

Annex 2

Distribution and Conservation Status of Selected Tree Species for Gene Conservation and working methodology

1. Introduction

In the natural forest of Cambodia, many species of plants are scattered. Up to now, there is limited information available on threatened species to assess forest genetic resource conservation. The problems are particularly apparent with lesser-known species where reliable information hardly exists. However, it is essential to avoid degradation of the gene pool of tree species not only at species level but also at population level.

Over the past several decades, increasing human activity has rapidly destroyed many ecological habitats throughout the country, and many rare species are being seriously threatened namely: *Dalbergia oliveri*, *Aquilaria crassna*, *Azelia xylocarpa*, *Pterocarpus macrocarpus*...and so on. Halting the decline of these species is a major concern, by undertaking conservation of their genetic diversity, which is of major importance for sustainable development.

The information presented here regarding the classification of 34 priority tree species identified by CTSP, is the first floristic assessment undertaken in Cambodia, focusing on the conservation status of tree species. Moreover, among these species, a plan or strategy for gene conservation is urgently needed. This paper takes an important step toward this, which is to assess the geographical distribution of the 21 highest selected tree species for conservation.

2. Outputs and Methodology.

Outputs

- Collect and present available data from all sources on distribution and occurrence of 21 selected tree species,
- Display species distribution on maps.
- Conclude the status of threat for each species
- Arrange a one day meeting for selected resource persons “technical expert support group”(Thea S, Saret K, Phurin Ch, Virak M, Nare T, Sopheavuth P, Sam Ath Ch, Ratha M, Pisit B, Sokeang K, Khorn L, Phaly Ch, and Chealy P., 2002) to gather information.
- Input data into a map.

Methodology

1. Tree species distribution and conservation status of assessment

Available data received from the expert group and information from all other sources was assembled. IUCN Red List Criteria was assigned which can be used for tree species evaluation, and ranged for separate specific purposes such as natural rarity assessment or high impact species.

2. Mapping method

Interpolation was applied using data from the available information to build a 21-tree species distribution map. Data was processed using Excel, and then converted into DBF4 (Projecting for UPT). Arcview 3.2 Software also used to generate locations on the. The map scale is 1/ 3,000,000 mm., and was prepared in the GIS and RS Unit of the Forestry Administration.

Documentation

Following information verification, documentation was compiled to provide a quantitative and qualitative assessment on tree species distribution, occurrence and threats for the immediate future. Distribution of tree species is confined to locations recently surveyed.

3. Results

Distribution and ecology

Species distribution gives information on the types and presence of species that exist in the natural forest. Most species occur in the northern areas, whilst a few are scattered in western Cambodia. The results showed that all tree species suffer from much pressure and presently have limited distribution (Table 1).

Table 1. Tree Species Distribution and Ecology

This table was constructed on the basis of meetings with the CTSP Expert Support Group and later refined by CTSP senior staff and advisor.

No	Species	Location (Province)	Remarks
1	<i>Dalbergia oliveri</i>	Kratie, Preah Vihear Kampong Thom Ratanakiri Strung Treng, Pursat Siem Riep	Rare tree species, distributed sparsely or in groups of 5-10 individuals in dense evergreen forest or semi-deciduous forest, and open dipterocarp. Light demanding tree.
2	<i>Aquilaria crassna</i> Pierre	Pursat, Koh Kong Moldulkiri, Sihanouk Ville, Kampong Speu,	Rare species, light demanding, occurring sparsely in primary and secondary forest, on typical ferralitic soils with shallow to moderately deep layers.
3	<i>Dalbergia cochinchinensis</i> Pierre	Kampong Thom, Preah Vihea, Ratanakiri, Pursat, Siem Riep, Kratie, Koh Kong, Strung Treng, Mondulkiri	Rare species, light demanding and drought tolerant but not demanding with regard to soil conditions. Shade tolerant when young, occurring sparsely in open and semi-deciduous forest, concentrated at altitudes of 400-500m above sea level, preferring deep sandy clay soil and calcareous soil.

