Tree	SEF
38	*Castanopsis* spp.	Fagaceae	Kor	x				Tree	SEF
39	*Lithocarpus elegans* (Blume) Hatus. ex Soepadmo	Fagaceae	Kor	x				Tree	SEF
40	*Kinabaluchloa wrayi* (Stapf)	Graminae	Mai te	x				Bamboo	SEF, BF

	K.M.Wong								
41	*Dendrocalamus longifimbriatus* Gamble	Graminae	Mai phang	x				Bamboo	SEF, BF
42	*Pseudostachyum polymorphum* Munro	Graminae	Mai sot	x				Bamboo	SEF, BF
43	*Neohouzeana mekongensis* Buse	Graminae	Mai ka sen	x				Bamboo	SEF, BF
44	*Schizostachum virgatum* (Munro) H.B.Nathani & Bennet	Graminae	Mai Hia	x				Bamboo	SEF, BF
45	*Calophyllum saigonense* Pierre	Guttiferae	?	x				Tree	SEF, MDF
46	*Garcinia speciosa* Wall.	Guttiferae	Mong	x				Tree	SEF, MDF, R, DF
47	*Irvingia malayana* Oliv.	Irvingiaceae	Mai Bok	x		Lower Risk/least concern		Tree	SEF, MDF
48	*Litsea glutinosa* (Lour.) C.B.Rob.	Lauraceae	Bong	x				Tree	SEF, MDF, R, DF
49	*Phoebe lanceolata* Nees	Lauraceae	Phai ven	x				Tree	SEF, MDF, R, DF
50	*Barringtonia longipes* Gagnep.	Lecythidaceae	Nom Ngan	x				Tree	SEF, MDF, R, DF
51	*Dalbergia cultrata*	Fabaceae	Mai dou lai	x		Near Threatened		Tree	
52	cf. *Dalbergia tonkinensis* Prain	Fabaceae	Mai dou lai	x				Tree	Cultivated
53	*Dialium indum* L.	Fabaceae	Mak kham peb	x				Tree	SEF
54	*Callerya atropurpurea* (Wall.) Schot	Fabaceae	Khi Mou	x				Tree	SEF, MDF, DF
55	*Erythrophleum fordii* Oliv.	Fabaceae	Ka cha	x		Endangered A1cd		Tree	SEF
56	*Parkia sumatrana* Miq.	Fabaceae	Houa lone	x				Tree	SEF, MDF
57	*Pterocarpus macrocarpus* Kurz	Fabaceae	Dou	x				Tree	SEF
58	*Saraca indica* L.	Fabaceae	Kha Ma	x				Tree	R, SEF, KF, MDF
59	*Sindora laotica* Gagnep.	Fabaceae	Te hor	x				Tree	SEF
60	*Lagerstroemia calyculata* Kurz	Lythraceae	Peuay khao	x				Tree	MDF, SEF, KF, DF
61	*Lagerstroemia floribunda* Jack	Lythraceae	Peuay deng	x				Tree	MDF, SEF, KF, DF
62	*Donax cannaeformis* (G.Forst.)	Maranthaceae	Kha	x				Herb	DF, SEF

	K.Schum.								
63	*Chisocheton cumingianus* (C.DC.) Harms	Meliaceae	kadouk	x				Tree	MDF, SEF, DF
64	*Toona ciliata* M.Roem.	Meliaceae	Ngom hom	x		Lower Risk/least concern		Tree	MDF, SEF, KF
65	*Fibraurea recisa* Pierre	Menispermaceae	Hem	x				Climber	SEF
66	*Artocarpus lakoocha* Roxb.	Moraceae	Had	x				Tree	MDF, SEF
67	*Broussonetia papyrifera* (L.) L'Hér. ex Vent.	Moraceae	Po sa	x				Tree	R
68	*Ficus albipila* (Miq.) King	Moraceae	Mak deua	x				Tree	MDF, SEF, KF, DF, R
69	*Ficus auriculata* L.	Moraceae	Mak deua va	x				Tree	MDF, SEF, KF, DF, R
70	*Ficus callophylla* Blume	Moraceae	Mak deua	x				Tree	MDF, SEF, KF, DF, R
71	Ficus callosa Wild.	Moraceae	Mak deua	x				Tree	MDF, SEF, KF, DF, R
72	*Ficus drupacea*Thunb.	Moraceae	Mak Hai	x				Tree	MDF, SEF, KF, DF, R
73	*Ficus fistulosa* Reinw. ex Blume	Moraceae	Mak deua	x				Tree	MDF, SEF, KF, DF, R
74	*Ficus fulva* Reinw. ex Blume	Moraceae	Mak deua	x				Tree	MDF, SEF, KF, DF, R
75	*Ficus hispida* L.f.	Moraceae	Mak deua pong	x				Tree	MDF, SEF, KF, DF, R
76	*Ficus racemosa* L.	Moraceae	Mak deua	x				Tree	MDF, SEF, KF, DF, R
77	*Ficus rumphii* Blume	Moraceae	Mak deua	x				Tree	MDF, SEF, KF,

