

# Notes on the Vegetation of the Cardamom Mountains, Cambodia

by

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## Summary

The following pages present some floristic and phytogeographic observations made in the course of ethnobotanical work. They must be considered merely as preliminary notes to a future more detailed study of a massif of which only the periphery has been previously visited by naturalists. It is therefore felt that, notwithstanding their incompleteness, these notes will represent a useful contribution to our botanical knowledge of the western Cambodian mountains, as little in the literature, and none of it in English, presently exists.

## Introduction

In 1965-1966, thanks to a grant from the National Institute for Scientific Research in Paris, I made my first ethnobotanical expedition to Cambodia. The investigations were then principally carried out in the area around Leach in Pursat province, and concentrated on the plants used by the lowland Cambodian peasants. I therefore had occasion, through the study of their uses, to become acquainted with tropical plants, and a flora, at first totally unknown to me, and particularly with the species of the Dry Dipterocarp forests, the monsoon forests rich in Leguminosae and Lythraceae, the swamp forests, and also those of certain secondary types.\* Some forays into the Cardamoms at this time convinced me of the intrinsic interest, as much to anthropology as to botany, that this, the most extensive montane area in Cambodia, presented. Further, during my second mission which began in February, 1969, I decided on this region, as little known to botanists as to ethnologists, as my study area. The forests to the south of the range alone have been recently studied (1), apart from some notes that are available on the vegetation of the Tamyong river basin in Pursat province (2). The following pages can hardly claim to contain an exhaustive study of this flora; they are merely observations that have been made within the framework of an ethnobotanical investigation: on-the-spot records that have for the most part been made along the lanes and tracks figured in map 2. It need hardly be added that the lists of species are very incomplete, but as far as possible the dominant or characteristic species have been noted; some, even of these, are yet to be identified.

The herbarium specimens collected are retained in the Natural History Museum in Paris. Those already identified are incorporated in the herbarium of the Phanerogam Laboratory; the remainder, which will be examined on my return to France, can meanwhile also be consulted in this laboratory. It is for this reason that I cite collection numbers for all unidentified species.

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\* I also made very limited number of collecting trips in lowland mixed rain forest.

1. P. Dy Phon, 1969. La végétation du sud-ouest du Cambodge. Thesis, Toulouse University, 261 pp. (unpublished). (This has subsequently been published in Ann. Fac. Sc. Phnom Penh 1970, no. 3, pp. 1-135 & 1971 no. 4, pp. 1-77 — ed.)

2. M. Schmid, 1969. Considérations sur la végétation du centre-ouest Cambodgien. Ann. Fac. Sc. Phnom Penh, 2: 81-100.

The field-work was carried out without any outside scientific assistance except for some botanical excursions made on the southern flanks of the massif with Dr. P. S. Ashton. I am most grateful to him for this opportunity to exchange our botanical experience, and for his encouragement; I am also indebted to him for the English translation of this manuscript.

### The Vegetation Types

No extensive rainfall figures are available for the Cardamom massif itself, merely limited observations from the Thmar Beng region near the centre and some valuable summaries from Khemarak Phouminville on the coast. The annual rainfall for the former (extrapolated from incomplete data) is approximately 4 m., and 5 m. for the latter; neither do detailed soil studies exist. Further, for non-scientific reasons it has not been possible to explore the montane vegetation above 1000 m. altitude.

The vegetation is here delineated according to the physiography; the main types to be considered are:

Forests of humid valley bottoms, notably riverain forests.

Forests of the slopes.

Forests of ridges.

Some notes are also provided for:

Moist submontane grasslands.

Monsoon forests (forêts claires) and savanna forests (forêts sèches).

#### 1. Riverain forests

These form a narrow fringe along the margins of the rivers. Where the valley is narrow and enclosed, the species of the hillslopes descend to the waterside; these will be described later. When the valley is broad, the forest which borders the river contains several characteristic species, one of which, *Altingia (siamensis)* is nearly always present. The structure is that of a true closed evergreen forest, with emergent species such as:

*Altingia (siamensis)*

*Anisoptera* sp. or *Hopea odorata* Roxb.

*Tristania (burmanica)*

*Hopea* is strictly riparian and disappears when one penetrates into the forest. The following species are prominent in the middle and understorey:

*Syzygium zeylanicum* (L.) DC

*Pandanus (tectorius)*

*Fagraea racemosa* Jack ex Wall.

