

Evergreen swamp forest in Cambodia: floristic composition, ecological characteristics, and conservation status

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As part of recent field studies, a hitherto undescribed type of evergreen freshwater swamp forest was discovered in Stung Treng Province, Cambodia. The swamp forest occurs in at least six disjunct localities and is dominated by hydrophytic trees (*Eugenia* spp., *Ficus* spp., *Litsea* spp., *Macaranga triloba*, *Myristica iners* and *Pterandra caerulea*). Although these same genera also occur in upland forests, most are represented by different species in the swamps. *Livistona saribus* emerges from the canopy as an indicator species of this vegetation type while dense stands of other palms (*Calamus*, *Areca*, *Licuala*) and sporadic, dense populations of tree ferns (*Cibotium barometz*) dominate the understory. Pneumatophores, stilt roots, and aerial roots characterize the hydrophytes. The floristic composition indicates that the forest type is distinct compared to other swamp forests described from the region and worthy of protection based on its rarity and ecological uniqueness.

Swamp forests occur in low-lying areas where slow-flowing streams drain shallow valleys. In such habitats, saturated substrates with high, subterranean water tables are often prone to flooding and persistent water retention. Different types of fresh water swamp forest occur in the humid tropics. Flooded riverine forests are described from the Amazonas (várzea and igapó, Goodland and Irwin 1975, Parolin 2004), central Africa (Richards 1952, WWF 2008), southeast Asia and the Pacific (Whitmore 1984a). Freshwater swamp forests are common in Malaysia and Indonesia (Whitmore 1984b), and covered approximately 5% of Singapore before wholesale forest clearance in the nineteenth century (Corlett 1991). Only two fragments of Singapore's swamps remain (Turner et al. 1996). Broadly disjunct peat swamp forests with narrow distributions occur throughout southeastern Asia, with notable examples in western Malaysia (Wyatt-Smith 1959, Yule 2010), Sarawak (Anderson 1963), eastern Borneo, southern Sumatra (Endert 1920), and central Sumatra (Sewardano 1938). Van Steenis (1957) mapped the distribution of this vegetation in Malaysia and noted that large areas of southern New Guinea are also covered by peat swamp, while Phengklai (1989) described peat swamp forest from Peninsular Thailand. In contrast, freshwater swamp forests and peat swamp forests are almost absent from continental Asia (Blasco et al. 1996).

Cambodia forms part of the Indo-Burma biodiversity hotspot (Mittermeier et al. 1998, Myers et al. 2000) and remains one of the countries with the highest forest cover in the Indochina bioregion (FAO 2005). Unlike Thailand and Vietnam, where remaining forests are mostly found in

mountainous areas, Cambodia still maintains substantial lowland forests. However, since few systematic collections of Cambodia's flora and fauna have been undertaken (Strange et al. 2007), our understanding of these forests is cursory. Previous studies were published primarily by French botanists during the first half of the 20th century, and usually in the form of forest species lists (Lecomte and Guibier 1926, Béjaud 1932, Maurand 1938), and floristic treatments (Lecomte 1907–1942, Forbé and Trojani 1930). Legris and Blasco (1971) recognized a variety of distinct forest types in their vegetation map of Cambodia. Seasonally inundated (flooded) forests are found around the lake Ton Le Sap in Cambodia (Yoshiki et al. 2007). The vegetation map of Cambodia by Legris and Blasco (1971) accurately mapped the flooded forests, but did not mention evergreen and permanently inundated freshwater swamp forests. Rollet (1972a), however, provided a brief account of evergreen swamp forests in Cambodia based on observations in the Kratie Province northwest of Snuol near the border to Vietnam (Rollet pers. comm.), in which a few characteristic species of the forest type were mentioned, but without a species inventory or observations on species frequencies. Rollet (1972b) emphasized the rarity of swamp forests and distinguished this vegetation type from marshes and flooded forests. Yet another aquatic forest type was described by Vidal (1979, 1997), who characterised rear mangroves dominated by *Melaleuca leucadendra*. He reported swamp forests among depressions beyond the rear mangrove on alluvial muddy soils in southwestern Cambodia, near the gulf of Thailand, which were also dominated by *Melaleuca leucadendra*. Furthermore, he distinguished

fresh-water formations including 1) aquatic herbaceous vegetation, 2) inundated vegetation (the flooded forest around Tonle Sap, and 3) stream vegetation. However, Vidal made no mention of inland swamp forests.

Since these studies, progress in remote sensing technology has allowed a more detailed view of Cambodia's plant cover with respect to forest phenology and physiognomy. A recent vegetation map of Cambodia based on satellite imagery included marsh and flooded forests in Cambodia, but did not detect evergreen freshwater swamp forests (JICA 2002). This may be due in part to the fact that there are very few ground-based studies of forest composition in Cambodia to support satellite imagery.