4	<i>Gardenia ankorensis</i> Pit	Strung Treng, Kratie Kampong Thom, Siem Riep, Otdarmean Chhey, Kampong Speu,	Rare species, light demanding and drought tolerant tree which can grow on soil degraded by shifting cultivation and forest fire, unfertile soil, and arid soil with severe climate. Occurring sparsely in the middle or under storey forest. The tree can tolerate fire.
5	<i>Afzelia xylocarpa</i> (Kruz.) Craib	Kampong Thom Kratie, Strung Treng Preah Vihea, Siem Riep, Battam Bong, Ratanakiri, Mondulkiri, Kampot, Pursat,	Rare species, light demanding, occurring on well-drained flat or on transitional zones between evergreen and dry open dipterocarp forest. The tree usually mixes with <i>Dalbergia bariaensis</i> , <i>Pterocapus macrocapus</i> , <i>Lagerstroemia calyculata</i> , <i>Dipterocapus tubinatus</i> and <i>Tetrameles nudilora</i> .
6	<i>Pterocapus macrocarpus</i> Kurz.	Kampong Thom, Strung Treng, Preah Vihea, Ratanakiri, Kratie, Siem Riep, Kampot, Pursat, Mondulkiri.	Rare species, light demanding and drought-tolerant tree. Preferably it grows on well-drained, light textured soils, but with shallow depth and poor in humus. The tree occurs sparsely in open deciduous or deciduous dipterocarp forest, particularly in dry and hot climate areas.
7	<i>Dysoxylum loureiri</i> Pierre	Koh Kong, Pursat, Kampong Thom.	Rare species, light demanding. Occurring in evergreen, primary, and secondary forests, sandstone, and sandy clay soils.
8	<i>Diospyros cruenata</i> Thwaites	Mondulkiri	Rare species, Insufficient information.
9	<i>Lasianthus kamputensis</i> Pierre ex. Pit	Kratie, Kampong Thom	Rare species, Insufficient information
10	<i>Diospyros bejaudii</i> Lecomte	Kratie, Koh Kong Kampong Thom, Strung Treng, Siem Riep, Preah Vihea, Kampot, Pursat, Mondulkiri.	Rare species, saplings demand shade under a medium forest-cover for normal development. When grown, it occupies the second or third storey of the forest.
11	<i>Fagraea fragrans</i> Pit	Koh Kong, Pursat, Strung Treng, Kratie Kampong Thom, Mondulkiri, Preah Vihea,	Rare species, rarely in dense forest or open forest, occurring usually in semi-deciduous forest. The tree can be found in sandy soil, periodically inundated along streams or rivers, below 800 m above sea level.

12	<i>Dasyaschalon lametaceum</i> Finet et Gagnep	Strung Treng, Mondulkiri, Ratanakiri, Kampong Thom, Preah Vihea	Rare species, Insufficient information
13	<i>Shorea cochinchinensis</i> Pierre	Kratie, Pursat, Koh Kong, Ratanakiri, Kampong Thom, Strung Treng, Preah Vihea, Siem Reap, Mondulkiri.	Rare species. The tree occurs mainly in the High Plateau, and can be found in mixed deciduous or evergreen forests, at altitudes of 50-1000 m above sea level.
14	<i>Hopea helferi</i> (Dyer) Brandis	Strung Treng, Siem Reap, Preah Vihea, Mondulkiri, Kampot, Pursat.	Rare species, shade-tolerant when young. The tree grows in evergreen forests, below 700m m above sea level, it is only found in small groups or in solitude. It demands wet and deep soil.
15	<i>Pinus merkusii</i> Jungh et de Vries	Kampong Thom, Koh Kong, Pursat, Kampong Speu, Mondulkiri	Common species, light demanding, heat and drought-tolerant. The tree grows well on sandy and red soils, slow growth during the first five years and later rather fast growing. It occurs in mixed deciduous forest or evergreen forest.
16	<i>Garcinia hanburyi</i> Hook.f.	Koh Kong, Kampong Thom, Kratie	Rare species, Insufficient information
17	<i>Cinnamomum cambodianum</i> Lecomte	Ratanakiri, Kampong Thom	Rare species, shade demanding when young, growing well in deep soil. It usually grows in clusters of 5-10 trees in the primary or secondary forest, at altitudes below 1,500 m above sea level.
18	<i>Sterculia lychnophora</i> Hance	Ratanakiri, Kampot, Pursat, Sihanouk Ville.	Rare species, shade demanding, grows in moist primary and secondary forests, at below 1,700m above sea level. It occurs as solitary trees on limestone.
19	<i>Cananga latifolia</i> (Hook.f. & Thomson) Finet & Gagnep	Preah Vihea, Siem Reap, Ratanakiri, Kampong Thom, Strung Treng, Pursat, Mondulkiri.	Rare species, Insufficient information
20	<i>Albizia lebbek</i> (L.) Benth.	Strung Treng, Ratanakiri, Koh Kong Battambang, Preah Vihea, Kampong Thom,	Rare species, The tree occurs in dry deciduous localities, and in evergreen forests, at altitudes 400 m above sea level.
21	<i>Hopea odorata</i> Roxb.	Kratie, Koh Kong,	Common species, shade-tolerant