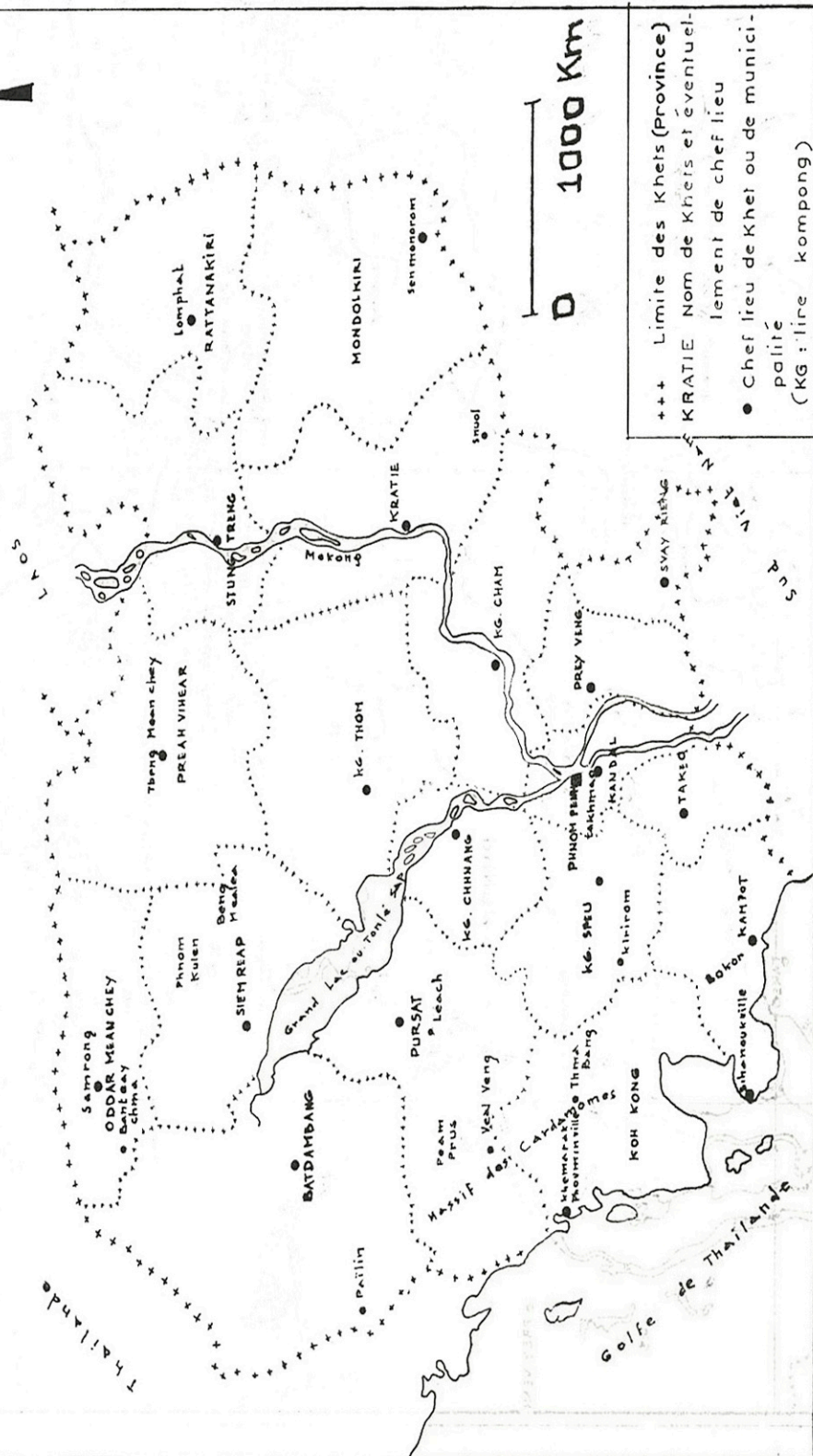
*Ficus* sp.

*Cinnamomum* sp.

*Xanthophyllum glaucum* Wall. ex Hassk.

With the exception of *Hopea* and *X. glaucum* the other species cited here are nearly always present and form the characteristic floristic component.