Evergreen lowland forests cover the northern reaches of Kampong Thom Province and western parts of Stung Treng and Kratie Provinces in the central lowlands of Cambodia. Local people refer to this forest complex as 'Prey Long'. As part of recent field studies in the area, a hitherto undescribed freshwater swamp forest was reported (McDonald 2004). During expeditions in 2008, 2009 and 2010, evergreen freshwater swamp forests in Stung Treng Province were mapped and inventoried in order to describe the floristic composition of the forest type and assess their conservation status.

Material and methods

The permanently inundated evergreen swamp forests, known as 'choams' in Khmer, reportedly occur in at least six disjunct localities restricted to Stung Treng, Kratie and Kampong Thom Provinces, between the Porong and O'Long Rivers. Five of the swamp forests, including Choam north of Spong, Choam Spong, Choam Takong, Choams west of Takong, and Choam Svay (Fig. 1), have been visited as part of the present study. The largest of these swamps, Choam Takong, which is the main field site of this study, covers about 2×1 km. This swamp drains into the O'Long River, a western tributary of the Mekong River (Fig. 1).

Checklists of plants within and bordering the evergreen swamp forest of Choam Takong were made with assistance from local guides. A total of twenty-two 50×10 m transects were made. The frequency of trees larger than 10 cm diameter breast height (dbh) was recorded. Transects covered areas that are permanently inundated and others that are seasonally flooded. The field work was conducted towards the end of the dry season in Apr–May 2008, 2009 and in Jan 2010. Voucher specimens were collected and deposited at TEX, PAUH, AAU, CMU, and the Forestry Administration Cambodia. We consulted the 'Flora of Thailand' (1963–2010), 'Flora générale de L'Indochine' (Lecomte 1907–1942), 'Lexique des arbres forestiers du Cambodge' (Dy Phon and Rollet 1999), and 'Vietnam forest trees' (FIPI 1996) to make species determinations.

Results and discussion

Ecological characteristics

Evergreen swamp forests of central Cambodia are found at 50–100 m a.s.l. on alluvial sandy soils with shallow stagnant

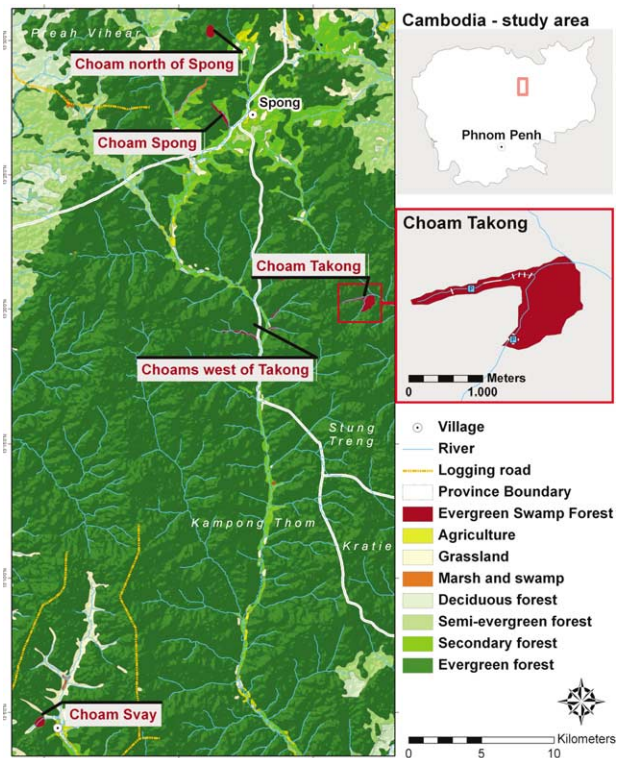


Figure 1. Map of Prey Long showing evergreen swamp forests visited in study; Choam north of Spong village, Choam Spong, Choam Takong, Choams west of Takong, and Choam Svay. At least 3 other swamp areas are known to local villagers but remains to be mapped. Areas indicated as “marsh and swamp” are delineated by JICA (2002) based on satellite imagery. Further field work is needed to determine whether these areas are floristically similar to the larger area of evergreen swamp forest described in this study. Insert: Map of Cambodia showing location of study area.

water. Annual rainfall in the area is 1600–2200 mm. The swamp forests are characterized by a dense understory and an irregular canopy from 10–25 m tall (Fig. 2) that is frequently interrupted by emergent *Livistona saribus* palms and scattered hardwood trees that are 30–35 m tall (Fig. 3). Pneumatophores, (aerial roots) and stilt roots characterize the hydrophytic trees and palms (Fig. 4–5). In some areas of the swamp, the understory is relatively open (Fig. 6). A profile of characteristic species and their distribution in relation to permanently inundated areas is illustrated in Fig. 7. The swamp forests do not exhibit the same degree of tree diversity as the surrounding lowland rainforests (Lecomte 1907–1942, Theilade et al. 2007).