		Kampong Thom, Strung Treng, Preah Vihea, Ratanakiri, Mondulkiri, Siem Reap.	tree when young during the first five years, but later requires sunlight. The tree can be found in small groups or alone, and occurs in dense evergreen forests. It demands wet and deep soil.
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Sources:

- CTSP Expert Support Group, 2002
- Annual logging plans and forest inventory projects of Forest Concession Companies in Cambodia.
- Forest Inventory and Planning Institute, 1996.

Assessment of tree species

Despite their disturbed nature and small size, forest fragments and relics are important for conservation of biodiversity because they host a high diversity of plant life and often contain species that do not occur in the existing forest area. It is necessary to assess tree species and their conservation status in order to evaluate natural rarity and impact species. All species are presented in the following table:

Table 2. Evaluation of tree species (IUCN Criteria)

No	Scientific name	Local name	CSTP	IUCN Red List	Remarks
1	<i>Dalbergia oliveri</i>	Neang Noun	EN, A1cd +2d, B3b	EN, A1cd	Heavy exploited. Assumed to be international trade
2	<i>Aquilaria crassna</i> Pierre	Chankrus Sna	CR, A1cd + 2c	CR, A1cd	Very rare and threatened by a range of influences.
3	<i>Dalbergia cochinchinensis</i> Pierre	Kra Nhung	CR, A1cd	VU, A1cd	Threatened and declined in the last several decades.
4	<i>Gardenia ankorensis</i> Pit	Day Kla	EN, A1cd	?	Unsure of international trade.
5	<i>Afzelia xylocarpa</i> (Kruz.) Craib	Beng	EN, A1cd + 2d	EN, A1d	Heavy exploited. Assumed to be international trade
6	<i>Pterocarpus macrocapus</i> Kurz.	Thnong	VU, A1cd + 2d	VU, A1cd	Heavy exploited. Assumed to be international trade
7	<i>Dysoxylum loureiri</i> Pierre	Mreas Prouv Phnom	EN, A1c	?	Based on limited information
8	<i>Diospyros cruenata</i> Thwaites	Chheu Khmao	EN, A1c	?	Insufficient information on conservation status
9	<i>Lasianthus kamputensis</i> Pierre ex. Pit	Rumleay Chheam	?	?	Insufficient information on conservation status
10	<i>Diospyros bejaudii</i> Lecomte	Angkot Khmao	EN, A1 c	?	Not international trade, but threatened by other influences.
11	<i>Fagraea fragrans</i> Pit	Ta Trav	EN, A1cd	?	Heavy exploited. Assumed to be local market.