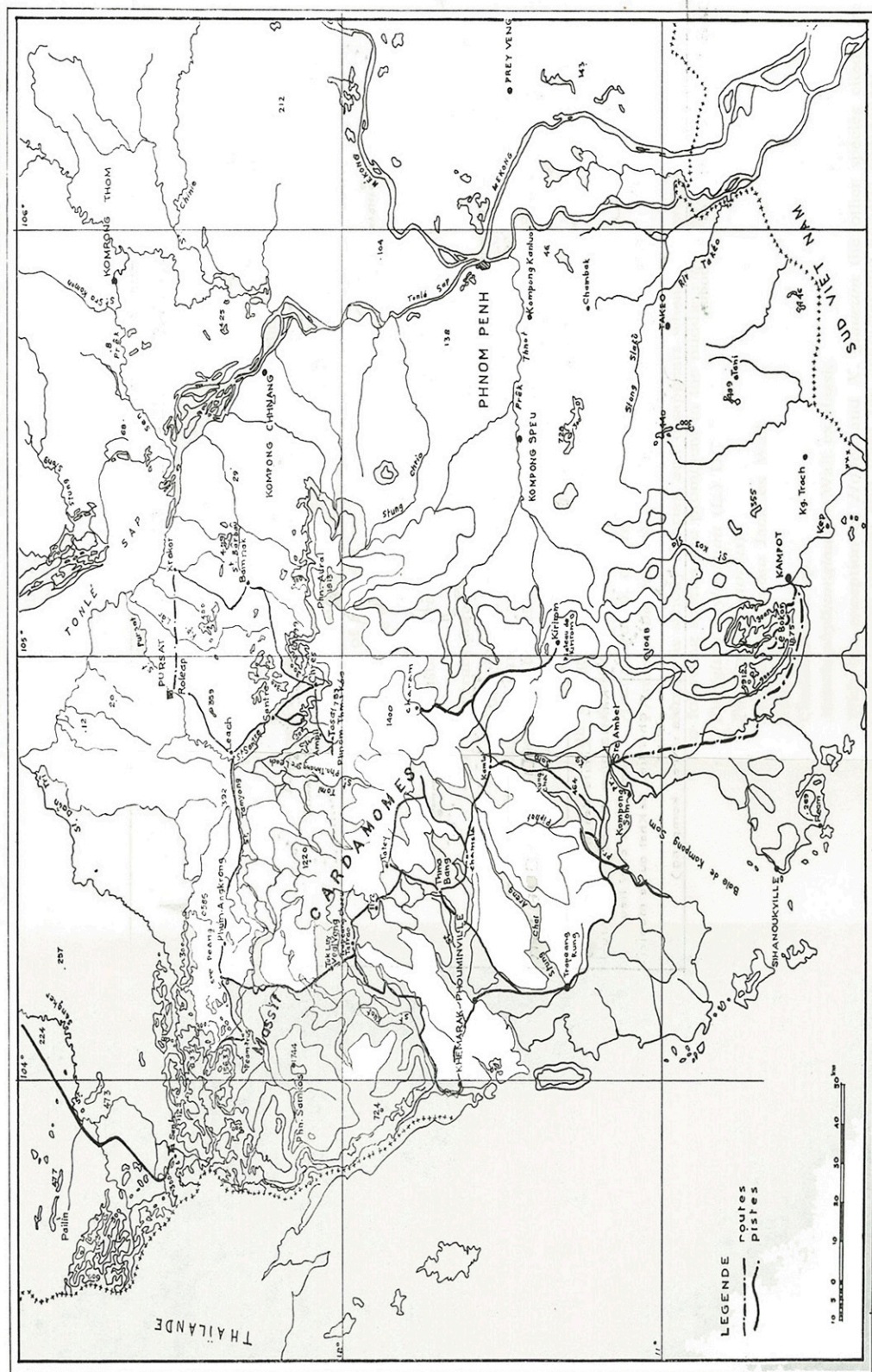
# CARTE GENERALE DU CAMBODGE



- +++ Limite des Khets (province)
- KRATIE Nom de Khets et éventuel-  
lement de chef lieu
- Chef lieu de Khet ou de municipi-  
palié  
(KG : lire kompong)

Map 1 : General Map of Cambodia.