Representation of families and floristic composition

The swamp forest is dominated by hydrophytic trees of *Eugenia*, *Myristica*, *Ficus*, *Litsea*, *Pternandra* and *Macaranga*. Although these same genera also occur in upland forests, most are represented in the uplands by different species. A total of 72 trees, 4 shrubs, 7 palms, 3 ferns, 1 liana, 2 sedges and 3 aquatic plants were recorded from the swamp forest representing 43 families. Their family disposition, by genus and species, is presented in Table 1.



Figure 2. Structure of evergreen swamp forest seen from open pond.



Figure 3. A rare but very conspicuous *Livistona saribus* reaches 35 m tall and emerges from the swamp forest canopy.



Figure 4. Pneumatophores of *Myristica iners* covers large areas of the swamp forest floor.

The overstory is dominated both in size and frequency by *Myristica iners* and two unidentified species of *Litsea*, one of which was found close to the borders of the swamp (*Litsea* sp. 1) while the other was restricted to inundated habitats (*Litsea* sp. 2). Other subdominant canopy trees included *Eugenia* spp., *Mastixia pentandra*, *Archidendron clypearia* ssp. *clypearia*, and *Ficus* spp. The less abundant, but very conspicuous *Livistona saribus* (*L. cochinchinensis* Mart. pro syn.) reaches to 35 m tall as an emergent (Fig. 3, 7). *Macaranga triloba*, *Pternandra caerulescens*, *Eugenia* spp., *Baccaurea bracteata*, *Euonymus glaber*, *Memecylon umbellatum*, *Parinari annamensis*, *Callophyllum* ssp., and *Xerospermum noronhianum* were the most common understory trees. Rarer understory trees include *Elaeocarpus* spp., *Irvingia malayana*, *Cleistanthus tomentosus*, *Fagraea racemosa*, *Garcinia xanthochymus* and *Shorea guiso*. The frequency of trees larger than 10 cm dbh are listed in Table 2.

Shrubby dicotyledons are rare, and those that do occur are largely confined to the more open forest in the centre of some swamps. Dense stands of palms (*Calamus*, *Areca*, *Licuala*) and sporadic clusters of tree ferns (*Cibotium barometz*) dominate the understory. A shrubby *Dracaena gracilis* occurs occasionally at the border of the swamp. This species is a more common riverine plant along smaller streams in Prey Long. Herbaceous dicotyledons are practically absent. Some species, such as the *Nepenthes*, have a climbing habit but are mainly found in light gaps around small ponds. Herbaceous monocotyledons, in particular

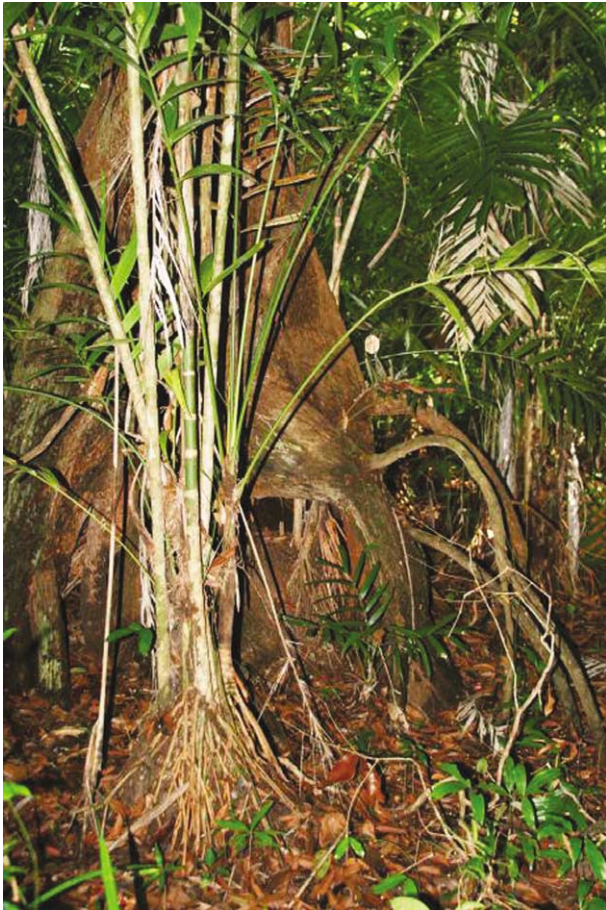


Figure 5. Stilt roots of *Eugenia grata* behind *Areca triandra* displaying aerial roots.

Cyperaceae, dominate the understory, of which *Mapania macrocephala* and *Hypolythrum nemorum* are the most abundant and widespread species. In ponds, near streams or in spots in the swamp, where the water is exposed to sunlight, the aquatic plants *Najas indica* and *Utricularia aurea* abound. A checklist of species, vernacular names, and whether species were recorded in permanently inundated swamp forest, seasonally inundated forest and/or upland forest is provided in Table 3.