									DF, R
78	*Ficus variegata* Blume	Moraceae	Mak deua	x				Tree	MDF, SEF, KF, DF, R
79	*Streblus taxoides* (Roth) Kurz	Moraceae	Nam Koi	x				Tree	MDF, SEF, KF
80	*Syzygium cumini* (L.) Skeels	Myrtaceae	Va	x				Tree	SEF
81	*Sygygium* sp.	Myrtaceae	Va dong	x				Tree	SEF
82	Syzygium mekongensis (Gagnep.) Merr. & L.M.Perry	Myrtaceae	Va nam	x				Tree	R
83	*Ochna integerrima* (Lour.) Merr.	Ochnaceae	Chang Nao	x				Tree	SEF, MDF
84	*Cansjera rheedii* J.F.Gmel.	Opiliaceae	Pak Van	x				Tree	SEF
85	*Arenga westerhoutii* Griff.	Palmae	Tao	x				Palm	SEF, MDF
86	*Calamus solitarius* T. Evan *et al.*	Palmae	Vai Yong	x				Palm	SEF, MDF
87	*Calamus tetradactylus* Hance	Palmae	Vai hang nou	x				Palm	SEF, MDF
88	*Caryota gigas* Hahn ex Hodel	Palmae	Tao hang	x				Palm	SEF, MDF
89	*Caryota mitis* Lour.	Palmae	Tao hang noi	x				Palm	SEF, MDF
90	*Daemonorops jenkinsiana* (Griff.) Mart.	Palmae	Boun	x				Palm	SEF, MDF
91	*Rhapis laosensis* Becc.	Palmae	Sane	x				Palm	SEF, MDF, KF
92	*Rhapis gracilis* Burret	Palmae	Sane	x				Palm	SEF, MDF, DF, KF
93	*Neonauclea purpurea* (Roxb.) Merr.	Rubiaceae	Khan leuang	x				Tree	SEF
94	*Mitragyna rotundifolia* (Roxb.) Kuntze	Rubiaceae	Thom	x				Tree	SEF, MDF
95	*Anthocephalus chinensis* (Lam.) Rich. ex Walp.	Rubiaceae	Kan Louang	x				Tree	SEF, MDF
96	*Canthium coffeoides* Pierre ex Pit.	Rubiaceae	Mak ki dek Noi	x				Tree	SEF, MDF
97	*Chassalia curviflora* var.	Rubiaceae	ns	x				Tree	SEF, MDF

	ophioxyloides (Wall.) Deb & B.Krishna								
98	*Chassalia curviflora* Thw. var. *longifolia* (Dalzell) Hook.f.	Rubiaceae	ns	x				Tree	SEF, MDF
99	*Gardenia sootepensis* Hutch.	Rubiaceae	Khai Nao	x				Tree	SEF, MDF
100	*Hedyotis capitellata* Wall. ex G.Don	Rubiaceae	Thin sin bor hi	x				Tree	SEF, MDF
101	*Hedyotis elegans* Wall. ex Kurz	Rubiaceae	Moun ka tai	x				Tree	SEF, MDF
102	*Ixora javanica* (Blume) DC.	Rubiaceae	Khem deng	x				Tree	SEF, MDF
103	*Ixora fusca* Geddes	Rubiaceae	Khem khao	x				Tree	SEF, MDF
104	*Lasianthus hirsutus* (Roxb.) Merr.	Rubiaceae	ns	x				Tree	SEF, MDF
105	*Oxyceros horridus* Lour.	Rubiaceae	Khad khao	x				Tree	SEF, MDF
106	*Pavetta petiolaris* Wall. ex Craib	Rubiaceae	Khem	x				Tree	SEF, MDF
107	*Prismatomeris* sp.	Rubiaceae	ns	x				Tree	SEF, MDF
108	*Psychotria* sp.	Rubiaceae	ns	x				Tree	SEF, MDF
109	*Schizomussaenda dehiscens* (Craib) H.L.Li	Rubiaceae	Meng ka beua	x				Tree	SEF, MDF
110	*Uncaria macrophylla* Wall.	Rubiaceae	Kho bet	x				Climber	SEF, MDF
111	*Hymenodictyon orixense* (Roxb.) Mabb.	Rubiaceae	Som kob	x				Tree	SEF, MDF
112	*Dimocarpus longan* Lour.	Sapindaceae	Lam ngai pa	x		Lower Risk/Near Threatened		Tree	SEF, MDF
113	*Nephelium lappaceum* L.	Sapindaceae	Nhoc pa	x		Lower Risk/Least Concern		Tree	SEF, MDF
114	*Pometia pinnata* J.R.Forst. & G.Forst.	Sapindaceae	Deng nam	x				Tree	SEF, MDF, R
115	*Duabanga grandiflora* (DC.) Walp.	Sonneratiaceae	Ten	x				Tree	SEF, MDF, R
116	*Sterculia pexa* Pierre	Sterculiaceae	Por khao	x				Tree	KF
117	*Sterculia urena* Roxb.	Sterculiaceae	Por deng	x				Tree	KF
118	*Pterospermum semisagittatum* Buch.-Ham.	Sterculiaceae	Ham Ao	x				Tree	SEF, MDF

119	*Schima wallichii* (DC.) Korth.	Theaceae	Peuak kai	x				Tree	SEF, MDF
120	*Gmelina arborea* Roxb.	Verbenaceae	Sor	x				Tree	SEF,R
121	*Vitex* sp.	Verbenaceae	Tin nok	x				Tree	KF
	Orchid								
122	*Panisea albiflora*	Orchidaceae	Dok Pheuang	x	x		II	Epiphytic	SEF, KF, MDF
123	*Phalaenopsis gibbosa*	Orchidaceae	Dok Pheuang	x	x		II	Epiphytic	SEF, KF, MDF
124	*Pteroceras simondianum*	Orchidaceae	Dok Pheuang	x	x		II	Epiphytic	SEF, KF, MDF
125	*Thrixspermum fleuryi*	Orchidaceae	Dok Pheuang	x	x		II	Epiphytic	SEF, KF, MDF
126	*Anoectochilus calcareous*	Orchidaceae	Dok Pheuang	x	x		II	Epiphytic	SEF, KF, MDF
127	*Mischobulbum longiscapum*	Orchidaceae	Dok Pheuang	x	x		II	Epiphytic	SEF, KF, MDF
128	*Rhomboda petelotii*	Orchidaceae	Dok Pheuang	x	x		II	Epiphytic	SEF, KF, MDF
129	*Aerides houlletianum* Rchb.f.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
130	*Aerides falcatum* Lindl. & Paxton	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
131	*Bromheadia aporoides* Rchb.f.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
132	*Acriopsis indica* C.Wright	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
133	*Acampe rigida* (Sm.) Hunt	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
134	*Acriopsis indica* C.Wright	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
135	*Agrostophyllum planicaule* (Lindl.) Rchb.f.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
136	*Apostasia wallichii* R.Br.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
137	*Arundina graminifolia* (D.Don) Hochr.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
138	*Calanthe veratrifolia* Hook.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
139	*Cephalantheropsis obcordata* (Lindl.) Ormerod	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
140	*Cleisostoma birmanicum* (Schltr.)Gar	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
141	*Cleisostoma simondii* (Gagnep.) Seidenf.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF

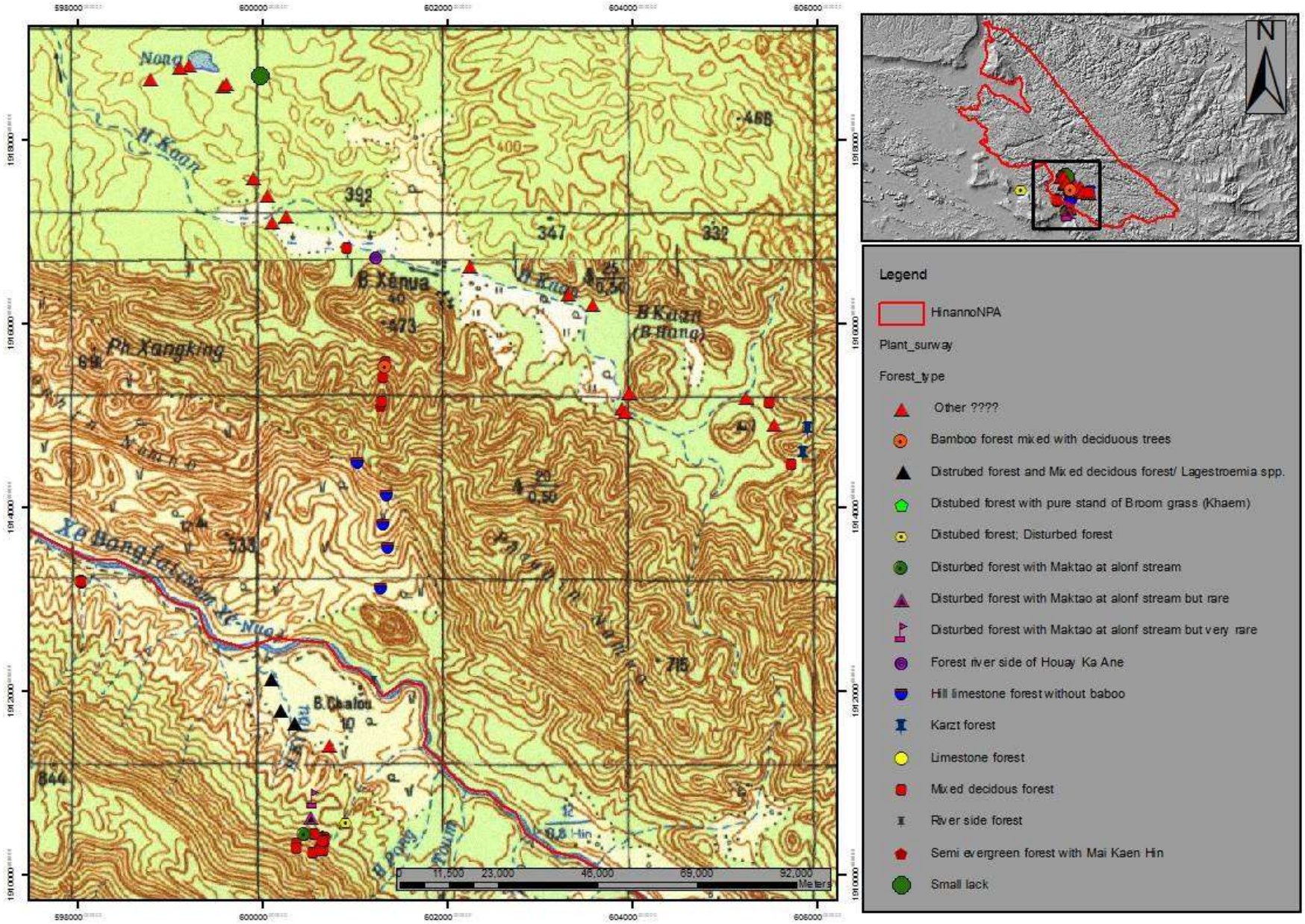
142	*Coelogyne fimbriata* Lindl.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
143	*Dendrobium acinaciforme* Roxb.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
144	*Dendrobium anosmum* Lindl.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
145	*Dendrobium aphyllum* (Roxb.) C.E.C.Fisch.	Orchidaceae	Dok Pheuang	x		Least Concern	II	Epiphytic	SEF, KF, MDF
146	*Dendrobium capillipes* Rchb.f.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
147	*Dendrobium chrysotoxum* Lindl.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
148	*Dendrobium crystallinum* Rchb.f.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
149	*Dendrobium fimbriatum* Lindl.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
150	*Dendrobium gratiosissimum* Rchb.f.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
151	*Dendrobium lindleyi* Steud.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
152	*Dendrobium primulinum* Lindl.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
153	*Dendrobium pulchellum* Roxb. ex Lindl.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
154	*Dendrobium signatum* Rchb.f.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
155	*Eria lasiopetala* (Willd.) Ormerod	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
156	*Eria ornata* (Blume) Lindl.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
157	*Eria pannea* Lindl.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
158	*Eria tomentosa* (J.König) Hook.f.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
159	*Liparis viridiflora* (Blume) Lindl.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
160	*Pholidota imbricata* Lindl.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
161	*Renanthera coccinea* Lour.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
162	*Rhynchostylis retusa* (L.) Blume	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
163	*Thrixspermum centipeda* Lour.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
164	*Thrixspermum leucarachne* Ridl.	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
165	*Vandopsis lissochiloides* (Gaudich.)	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF
166	*Zeuxine affinis* (Lindl.) Benth.ex Hook	Orchidaceae	Dok Pheuang	x			II	Epiphytic	SEF, KF, MDF

Table 3. 124 Selected Key Species and 67 Indicator Plants species (red color) for monitoring in Hin Nam No National Protected Area