Map 2 : Location of places near Pursat and in the Cardamom Mountains.

## 2. Evergreen forests of ridges and plateaux

(a) Forest with Fagaceae, Lauraceae, Myrtaceae, Meliaceae. This occurs also on some slopes free of rocks. It is possible to recognize several strata:

An upper and a lower canopy stratum; these when taken together are dense. Trees of the former are often variable both in height and diameter, yet form a more or less complete cover except in certain types where the understorey is very dense. The lower canopy stratum only sometimes forms a complete cover. Taken together, the espacement between individual trees is typically 3-5 m. The boles are cylindrical and straight, without prominent buttresses though often somewhat flared at the base; in some areas between a quarter and a third of the lower canopy trees are leaning. The crowns of the upper canopy stratum are generally light, with diffuse foliage; those of the lower tend to be lanceolate, and the stratum taken as a whole is more dense. For the most part the first branches appear in the upper two-thirds to three-quarters of total height of the trees; they generally arise from the same point at the bole apex, with the exception of certain monopodial species in the lower canopy, notably *Garcinia vilersiana* Pierre and *Sageraea elliptica* (A. DC.) Hook. f.

The understorey stratum includes many Rubiaceae and spiny palmlets as well as tree ferns. Along the roadsides a Melastomataceous shrub *Medinilla coerulescens* Guill. is very abundant.

The herb and shrub stratum consists essentially of zingibers, some ferns, and a semi-woody gregarious *Strobilanthes* which can reach 2½ m. and which often by itself constitutes the shrub layer. In open glades a Cyperaceae (1537) is usually noted.

Epiphytes are abundant both in the upper and lower canopy strata: orchids of many kinds, the smallest growing in among the moss; many ferns, in particular *Asplenium*, *Platyserium* and *Drynaria*; mosses and hepatics are conspicuously abundant.

Herbaceous and semi-woody climbers are frequent, twisted round the tree trunks; large woody climbers, reaching into the upper-most branches, are less abundant.

Appearance of the understorey: When the forest is completely closed, as is generally the case, the understorey though lush is easy to pass through in spite of the presence of spiny palms. When light penetrates the canopy to any extent, the more the understorey (both woody and herbaceous) is illuminated the more it burgeons; the plants become entangled and progress becomes exceedingly difficult.

This evergreen forest with Lauraceae, Fagaceae and Myrtaceae is the most widespread in the massif. It is rich in species, of which the most frequent are:

### MAIN CANOPY:

*Cinnamomum* aff. *javanicum*

*Cinnamomum* sp. (1443)

*Syzygium* sp. (1553)

*Syzygium* aff. *cochinchinensis*

*Quercus chrysocalyx* Hick. & A. Camus

*Castanopsis pierrei* Hance

*Dysoxylum cauliflorum* Hiern.

*Dysoxylum* aff. *hoaensis*

*Dysoxylum procerum* Hiern.

*Schima crenata* Korth.

*Podocarpus imbricatus* Bl.

*Parkia streptocarpa* Hance

*Baccaurea oxycarpa* Gagnep.

*Aquilaria krassna* Pierre ex Lecomte

*Garcinia hanburyi* Hook. f.



## UNDERSTOREY:

*Areca triandra* Roxb. or *Pinanga duperreana* Pierre ex Becc. (The two species never occur together.)

*Daemonorops* aff. *pierreanus*

*Cyathea podophylla* (Hook.) Copel.

*Cyathea latebrosa* (Wall.) Copel.

Some Rubiaceae

*Medinilla coerulescens* Guill.

Some spiny *Smilax* spp.

## HERB AND SHRUB STRATUM:

*Amomum kravanh* Pierre ex Gagnep.  
(the Cambodian Cardamom plant,  
confined to rich soils).

*Amomum* spp. (Among which is No.  
1507)

*Alpinia* spp. (Among which is No.  
1709)

*Strobilanthes* sp.

Many vascular cryptogams, especially  
*Selaginella siamensis* Hiern. and  
*Pteridium esculentum* (Forst.) Co-  
kayne

## CLIMBERS AND EPIPHYTES:

*Albizzia* sp.

Apocynaceae (1528)

*Dischidia* aff. *imbricata* (Bl.) Steud.