Unidentified species

There are a few undetermined plant specimens at TEX, AAU and Chiang Mai, which will require further study at K, L, P, and SING. It is not unlikely that some of these will be new to science. It was impossible to secure fertile collections of all tree species despite one of the authors being an experienced tree climber. According to local guides, a number of tree species flower during the rainy season (May–Oct) when roads are inaccessible. Furthermore, many rare elements of this endemic plant community have yet to be collected.

Comparison with other swamp forests in the region

Inland swamp forests have been reported from the southwest of Kampong Thom Province towards the Tonle Sap Lake (Tani et al. 2007), but these swamp forests have a low species diversity and are completely dominated by *Melaleuca cajuputi* Roxb., a species that is notably absent from the inland swamp forest described herewith.

The freshwater swamp forests described in this study bear some resemblance to a swamp forest described from the coastal provinces by Vidal (1979, 1997), in that palms of the genera *Calamus*, *Areca*, *Daemonorops* and *Licuala* are



Figure 6. Swamp forest habitat with open understory.

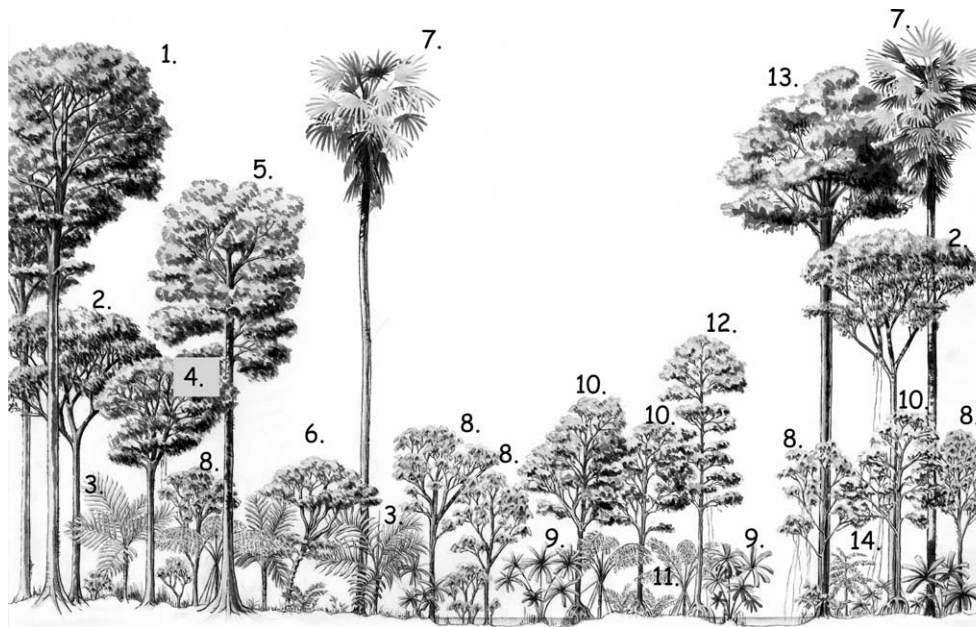


Figure 7. Profile of evergreen swamp forest showing the characteristic species and their distribution in relation to permanently inundated areas. Drawing is based on water table towards the end of the dry season in May. Water rises 1–2 m during wet season inundating larger areas of the surrounding forests. Height and length approximately 35 × 50 m. (1) *Shorea guiso*, (2) *Archidendron clypearia*, (3) *Areca triandra*, (4) *Sindora siamensis*, (5) *Myristica iners*, (6) *Fagraea racemosa*, (7) *Livistona saribus*, (8) *Macaranga triloba*, (9) *Licuala spinosa*, (10) *Eugenia albiflora*, (11) *Cibotium barometz*, (12) *Litsea* sp. (13) *Dipterocarpus costatus*, (14) *Pternandra caeruleascens*.

common. However, upon closer examination, there are major differences in the floristic composition of these forest types. While *Oncosperma tigillaria* Ridl. dominates in the swamps in southwestern Cambodia, the species is absent from the inland swamp forests. Moreover, the composition of dicotyledons in the coastal swamp forest is totally different from the inland swamp forest. Hence, none of the tree species mentioned by Vidal as common in the swamp forest of the southwest have been found in the inland swamp forests. *Melaleuca leucadendra*, which forms pure stands in the coastal swamp forest, is absent from the inland swamp forests of central Cambodia.

Flooded forest occurs on the shores of the great Ton Le Sap Lake in central Cambodia as well as in smaller low lying areas bordering the Mekong River. Unlike the evergreen freshwater swamp forest of Choam Takong, however, flooded forest is dominated by *Barringtonia acuminata* Korth., *Terminalia cambodiana* Gagnep., *Diospyros cambodiana* Lecomte, *Coccoceras anisopodum* Gagnep. and *Homalium brevidens* Gagnep. (Rollet 1972b, Yoshiki et al. 2007). None of these species are found in the freshwater swamp forest of the Stung Treng Province.