No	Latin Name	Family name	Lao Name	Red list IUCN	CITES	Habit	Habitat	8 FAO Criteria (fill values 0-3: 0= no effect, 1 =small,2 =medium and 3= important factor)								
								high value	rarity	specific	shade	irregular	specific		ecological	
								high harv		ecology	required	seeding	pollinator	Monoecious	keystone	SUM
A:	**Woody Species**															
1	***Cycas simplicipinna* (Smitinand) K.D**	**Cycadaceae**	Pong	**Near Threatened**	II	Herb	SEF	3	3	2	3	3	3	3	3	23
2	***Diospyros* cf. *curranii* Merr.**	**Ebenaceae**	**Mai moun**		**II**	**Tree**	**SEF**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**23**
3	***Diospyros* cf. *variegata* Kurz**	**Ebenaceae**	**Mai dang dam**		**II**	**Tree**	**SEF**	**1**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**21**
4	***Diospyros* cf. *wallichii* King & Camb**	**Ebenaceae**	**Dang dam**		**II**	**Tree**	**SEF**	**1**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**21**
5	***Nageia wallichiana* (C.Presl) Kuntze**	Podacarpaceae	?	Least Concern		Tree	SEF	1	3	3	3	3	1	3	3	20
6	***Dracaena loureiri* Gagnep.**	**Dracaenaceae**	**Chan deng**	**ns**		**Palm**	**KF**	**3**	**1**	**3**	**1**	**3**	**3**	**0**	**3**	**17**
7	***Fagraea fragrans* Roxb.**	Gentianaceae	Man pa			Tree	SEF	2	3	3	2	2	2	0	3	17
8	***Dalbergia cultrata***	**Fabaceae**	**Mai dou lai**	**Near Threatened**		**Tree**	**Cultivate**	**3**	**3**	**3**	**2**	**2**	**1**	**0**	**3**	**17**
9	**cf. *Dalbergia tonkinensis* Prain**	**Fabaceae**	**Mai dou lai**			**Tree**	**Cultivate**	**3**	**3**	**3**	**2**	**2**	**1**	**0**	**3**	**17**
10	***Pterocarpus macrocarpus* Kurz**	**Fabaceae**	**Dou**			**Tree**	**SEF**	**3**	**3**	**3**	**2**	**2**	**1**	**0**	**3**	**17**
11	***Cansjera rheedii* J.F.Gmel.**	**Opiliaceae**	**Pak Van**			**Tree**	**SEF**	**2**	**2**	**2**	**3**	**2**	**2**	**0**	**3**	**16**
12	***Arenga westerhoutii* Griff.**	**Palmae**	Tao			Palm	SEF, MD	3	2	2	3	2	1	0	3	16
13	***Dipterocarpus costatus* C.F.Gaertn.**	**Dipterocarpaceae**	**Ngang deng**	**Endangered A1cd+2cd**		**Tree**	**SEF**	**3**	**2**	**3**	**2**	**1**	**1**	**0**	**3**	**15**
14	***Dipterocarpus retusus* Blume**	**Dipterocarpaceae**	**Ngang dong**	**Vulnerable A1cd+2cd, B1+2c**		**Tree**	**SEF**	**3**	**2**	**3**	**2**	**1**	**1**	**0**	**3**	**15**
15	***Hopea ferrea* Pierre**	**Dipterocarpaceae**	**Khaen hin**	**Endangered A1cd+2cd, B1+2c**		**Tree**	**SEF**	**3**	**2**	**3**	**2**	**1**	**1**	**0**	**3**	**15**
16	***Shorea thorelii* Pierre**	**Dipterocarpaceae**	**Mai si dong**	**Critically Endangered A1cd**		**Tree**	**SEF**	**3**	**2**	**3**	**2**	**1**	**1**	**0**	**3**	**15**
17	***Erythrophleum fordii* Oliv.**	**Fabaceae**	**Ka cha**	**Endangered A1cd**		**Tree**	**SEF**	**3**	**2**	**3**	**2**	**1**	**1**	**0**	**3**	**15**
18	***Daemonorops jenkinsiana* (Griff.) Ma**	**Palmae**	**Boun**			**Palm**	**SEF, MI**	**3**	**2**	**2**	**3**	**2**	**1**	**0**	**2**	**15**
19	***Dipterocarpus alatus* Roxb. ex G.Don**	**Dipterocarpaceae**		**Endangered A1cd+2cd, B1+2c**		**Tree**	**MDF**	**3**	**3**	**2**	**2**	**1**	**1**	**0**	**3**	**15**
20	***Gnetum montanum* Markgr.**	Gnetaceae	Mouay	Least Concern	III	Climber	SEF	2	3	2	2	2	2	0	2	**15**
21	***Dialium indum* L.**	Fabaceae	Mak kham peb			Tree	SEF	2	1	3	2	2	1	0	3	**14**
22	***Sindora laotica* Gagnep.**	Fabaceae	Te hor			Tree	SEF	2	2	2	2	2	1	0	3	**14**
23	*Calamus solitarius* T. Evan *et al.*	Palmae	Vai Yong			Palm	SEF, MD	2	2	2	3	2	1	0	2	14
24	*Calamus tetradactylus* Hance	Palmae	Vai hang nou			Palm	SEF, MD	2	2	2	3	2	1	0	2	14
25	*Rhapis laosensis* Becc.	Palmae	Sane			Palm	SEF, MD	2	2	2	3	2	1	0	2	14
26	*Rhapis gracilis* Burret	Palmae	Sane			Palm	SEF, MD	2	2	2	3	2	1	0	2	14
27	*Toona ciliata* M.Roem.	Meliaceae	Ngom hom	Lower Risk/least concern		Tree	MDF, SE	2	3	2	2	2	1	0	2	14
28	*Dimocarpus longan* Lour.	Sapindaceae	Lam ngai pa	Lower Risk/Near Threatened		Tree	SEF, MD	1	3	2	2	2	2	0	2	14
29	*Nephelium lappaceum* L.	Sapindaceae	Nhoc pa	Lower Risk/Least Concern		Tree	SEF, MD	1	3	2	2	2	2	0	2	14
30	*Donax cannaeformis* (G.Forst.) K.Schu	Maranthaceae	Kha			Herb	DF, SEF	2	2	2	2	2	1	0	2	13
31	*Ficus albipila* (Miq.) King	Moraceae	Mak deua			Tree	MDF, SE	1	1	1	2	3	3	0	2	13
32	*Ficus auriculata* L.	Moraceae	Mak deua va			Tree	MDF, SE	1	1	1	2	3	3	0	2	13
33	*Ficus callophylla* Blume	Moraceae	Mak deua			Tree	MDF, SE	1	1	1	2	3	3	0	2	13
34	Ficus callosa Wild.	Moraceae	Mak deua			Tree	MDF, SE	1	1	1	2	3	3	0	2	13
35	*Ficus drupacea* Thunb.	Moraceae	Mak Hai			Tree	MDF, SE	1	1	1	2	3	3	0	2	13
36	*Ficus fistulosa* Reinw. ex Blume	Moraceae	Mak deua			Tree	MDF, SE	1	1	1	2	3	3	0	2	13
37	*Ficus fulva* Reinw. ex Blume	Moraceae	Mak deua			Tree	MDF, SE	1	1	1	2	3	3	0	2	13
38	*Ficus hispida* L.f.	Moraceae	Mak deua pong			Tree	MDF, SE	1	1	1	2	3	3	0	2	13
39	*Ficus racemosa* L.	Moraceae	Mak deua			Tree	MDF, SE	1	1	1	2	3	3	0	2	13
40	*Ficus rumphii* Blume	Moraceae	Mak deua			Tree	MDF, SE	1	1	1	2	3	3	0	2	13