*Dischidia nummularia* R. Br.

Certain Annonaceae

*Cassytha filiformis* L.

Araceae (*Pothos* spp. ?)

*Gleichenia* aff. *norrisii*

*Asplenium nidus* L.

*Platynerium coronarium* Desv.

*Drynaria* spp.

Many orchids, notably *Eria*,  
*Bulbophyllum*, *Dendrobium* and  
*Appendicula* spp.

## MOSSES AND HEPATICS\*:

*Acroporium* sp.

*Bazzania* sp.

*Chaetomitrium* sp.

*Cheilolejeunea ceylanica* (St.) Schust.  
& Kahr.

*Cheilolejeunea verdonii* (Hoff.) Schust.  
& Kahr.

*Cololejeunea* sp.

*Dicranoloma braunii* (C.M.) Par.

*Drepanolejeunea thwaitesiana*

*Ectropothecium buitenzorgii* (Bel.)  
Jaeg.

*Fissidens* aff. *nobilis* Griff.

*Homaliiodendron crassinervium* Ther.

*Leptolejeunea subacuta* St.

*Leucobryum bowringii* Mitt.

*Leucoloma molle* (C.M.) Par.

*Plagiochila* sp.

*Radula acuminata* St.

*Raphidolejeunea subacuta* St.

*Trachypus bicolor* Reinw. & Hornsch.

*Trichocolea pluma* Mont.

*Thuidium meyenianum* (Hamp.) Jaeg.

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\* Identified by Mr. Pierre Tixier.

Besides these species there are others which can become locally abundant within this forest type:

## TREES:

A very large Apocynaceae, reaching 50 m. tall (1533)

*Anisoptera* sp.

*Dipterocarpus turbinatus* Gaertn. f.

*Dipterocarpus costatus* Gaertn. f.

*Vatica odorata* (Griff.) Sym.

*Ficus* sp. (1562)

*Heritiera javanica* (Bl.) Kost.

*Sapium baccatum* Roxb.

*Adenanthera pavonina* L.

(?) *Aglaia* sp.

*Maba* sp.

(?) Lauraceae: No. 1548

Leguminosae or Sapindaceae (1534)

*Irvingia malayana* Oliv. ex Benn.

*Castanopsis cambodiana* A. Cheval.

*Lithocarpus cerifera* Hick. & A. Camus

*Calophyllum* sp. and other Guttiferae

*Melia azedarach* L.

*Baccaurea sapida* Muell.-Arg.

## SHRUBS AND HERBS:

*Sageraea elliptica* (A.DC.) Hook. f.

*Evodia triphylla* DC.

An arborescent *Pandanus*

Certain species reach 1000 m. altitude (and perhaps higher), such as many Myrtaceae, some Lauraceae and Guttiferae, *Schima crenata*, *Podocarpus imbricatus* and *Sapium baccatum*.

On the other hand there are others confined to middle altitudes, including:

All Meliaceae

*Parkia streptocarpa*

*Dipterocarpus costatus*

*Ficus* sp.

Apocynaceae No. 1533

Most palms (excepting *Pinanga duperreana*) do not exceed 600-800 m.

By contrast: *Irvingia malayana*, *Heritiera javanica*, *Quercus chrysocalyx*, *Baccaurea oxycarpa*, *Melia azedarach* disappear near 400-600 m.

Yet others only appear at certain restricted altitudes: the genus *Cyathea*, at c. 500 m., *Pinanga duperreana*, at c. 600 m., Fagaceae, No. 1549, at c. 800 m.

On red soil derived from basalt, Meliaceae, the larger Lauraceae notably *Cinnamomum* aff. *javanicum*, *Tetrameles nudiflora*, *Sapium baccatum* and *Syzygium* sp. (1553) are particularly well represented.

(b) Forest with *Hopea pierrei* Hance, *Quercus chrysocalyx* Hick. et A. Camus, *Anthocephalus* sp. (1739).

One finds this type in the western part of the mountain range. One dominant species, *Hopea pierrei*, exceptionally successful, prevails at all levels, as saplings, poles and mature trees. It grows also to the north, around the plateau of Veal Veng in the same forest type. The height of its crown hardly exceeds 20 m. In both areas the soil is a red lateritic clay. Two species of medium height (c. 30 m.) are associated with *Hopea pierrei*: *Anthocephalus* sp. (1739) and *Quercus chrysocalyx*. A *Tristania* (1736) which is sometimes associated seems to prefer in particular the moister habitats. Finally, another Fagaceae appears in this type, which it has not so far been possible to collect.