The evergreen swamp forests of central Cambodia have floristic characteristics in common with the freshwater swamp forests of Singapore in the presence and abundance of a number of genera such as *Eugenia*, *Myristica*, *Calophyllum*, *Pternandra*, *Macaranga*, *Baccaurea*, *Litsea*, *Mastixia*, *Memecylon*, *Baccaurea*, *Shorea*, *Diospyros*, *Archidendron* and *Xerospermum* (Turner et al. 1996). Yet, only 4 species are common to both localities: *Carallia brachiata*, *Macaranga triloba*, *Pternandra caeruleascens*, *Myristica iners*.

Swamp forest in Singapore resembles those of Cambodia in the restricted number of terrestrial herbs, of which none are identical to the species found in Cambodian swamps.

The peat swamp forest described from Narathiwat, Peninsular Thailand by Pengklai et al. (1989) also shares some of the characteristic genera with the evergreen swamp forests of central Cambodia. However, only three tree species, *Baccaurea bracteata*, *Myristica iners* and *Pternandra caeruleascens*, are common to the peat swamp forest in Thailand and the freshwater swamp forest described in this study. The same observation is valid for the peat swamp forests of Borneo, for which Anderson (1963) provides a detailed description. Although the two forest types have many genera in common, only two tree species (*Baccaurea bracteata* and *Fragraea racemosa*) co-occur in Bornean peat swamp forest and Cambodian choams. Hence, the inland freshwater swamp forest described in this study is distinct in its floristic composition compared to other swamp forests described from the region, and we conclude that it is endemic to the central lowlands of Cambodia.

Conservation concerns

Forested wetlands represent a particularly vulnerable forest type, as they are usually targeted for conversion to rice cultivation (McDonald 2004). It may be speculated that swamp forests were formerly relatively common, historically covering upper reaches of rivers of the former widespread lowland evergreen rain forest throughout the Mekong River catchment and delta. They are highly biodiversity-rich and

Table 1. Representation of botanical families and species of angiosperms and gymnosperms. Total number of genera and species (in brackets) represented.

Family	Genera	Trees	Shrubs	Herbs	Climbers and lianas	Epiphytes	Aquatic plants
Gymnosperms							
Gnetaceae	1 (1)	1 (1)					
Angiosperms							
Dicotyledons							
Anacardiaceae	1 (1)	1 (1)					
Annonaceae	2 (2)	2 (2)					
Apocynaceae	1 (1)	1 (1)					
Capparidaceae	1 (1)	1 (1)					
Celastraceae	1 (1)	1 (1)					
Chrysobalanaceae	1 (1)	1 (1)					
Combretaceae	1 (1)	1 (1)					
Cornaceae	1 (1)	1 (1)					
Dilleniaceae	1 (1)	1 (1)					
Dipterocarpaceae	5 (5)	5 (5)					
Ebenaceae	1 (3)	1 (3)					
Elaeocarpaceae	1 (2)	1 (2)					
Euphorbiaceae	6 (8)	5 (6)	1 (2)				
Fagaceae	1 (1)	1 (1)					
Fabaceae	3 (3)	3 (3)					
Guttiferae	2 (4)	2 (4)					
Lauraceae	3 (4)	3 (4)					
Lentibulariaceae	1 (1)						1 (1)
Loganiaceae	1 (1)	1 (1)			*climber as young		
Malvaceae	1 (1)	1 (1)					
Melastomataceae	3 (3)	2 (2)	1 (1)				
Meliaceae	4 (4)	4 (4)					
Moraceae	1 (4)	1 (3)			1 (1)		
Myristicaceae	1 (1)	1 (1)					
Myrtaceae	1 (4)	1 (4)					
Najadaceae	1 (1)						1 (1)
Nepenthaceae	1 (1)				1 (1)		
Oleandraceae	1 (1)						1 (1)
Polygalaceae	1 (1)	1 (1)					
Rhizophoraceae	1 (1)	1 (1)					
Rutaceae	1 (1)	1 (1)					
Sapindaceae	2 (2)	2 (2)					
Simaroubaceae	2 (2)	2 (2)					
Sterculiaceae	3 (3)	3 (3)					
Tilliaceae	1 (1)	1 (1)					
Verbenaceae	1 (1)	1 (1)					
Monocotyledons							
Agavaceae	1 (1)		1 (1)				
Cyperaceae	2 (2)			2 (2)			
Orchidaceae	1 (1)					1 (1)	
Palmae	6 (7)	4 (4)			2 (3)		
Zingiberaceae	1 (1)			1 (1)			
Pteridophytes							
Blechnaceae	1 (1)				1 (1)		
Dicksoniaceae	1 (1)		1 (1)				

provide significant ecosystem services, such as carbon sequestration, and they sustain productive fisheries. At the same time, forested wetlands are vulnerable not only to excessive direct use, but also the added threat of unsustainable water use. A lack of data constrains the estimates of the extent of coverage for this forest type under existing protected area systems (MEA 2005).