No	Latin Name	Family name	Lao Name	Red list IUCN	CITES	Habit	Habitat	8 FAO Criteria (fill values 0-3: 0= no effect, 1 =small,2 =medium and 3= important factor)								
								high value	rarity	specific	shade	irregular	specific		ecological	
								high harv		ecology	required	seeding	pollinator	Monoecious	keystone	SUM
A:	**Woody Species**															
41	*Ficus variegata* Blume	Moraceae	Mak deua			Tree	MDF, SE	1	1	1	2	3	3	0	2	13
42	*Sygygium* sp.	Myrtaceae	Va dong			Tree	SEF	1	2	2	2	2	2	0	2	13
43	*Pometia pinnata* J.R.Forst. & G.Forst.	Sapindaceae	Deng nam			Tree	SEF, MD	1	2	2	2	2	2	0	2	13
44	*Sterculia pexa* Pierre	Sterculiaceae	Por khao			Tree	KF	1	1	3	1	2	2	0	3	13
45	*Sterculia urena* Roxb.	Sterculiaceae	Por deng			Tree	KF	1	1	3	1	2	2	0	3	13
46	*Schima wallichii* (DC.) Korth.	Theaceae	Peuak kai			Tree	SEF, MD	1	1	2	2	2	2	0	3	13
47	*Gmelina arborea* Roxb.	Verbenaceae	Sor			Tree	SEF,R	1	2	2	2	2	2	0	2	13
48	*Irvingia malayana* Oliv.	Irvingiaceae	Mai Bok	Lower Risk/least concern		Tree	SEF, MD	1	3	2	2	2	1	0	2	13
49	*Mangifera longipetiolata* King	Anacardaceae	Nam Kiang			Tree	SEF	1	2	2	2	2	1	0	2	12
50	*Mangifera caloneura* Kurz.	Anacardaceae	Mouang pa			Tree	SEF	1	2	2	2	2	1	0	2	12
51	*Bombax ceiba* L.	Bombacaceae	Ngiou Dok Deng			Tree	KF	1	1	3	1	2	1	0	3	12
52	*Bischofia javanica* Blume	Euphorbiaceae	Som phat			Tree	SEF, MD	1	2	2	2	2	1	0	2	12
53	*Parkia sumatrana* Miq.	Fabaceae	Houa lone			Tree	SEF, MD	2	2	2	2	1	1	0	2	12
54	*Fibraurea recisa* Pierre	Menispermaceae	Hem			Climber	SEF	2	2	2	2	1	1	0	2	12
55	*Neonauclea purpurea* (Roxb.) Merr.	Rubiaceae	Khan leuang			Tree	SEF	1	2	1	2	2	2	0	2	12
56	*Anthocephalus chinensis* (Lam.) Rich. e	Rubiaceae	Kan Louang			Tree	SEF, MD	1	2	1	2	2	2	0	2	12
57	*Crateva magna* (Lour.) DC.	Capparidaceae	Koum nam			Tree	R	1	2	2	2	1	1	0	2	11
58	*Lagerstroemia calyculata* Kurz	Lythraceae	Peuay khao			Tree	MDF, SE	3	1	1	2	2	1	0	1	11
59	*Lagerstroemia floribunda* Jack	Lythraceae	Peuay deng			Tree	MDF, SE	3	1	1	2	2	1	0	1	11
60	*Streblus taxoides* (Roth) Kurz	Moraceae	Nam Koi			Tree	MDF, SE	1	1	1	3	2	1	0	2	11
61	*Duabanga grandiflora* (DC.) Walp.	Sonneratiaceae	Ten			Tree	SEF, MD	1	1	1	2	2	2	0	2	11
62	*Terminalia bellirica* (Gaertn.) Roxb.	Combretaceae	Ngen			Tree	MDF	1	1	2	1	2	1	0	2	10
63	*Baccaurea ramiflora* Lour.	Euphorbiaceae	Mak Fai			Tree	SEF, MD	1	1	2	3	1	1	0	1	10
64	*Broussonetia papyrifera* (L.) L'Hér. ex	Moraceae	Po sa			Tree	R	1	1	2	2	1	1	0	2	10
65	*Tetrameles nudiflora* R.Br.	Datiscaceae	Sa phoung	Lower Rist/Least Concern		Tree	SEF, MD	1	3	1	1	2	1	0	1	10
66	*Homonoia riparia* Lour.	Euphorbiaceae	Khai nam	Least Concern		Tree	R	1	3	1	2	1	1	0	1	10
67	*Trewia nudiflora* L.	Euphorbiaceae	Pop			Tree	R, DF	1	1	1	2	1	1	0	2	9
68	*Kinabaluchloa wrayi* (Stapf) K.M.Won	Graminae	Mai te			Bamboo	SEF, BF	2	1	1	2	1	1	0	1	9
69	*Dendrocalamus longifimbriatus* Gambl	Graminae	Mai phang			Bamboo	SEF, BF	2	1	1	2	1	1	0	1	9
70	*Pseudostachyum polymorphum* Munro	Graminae	Mai sot			Bamboo	SEF, BF	2	1	1	2	1	1	0	1	9
71	*Schizostachum virgatum* (Munro) H.B.	Graminae	Mai Hia			Bamboo	SEF, BF	2	1	1	2	1	1	0	1	9
72	*Callerya atropurpurea* (Wall.) Schot	Fabaceae	Khi Mou			Tree	SEF, MD	1	1	1	2	1	1	0	2	9
73	*Artocarpus lakoocha* Roxb.	Moraceae	Had			Tree	MDF, SE	1	1	1	2	1	1	0	2	9
74	Syzygium mekongensis (Gagnep.) Merr. &	Myrtaceae	Va nam			Tree	R	1	1	1	2	1	2	0	1	9
75	*Allospondias lakonensis* (Pierre) Stapf	Anacardaceae	Som hor			Tree	SEF, MD	1	1	1	1	2	1	0	1	8
76	*Spondias pinnata* (L.f.) Kurz	Anacardaceae	Kok			Tree	MDF, R,	1	1	1	1	2	1	0	1	8
77	*Neohouzeana mekongensis* Buse	Graminae	Mai ka sen			Bamboo	SEF, BF	1	1	1	2	1	1	0	1	8
78	*Saraca indica* L.	Fabaceae	Kha Ma			Tree	R, SEF, I	1	1	1	2	1	1	0	1	8
79	*Chisocheton cumingianus* (C.DC.) Har	Meliaceae	kadouk			Tree	MDF, SE	1	1	1	2	1	1	0	1	8