Apart from these distinctions, one meets in this forest type nearly all the trees of evergreen forest type (a), and the understorey is equally similar.

Locally, several dipterocarps appear: besides *Hopea pierrei*, *Anisoptera* sp. and *Dipterocarpus costatus* can occur. In the forests to the north, *Vatica odorata* is abundant adjacent to *Hopea pierrei* and *Anthocephalus* sp.

In rocky places these species are mixed with a bamboo (*Bambusa* sp., 1710).

### 3. Forests on slopes, with bamboo

It can happen that, on the slopes of certain phnoms\*, the vegetation may not be different from that which covers the summits; this occurs particularly where the soil remains of more or less uniform depth. Generally, however, the slopes present the appearance of a mosaic of sandstone blocks, the prevailing substrate of the Cardamom mountains, and of more or less humiferous clay screes — resulting from the decomposition of certain types of sandstone.

On occasion walls of exposed rock strata are exposed, as if the water, in seeping down the slopes had exposed a buried relief; on others they occur in irregular screes. Sometimes also, landslips have carried the sandstone down from the hilltops towards the lower slopes, where it accumulates; the persisting scars on the slopes, and the blocks that mark their course, remain as testimony. Be that as it may, whether the rock rests in situ or has fallen from the ridges, there is hardly any room for the establishment of vegetation.

Here bamboos (*Bambusa* sp., 1710, 1696) are dominant. Sometimes there are few trees, or even none. On the ground an *Alpinia* and a small species of fern can grow among the bamboos, but are local. Above 500 m. one meets some cyatheas here and there. Two large and aggressive invading ferns, *Gleichenia* aff. *norrisii* and *Dicranopteris* sp. can grow among the bamboos and even completely replace them. It appears that this comes about when the soil is particularly impoverished. Certain spiny plants, such as *Rubus* spp. (especially bordering tracks) and certain climbers can render such thicket impenetrable.

Between these communities with bamboos and the majestic evergreen forests occurring on ridges and here and there on slopes, there can occur a transitional type where some species of the evergreen forests mix with the bamboos. *Quercus chrysocalyx* is the most frequent but all the other species can occur from time to time; their density is generally low and their height hardly exceeds 20 m. The spiny palms, and in particular the rattans, are numerous.

These bamboo forests climb to 1000 m., possibly higher seeing that we know so little about the vegetation that grows above that altitude.

### 4. The vegetation of the wet grasslands

The tracks that cross the range from time to time open out into plateaux covered with herbaceous vegetation. Trees are very scattered or for much of the time absent. On the ground grasses and *Drosera* (*indica*) occur in abundance; an unidentified herb (1664) is generally associated with them. Locally, *Leptocarpus disjunctus* Mast. is dominant, at which time it is associated with *Centrolepis cambodiana*. Further plants encountered here sometimes are a Euphorbiaceae (1769) and another small undetermined herb (1764).

This vegetation has been observed to occur over sandy soil and on surfaces where the iron pan, close to the surface, outcrops here and there.

Where swampy terrain occurs it is hemmed by giant grasses such as *Saccharum arundinaceum* Retz., by *Phragmites* sp. or by Cyperaceae.

\* Phnom: a mountain, hill or mound.



**5. Dry deciduous forest, *Erythrophloeum cambodianum* Gagnep., *Irvingia malayana*, *Lagerstroemia* sp.**

On the slopes of certain phnoms to the north of the range grows a semi-deciduous forest, characterised by the abundance of leguminous trees.

TREES: the following are dominant:

*Erythrophloeum cambodianum* Gagnep.

*Irvingia malayana*

*Lagerstroemia* sp.

*Bombax ceiba* L.

(?) *Nephelium* sp.

and are accompanied by:

*Dalbergia nigrescens* Kurz

*Ficus* sp.

*Xylia kerrii* Craib & Hutch.

*Aquilaria krassna* Pierre ex Lecomte

*Sindora cochinchinensis* Baill.

*Garcinia ferrea* Pierre

*Pterocarpus* sp.