Preliminary documentation indicates that the evergreen swamp forest is endemic to central Cambodia and share limited floristic relations with swamp forests in Thailand, western Malaysia, Singapore and Borneo. Cambodia's lowland rainforests share close affinities with the vegetation of Malesia, while montane rainforests of the country share closer affinities with Indian and Chinese floras (Dy Phon

1982). Hence the lowlands may be regarded as a unique biogeographic realm within the country. Cambodia's system of protected areas, however, reveals a notable lack of protection for lowland rainforests. This lack of representation of lowland evergreen forest in national protected area system is typical for the Indo-Burmese hotspot. Consequently, the central lowland of Cambodia has been identified as a critical ecosystem for the Indo-Burmese biodiversity hotspot, as it is the last intact vestige of Indochina's once widespread lowland evergreen forest (Birdlife International 2005). As presently known, this region is the only area where inland evergreen swamp forest occurs. Many endangered plants and animals are found in this area, identifying it as of great importance in terms of

Table 2. Frequency of trees and shrubs (>10 cm dbh) based on 22 transects covering 1.14 ha in permanently inundated and seasonally inundated swamp forest. Frequency of the indicator species *Livistona saribus* is also included. Sixteen species from the checklist of trees and shrubs were not recorded in transects.

Latin name	Frequency
<i>Acronychia pedunculata</i> (L.) Miq.	0
<i>Aglaia</i> sp.	1.75
<i>Anisoptera costata</i> Pierre	0.00
<i>Antidesma cambodianum</i> Gagnep.	3.51
<i>Antidesma montanum</i> Bl. var. <i>montanum</i>	2.63
<i>Aphanamixis polystachya</i> (Wall.) R. Parker	2.63
<i>Aporosa ficifolia</i> Baill.	4.39
<i>Archidendron clypearia</i> (Jack) Niels. ssp. <i>clypearia</i> var. <i>clypearia</i>	4.39
<i>Baccaurea bracteata</i> M. A.	15.79
<i>Baccaurea ramiflora</i> Duth ex Kurz	0.00
<i>Brucea amarissima</i> Desv. ex Gomes	0.00
<i>Calophyllum spectabile</i> Willd.	11.40
<i>Calophyllum tetrapetalum</i> Roxb.	4.39
<i>Capparis micrantha</i> DC.	1.75
<i>Carallia brachiata</i> Merr.	1.75
<i>Cassia</i> sp.	0.88
<i>Chisocheton cumingianus</i> (C. DC. Harms)	0.00
<i>Cinnamomum cambodianum</i> Lecomte	3.51
<i>Cleistanthus tomentosus</i> Hance	6.14
<i>Croton</i> sp.	0.88
<i>Dehaasia cuneata</i> Blume	1.75
<i>Dillenia parviflora</i> Griff. var. <i>parviflora</i>	0.88
<i>Diospyros bejardii</i> Lecomte	3.51
<i>Diospyros filipendula</i> Lecomte	1.75
<i>Diospyros sumatrana</i> Miq.	0.00
<i>Dipterocarpus costatus</i> C. F. Gaertn.	1.75
<i>Dracaena gracilis</i> Wall.	0.88
<i>Elaeocarpus griffithii</i> Mast.	6.14
<i>Elaeocarpus</i> sp.	8.77
<i>Euonymus glaber</i> Roxb.	15.79
<i>Eugenia albiflora</i> Duth. ex Kurz	26.32
<i>Eugenia cinerea</i> Kurz	0.88
<i>Eugenia grata</i> Wight	11.40
<i>Eugenia syzygioides</i> (Miq.) M. R. Hend.	13.16
<i>Fagraea racemosa</i> Jack ex Wall.	6.14
<i>Ficus fistulosa</i> Reinw. ex Bl.	0.00
<i>Ficus rumphii</i> Blume	0.00
<i>Ficus</i> sp.	0.00
<i>Garcinia merguensis</i> Wight	2.63
<i>Garcinia xanthochymus</i> Hook f.	6.14
<i>Gnetum montanum</i> Markgr.	0.00
<i>Grewia asiatica</i> Wall.	3.51
<i>Heritiera javanica</i> (Blume) Kosterm.	0.88
<i>Hopea odorata</i> Roxb.	0.00
<i>Irvingia malayana</i> Oliv. ex Benn.	7.02
<i>Lithocarpus polystachyus</i> Rehder	0.00
<i>Litsea</i> sp. 1	29.82
<i>Litsea</i> sp. 2	10.53
<i>Livistona saribus</i> Merr. ex A.Chev. Syn. L. <i>cochinchinensis</i> Mart.	5.26
<i>Macaranga triloba</i> (Reinw. ex Bl.) Muell. Arg.	45.61
<i>Mastixia pentandra</i> Bl. spp. <i>chinensis</i> (Merr.) Matt.	10.53
<i>Melastoma villosum</i> Aubl.	0.00
<i>Melodorum fruticosum</i> Lour.	0.88
<i>Memecylon umbellatum</i> Burm. f.	14.91
<i>Mischocarpus sundaicus</i> Bl.	0.00
<i>Myristica iners</i> Bl.	23.68
<i>Parinari anamensis</i> (Hance) J. E. Vidal	12.28
<i>Pternandra caerulescens</i> Jack	30.70
<i>Sandoricum indicum</i> Cav.	0.88
<i>Sapium insigne</i> (Royle) Trimen	0.00
<i>Semecarpus</i> sp.	4.39
<i>Shorea guiso</i> (Blanco) Bl.	6.14
<i>Sindora siamensis</i> Teijsm. Ex Miq.	0.00
<i>Sterculia gilva</i> Miq.	0.88
<i>Terminalia</i> sp.	0.88
<i>Vatica odorata</i> (Griff.) Symington	1.75