No	Latin Name	Family name	Lao Name	Red list IUCN	CITES	Habit	Habitat	8 FAO Criteria (fill values 0-3: 0= no effect, 1 =small,2 =medium and 3= important factor)								
								high value	rarity	specific	shade	irregular	specific		ecological	
								high harv		ecology	required	seeding	pollinator	Monoecious	keystone	SUM
B:	**Orchids**															
80	***Dendrobium acinaciforme* Roxb.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	3	3	2	2	2	1	0	2	15
81	***Dendrobium anosmum* Lindl.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	3	3	2	2	2	1	0	2	15
82	***Dendrobium aphyllum* (Roxb.) C.E.C**	Orchidaceae	Dok Pheuang	Least Concern	II	Epiphytic	SEF, KF,	3	3	2	2	2	1	0	2	15
83	***Dendrobium capillipes* Rchb.f.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	3	3	2	2	2	1	0	2	15
84	***Dendrobium chrysotoxum* Lindl.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	3	3	2	2	2	1	0	2	15
85	***Dendrobium crystallinum* Rchb.f.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	3	3	2	2	2	1	0	2	15
86	***Dendrobium fimbriatum* Lindl.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	3	3	2	2	2	1	0	2	15
87	***Dendrobium gratiosissimum* Rchb.f.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	3	3	2	2	2	1	0	2	15
88	***Dendrobium lindleyi* Steud.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	3	3	2	2	2	1	0	2	15
89	***Dendrobium primulinum* Lindl.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	3	3	2	2	2	1	0	2	15
90	***Dendrobium pulchellum* Roxb. ex Li**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	3	3	2	2	2	1	0	2	15
91	***Dendrobium signatum* Rchb.f.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	3	3	2	2	2	1	0	2	15
92	***Aerides houlletianum* Rchb.f.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	2	3	2	2	2	1	0	2	14
93	***Aerides falcatum* Lindl. & Paxton**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	2	3	2	2	2	1	0	2	14
94	***Bromheadia aporoides* Rchb.f.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
95	***Acriopsis indica* C.Wright**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
96	***Acampe rigida* (Sm.) Hunt**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
97	***Acriopsis indica* C.Wright**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
98	***Agrostophyllum planicaule* (Lindl.) R**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
99	***Apostasia wallichii* R.Br.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
100	***Arundina graminifolia* (D.Don) Hoch**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
101	***Calanthe veratrifolia* Hook.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
102	***Cephalantheropsis obcordata* (Lindl.)**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
103	***Cleisostoma birmanicum* (Schltr.) Ga**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
104	***Cleisostoma simondii* (Gagnep.) Seid**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
105	***Coelogyne fimbriata* Lindl.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
106	***Eria lasiopetala* (Willd.) Ormerod**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
107	***Eria ornata* (Blume) Lindl.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
108	***Eria pannea* Lindl.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
109	***Eria tomentosa* (J.König) Hook.f.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
110	***Liparis viridiflora* (Blume) Lindl.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
111	***Pholidota imbricata* Lindl.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
112	***Renanthera coccinea* Lour.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
113	***Rhynchostylis retusa* (L.) Blume**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
114	***Thrixspermum centipeda* Lour.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
115	***Thrixspermum leucarachne* Ridl.**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
116	***Vandopsis lissochiloides* (Gaudich.) P**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
117	***Zeuxine affinis* (Lindl.) Benth. ex Ho**	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	1	2	2	2	2	1	0	2	12
118	***Panisea albiflora***	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	0	3	0	0	0	0	0	0	3
119	***Phalaenopsis gibbosa***	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	0	3	0	0	0	0	0	0	3
120	***Pteroceras simondianum***	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	0	3	0	0	0	0	0	0	3
121	***Thrixspermum fleuryi***	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	0	3	0	0	0	0	0	0	3
122	***Anoectochilus calcareous***	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	0	3	0	0	0	0	0	0	3
123	***Mischobulbum longiscapum***	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	0	3	0	0	0	0	0	0	3
124	***Rhomboda petelotii***	Orchidaceae	Dok Pheuang		II	Epiphytic	SEF, KF,	0	3	0	0	0	0	0	0	3