*Terminalia nigrovenulosa* Pierre

Near the summits *Tetrameles nudiflora* R.Br. is noticed.

**SHRUBS:**

*Cratoxylon* sp.

*Memecylon* sp.

Some Rubiaceae

A few climbers and spiny plants

The ground is covered by numerous ferns and zingibers, including *Anomum kravanh* Pierre ex Gagnep.

Many of the species quoted grow in dry habitats and one comes across them often in the deciduous formations of the plains of Tonlé Sap and Mekong. In the mountains they are to be found up to 500 m. altitude on rocky outcrops with shallow soils.

**6. The savanna forests**

**(a) The pine forests:**

*Pinus merkusii* Jungh. et de Vriese. These are as a rule submontane, but they do exist also in the lowlands. On the Cardamoms themselves they follow certain cuestas and plateaux.

In the regions visited *Tristania burmanica* is the best represented woody species though *Dipterocarpus obtusifolius* Teysm. and *Melastoma* sp. also occur; *Imperata cylindrica* P. Beauv. and *Selaginella* sp. dominate the field layer. In all, the number of species appears to be low.

## (b) The savanna forests with dipterocarps:

Unique to South-East Asia, these, frequently called Dry Dipterocarp forests, are widespread in Cambodia; they occur to several hundred metres altitude and are generally found on sandy soils. The best represented species in them are:

*Shorea obtusa* Wall. ex Bl., which can form almost pure stands.

*Dipterocarpus tuberculatus* Roxb.

*Dipterocarpus obtusifolius* Teysm.

*Pentacme siamensis* Kurz

*Dipterocarpus intricatus* Dyer, which seems to indicate somewhat better soil conditions.

The Dipterocarpaceae can alone constitute the single tree stratum, or equally can be accompanied by:

*Careya sphaerica* Roxb.

*Aporosa sphaerosperma* Gagnep.

*Terminalia alata* Heyne ex Roth

*Mitragyna brunonis* (Wall. ex G. Don)

Craib

*Diospyros erhetoides* Wall.

*Melanorrhoea laccifera* Pierre

*Sindora cochinchinensis* Baill.

*Xylia kerrii* Craib & Hutch

*Parinari anamensis* Hance

*Buchanania reticulata* Hance

*Dillenia ovata* Wall. ex Hook. f. & Thoms.

*Dillenia pentagyna* Roxb.

*Zizyphus cenoplia* Mill.

*Randia tomentosa* Bl.

*Feroniella lucida* (Teijsm. & Binn. ex Scheff.) Swingle

A bush with distinct red bark (1349)

In the understorey *Corypha lecomtei* Becc. is particularly abundant; it occurs also in analogous vegetation types to the north of Kompong Thom away on the other side of the Great Lake. The most abundant and ubiquitous herb is *Arundinaria falcata* Nees, though it can sometimes be replaced by *Imperata cylindrica* P. Beauv., notably after persistent burning.

It should be recalled that the savanna forests, including the pine forests, are for the most part burned annually to facilitate the hunting of game which frequent them. Some foresters (3) believe that these types are mostly man-induced and that the climatic climax-type is an unfired savanna forest with dipterocarps; such a savanna forest, which still occurs here and there on the plains, includes many Leguminosae:

*Xylia kerrii* Craib & Hutch.

*Sindora cochinchinensis* Baill.

*Peltophorum* aff. *pterocarpa*

*Azelia xylocarpa* Craib

*Dalbergia nigrescens* Kurz

*Dialium cochinchinensis* Pierre

*Dalbergia* aff. *cochinchinensis*

*Dalbergia* aff. *lanceolaria*

as well as:

*Lagerstroemia* spp.

*Combretum quadrangulare* Kurz

*Terminalia* sp.

*Terminalia nigrovenulosa* Pierre

*Bombax ceiba* L.

*Shorea talura* Roxb.

The shrub (1349) already mentioned.

Sometimes also, *Dipterocarpus intricatus* Dyer occurs.

A bamboo (1696), encountered also in evergreen forest, grows at times in the understorey.

(3) P. Maurand, 1968, Politique forestière à envisager au Vietnam, dans l'après-guerre. Bull. Soc. Ét. Indochin., Saigon, 43, 4: 267-309.