Table 2 (Continued)

Latin name	Frequency
<i>Vitex glabrata</i> R. Br.	3.51
<i>Wrightia religiosa</i> Benth. & Hook. f.	2.63
<i>Xanthophyllum virens</i> Roxb.	1.75
<i>Xerospermum noronhianum</i> Blume	10.53
<i>Xylopia vielana</i> Pierre	1.75
<i>Lecythidaceae</i> A. Rich.	1.75
Malvaceae Juss.	0.88
Simaroubaceae DC.	0.88
Tiliaceae Juss.	0.88
Unidentified (1)	2.63
Unidentified (2)	0.88
Unidentified (3)	4.39
Unidentified (4)	1.75

the biodiversity of Cambodia. So far, 36 threatened tree species have been recorded from the swamp and surrounding lowland forest (Theilade et al. 2007, UNEP-WCMC 2010). In addition to its floristic uniqueness, the evergreen swamp forest is of particular importance to wildlife during the dry season, including large mammals such as elephant, bear, gaur, banteng, and fishing cat (Emmet and Olsson 2007). The critically endangered Siamese crocodile is reported from one of the evergreen swamp forests. It is suggested that the evergreen swamp forests are worthy of protection based on their rarity and ecological uniqueness.

Currently, all known inland evergreen swamp forests in Cambodia are found within logging concessions. So far, the logging moratorium, which came into effect in 2001, has maintained forests of the lowland plains in central Cambodia in relatively good condition. However, there is a need for post-concession management including conservation planning in order to protect these unique forests (Schmidt and Theilade 2010).

It would be useful to compare the different vegetation types (evergreen swamp forest, flooded forest, evergreen lowland forest, and other freshwater swamp forests in the region) with multivariate or statistical methods, but the type of quantitative data needed for such analyses is not presently available. We suggest that further vegetation studies in the central lowlands of Cambodia would contribute to the understanding of distribution of lowland forest types, which are no longer present in neighbouring countries within the bioregion. Finally, we recommend that vegetation maps and land use maps are field-checked, because relying solely on satellite imagery and aerial photographs is not conclusive enough to detect all forest types present.

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Table 3. Checklist of species at Choam Takong. Scientific name, vernacular name, and habitat where recorded: permanently inundated swamp forest =S, periodically inundated areas =P, and upland =U.