Map 1: Topo-map of the research area around Ban Chalou

Figure 1: Overview of the botanical sampling site at Ban Chalou

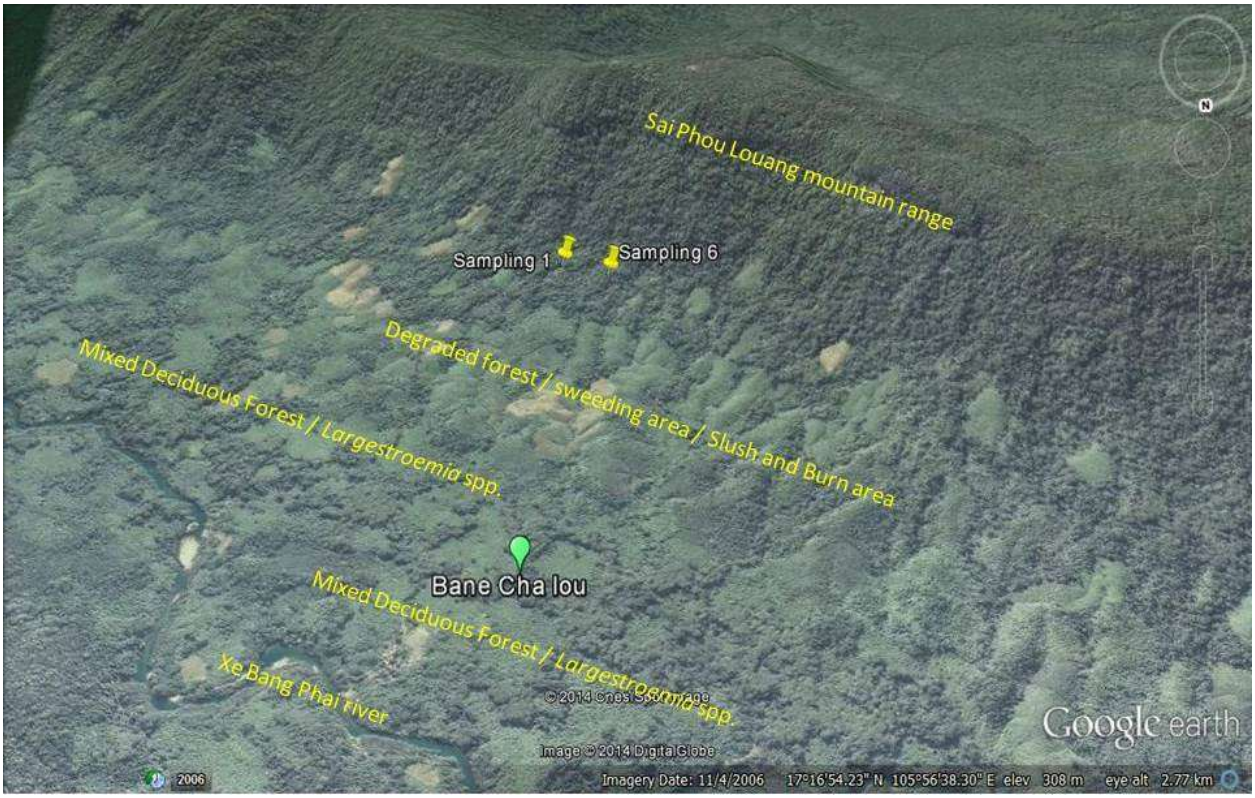


Figure 2:Close-Up of the hou Louang area to the South of Chalou Village

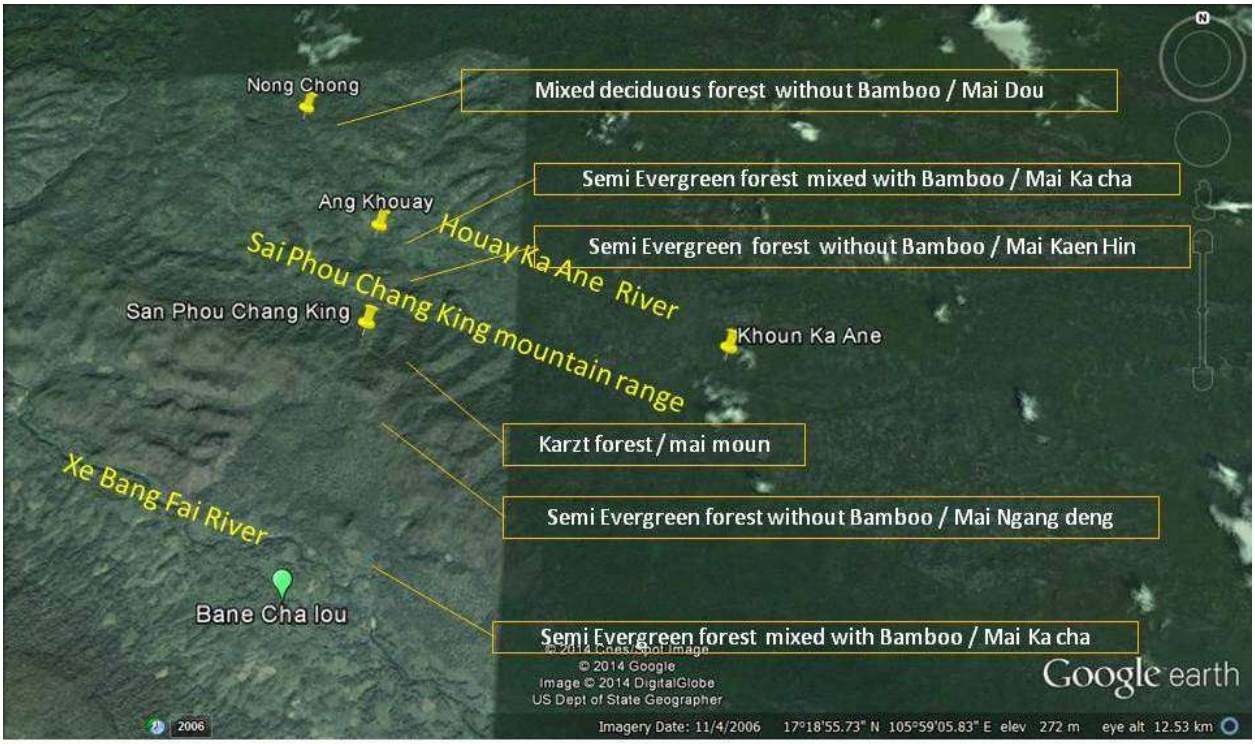


Figure 3: Close-Up of the Kouan Ka-ane valley to the North of Chalou village

Pure stand of Broom Grass *Thysanolaena latifolia* (Graminae) at along Houay Nam Lin, foot of Phou Louang

Figure 4: Example of degraded forest: grassland

The Degraded forest as a serious disturbed by agriculture develop land at foot of Phou Louang

Figure 5: Examples of Degraded or Fallow land

Figure 6: Examples of Evergreen Forest