12	<i>Dasydaschalon lamentaceum</i> Finet et Gagnep	Chheung Chap Phnom	VU, A1b	?	Insufficient information on conservation status
13	<i>Shorea cochinchinensis</i> Pierre	Po Pel	EN, A1cd + 2d	EN, A1cd	Heavy exploited. Assumed to be local market.
14	<i>Hopea helferi</i> (Dyer) Brandis	Ko Ki Dek	EN, A1cd + 2d	CR, A1cd + 2cd, B1+2c	Unclear if there is international trade
15	<i>Pinus merkusii</i> Jungh et de Vries	Sral	LR, nt	?	Heavy exploitation and resin extraction. Assumed to be international trade.
16	<i>Garcinia hanburyi</i> Hook.f.	Rorong	VU, A1cd +2d	?	Insufficient information on conservation status.
17	<i>Cinnamomum cambodianum</i> Lecomte	Tepirou	VU, A1cd +2d	?	Heavy exploitation. Assumed to be international trade.
18	<i>Sterculia lychnophora</i> Hance	Sam Rong	CR, A1cd +2d	?	Assumed to be used for local medicine and international trade.
19	<i>Cananga latifolia</i> (Hook.f. & Thomson) Finet & Gagnep	Chhke Sreng	EN, A1cd +2d	?	Utilized for traditional medicine in local markets
20	<i>Albizia lebbek</i> (L.) Benth.	Chres	CR, A1cd	?	Threatened species. Unsure if there is local or international trade.
21	<i>Hopea odorata</i> Roxb.	Ko Ki Msau	VU, A1 cd +2cd	Vu, A1cd +2cd	Heavy exploitation. Assumed to be local and international trade.

Source: Based on assessment by Mr. Khorn Saret, national consultant, in discussion with CTSP staff.

Mapping tree species distribution

A main reason for the establishment of a species map is to detail information about the vegetation coverage at species level. The species distribution map preferably links the occurring species information with the remote sensing based digital map. Combining the information on tree species from the Expert Support Group, materials, and data, a tree species distribution map within the forest area of the forest concession companies was compiled. The selected 21 tree species are mapped separately (see maps in appendix III). To assess the main uncertainties, the results have been compared with a document of plants in Cambodia (Forestry Administration, 1985). This information permits the user to identify where the species is abundant, and also to examine the viability of species within specific locations.

4. Constraints

- With assessment of tree species distribution based upon office work by using all source information and knowledge of small expert group, some data may have been missed in the compilation of documentation.

- For non-common species, data was unavailable, and existing information could not always be used as it is out of date.

5. Conclusions

Identification and mapping of tree species distribution has built on recent observations and assessment of spatial distribution of the tree species, and the assembly of all available information on the distribution of the 21 selected tree species.

The result showed several species to be endangered, such as: *Cananga latifolia* (Hook.f & Thomson) Finet & Gagnep, *Diospyros cruenta* Thwaites, *Lasianthus kamputensis* Pierre ex. Pit, *Dasymaschalon lamentaceum* Finet et Gagnep, and *Garcinia hanburyi* Hook.f. The trees are indigenous species that are poorly protected, and there is limited knowledge of their ecology and distribution. With regard to the less common species, even the attached Expert Support Group (most of whom have conducted forest inventories) expressed difficulties in providing information. It can, however, be concluded that species have, and are, facing serious over-exploitation that leads to gene degradation.

In closing, this paper of tree species distribution can provide a valuable tool for biodiversity and genetic conservation. It mainly strives to comply with the adopted standards at the earliest possible date with the resources available, in order to develop the forest in a way that is both environmentally sound, socially beneficial and economically sustainable.

6. Recommendations

Primary issues deserving attention in tree species distribution are outlined below:

- More research is needed to broaden the range of knowledge on species distribution.
- Other species should be studied, including viable sizes and changes of population and threats in order to add to the priority list for conservation.
- Threatened species must be included into a gene conservation programme.
- In-situ ecosystems / ex-situ conservation strategies must be precise objectives and suitably integrated into support programmes that aim to improve the use of genetic materials. This mainly applies to natural forests and reforestation programmes.
- The involvement of local communities is needed, as long as people participate in the conservation of certain species, conservation of their entire habitats will also be achieved.
- One of the main weaknesses of the forestry sector is the lack of information, but forestry should be promoted to play a key role in raising public awareness.

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