Figure 7: Examples of Mixed Deciduous Forest

Figure 8: Examples of Bamboo Forest

Figure 9: Examples of Riverine Forest

Figure 10: Examples of Karst Forest

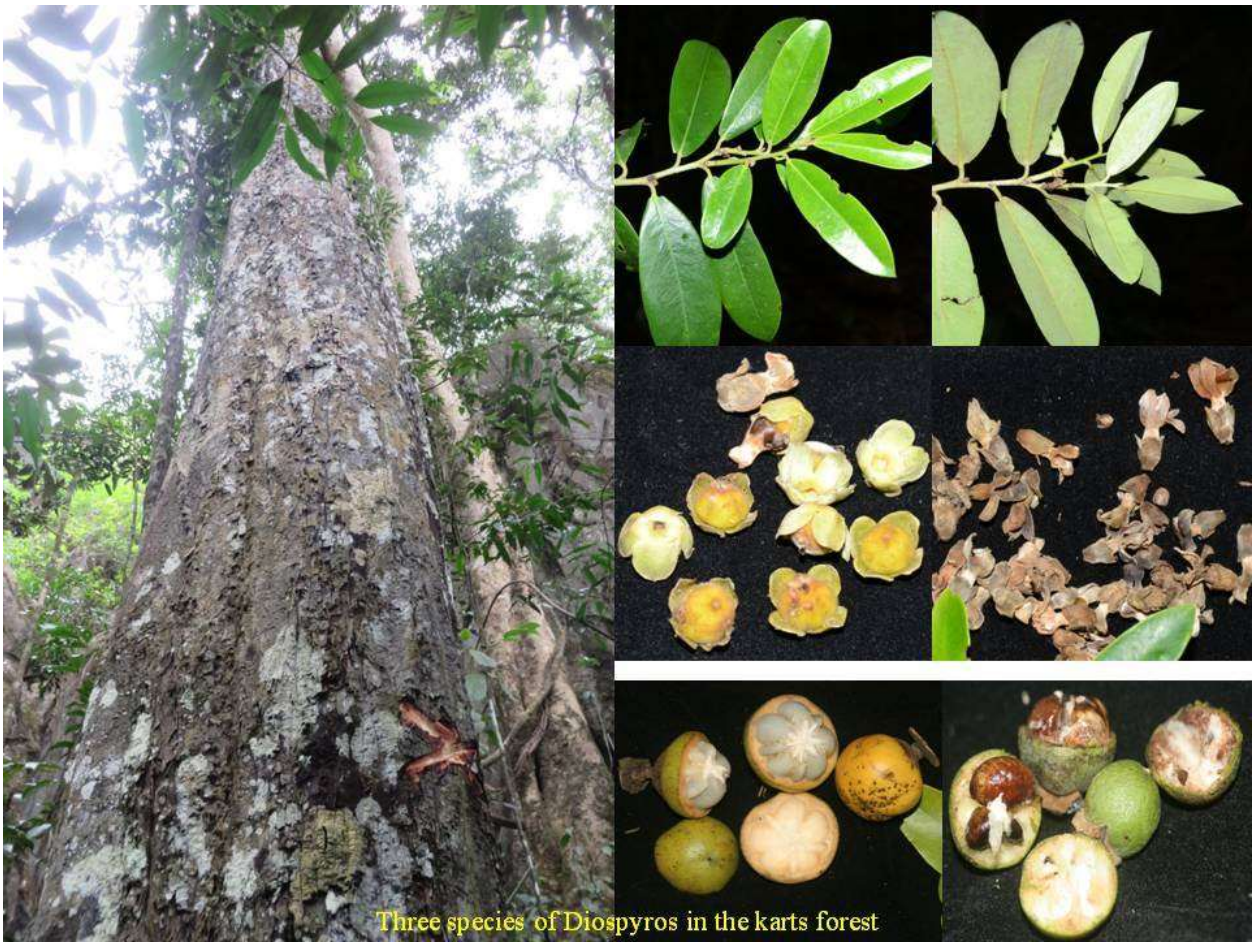


Figure 11: Mai Moun Ebony (Diospyros sp.) occurring in Karst Forest

Figure 12: Mai Chan Deng (Draceana loureii) in Karst Forest

Figure 13: Examples of Orchids (Dendrobium spp.)

Figure 14: Peuak Meuak, Boehmeria malabarica, bark can be used to make incense

Figure 15: Examples of clearing Mixed Deciduous Forest around the village for agriculture

Figure 16: Mai Yang Dipterocarpus costatus, big timber tree, also

Figure 17: Recent Forest fires in the core zone of Khouan Ka-ane

Figure 18: Logging Lagerstroemia trees for agriculture