Family	Species	Vernacular name	Habitat
Angiosperms			S P U
Dicotyledons			
Anacardiaceae	<i>Semecarpus</i> sp.	unknown to locals	S P
Annonaceae	<i>Melodorum fruticosum</i> Lour.	Romduol	P
Annonaceae	<i>Xylopia vielana</i> Pierre	Kray	S P
Apocynaceae	<i>Wrightia religiosa</i> Benth. & Hook. f.	Pich changua	P
Capparidaceae	<i>Capparis micrantha</i> A. Rich.	Kanhcheu baidach	S P
Celastraceae	<i>Euonymus glaber</i> Roxb.	Srolork	S P
Chrysobalanaceae	<i>Parinari anamensis</i> (Hance) J. E. Vidal	Thlork	S P
Combretaceae	<i>Terminalia</i> sp.	Chambak kaek	P
Cornaceae	<i>Mastixia pentandra</i> Blume spp. <i>chinensis</i> (Merr.) Matt.	Prolop	P U
Dilleniaceae	<i>Dillenia parviflora</i> Griff. var. <i>parviflora</i>	Phlou	P U
Dipterocarpaceae	<i>Anisoptera costata</i> Pierre	Pha deak	P U
Dipterocarpaceae	<i>Dipterocarpus costatus</i> C.F. Gaertn.	Cheutiel kreu/bang keou	P U
Dipterocarpaceae	<i>Hopea odorata</i> Roxb.	Koki	P U
Dipterocarpaceae	<i>Shorea guiso</i> (Blanco) Blume	Chor chong	P
Dipterocarpaceae	<i>Vatica odorata</i> (Griff.) Symington	Chramas	P
Ebenaceae	<i>Diospyros bejaudii</i> Lecomte	Angkat khmav	S P
Ebenaceae	<i>Diospyros filipendula</i> Pierre ex Lecomte	Ambeng proes	P
Ebenaceae	<i>Diospyros sumatrana</i> Miq.	Chheu phleung	P U
Elaeocarpaceae	<i>Elaeocarpus griffithii</i> Mast.	Chorm nhi	S P
Elaeocarpaceae	<i>Elaeocarpus</i> sp.	Chambokpraeng	S P
Euphorbiaceae	<i>Antidesma montanum</i> Blume var. <i>montanum</i>	Krachak andeuk	P U
Euphorbiaceae	<i>Antidesma cambodianum</i> Gagnep.	Kampung tra-oh	P U
Euphorbiaceae	<i>Aporosa ficifolia</i> Baill.	Kruong	S P
Euphorbiaceae	<i>Baccaurea bracteata</i> Müll.Arg.	Phnieu tuk	S P
Euphorbiaceae	<i>Baccaurea ramiflora</i> Lour.	Phnieu	P
Euphorbiaceae	<i>Cleistanthus tomentosus</i> Hance	Phlov neang	S P
Euphorbiaceae	<i>Croton</i> sp.	Tum poung	P
Euphorbiaceae	<i>Sapium insigne</i> (Royle) Trimen	Chhaves	S P
Fagaceae	<i>Lithocarpus polystachyus</i> Rehder	Kraing	P U
Fabaceae	<i>Sindora siamensis</i> Teijsm. Ex Miq.	Kakoh	P U
Fabaceae	<i>Cassia</i> sp.	Kal	S
Fabaceae	<i>Archidendron clypearia</i> (Jack) I. C. Nielsen ssp. <i>clypearia</i>	Unknown to locals	S P
Guttiferae	<i>Calophyllum spectabile</i> Willd.	Pa ong chorm	S P
Guttiferae	<i>Calophyllum tetrapetalum</i> Roxb.	Pha ong	S P
Guttiferae, Garcineae	<i>Garcinia merguensis</i> Wight	Kreh/Kré/Prous	S P
Guttiferae, Garcineae	<i>Garcinia xanthochymus</i> Hook. f.	Prohout	P
Lauraceae	<i>Cinnamomum cambodianum</i> Lecomte	Teppirou	S P
Lauraceae	<i>Dehaasia cuneata</i> Blume	Atith	P
Lauraceae	<i>Litsea</i> sp. 1	Kong kang	S P
Lauraceae	<i>Litsea</i> sp. 2	Bompong prohok	S
Lecythidaceae sp.		Unknown to locals	P
Lentibulariaceae	<i>Utricularia aurea</i> Lour.	Sarai	S
Loganiaceae	<i>Fagraea racemosa</i> Jack	Changka trong	S P
Malvaceae sp.		Kabasprei	P
Melastomataceae	<i>Melastoma villosum</i> Aubl.	Baynhinh chhmoll	S P
Melastomataceae	<i>Memecylon umbellatum</i> Gaertn.	Phlorng	S P
Melastomataceae	<i>Pternandra caerulescens</i> Jack	Changkat prak	S
Meliaceae	<i>Aglaiia</i> sp.	Bang keou	P
Meliaceae	<i>Aphanamixis polystachya</i> (Wall.) R. Parker	Bang keou	P
Meliaceae	<i>Chisocheton cumingianus</i> Harms	Bang keou sva	S
Meliaceae	<i>Sandoricum indicum</i> Cav.	Kamping reach	P
Moraceae	<i>Ficus fistulosa</i> Reinw. ex Blume	Lovea tuk	P U
Moraceae	<i>Ficus pumila</i> L.	Kro bei tros (troh)	S P
Moraceae	<i>Ficus rumphii</i> Blume	Chrey	S P
Moraceae	<i>Ficus</i> sp.	Chorm	S
Myristicaceae	<i>Myristica iners</i> Blume	Kouk	S P
Myrtaceae	<i>Eugenia albiflora</i> Duthie ex Kurz	Pring chorm/ Pring phle thom	S
Myrtaceae	<i>Eugenia cinerea</i> Kurz	Pring muoyroy srotab	S P
Myrtaceae	<i>Eugenia grata</i> Wight	Smach tuk/Smach kraham	S P
Myrtaceae	<i>Eugenia syzygioides</i> (Miq.) M. R. Hend.	Pring angkam	S P
Najadaceae	<i>Najas indica</i> Cham.	Sarai	S
Nepenthaceae	<i>Nepenthes thorelii</i> Lecomte	Bamong sromoch	S
Oleandraceae	<i>Nephrolepis cordifolia</i> (L.) C. Presl	Thnaing cheum	S
Polygalaceae	<i>Xanthophyllum virens</i> Roxb.	Prich	S
Rhizophoraceae	<i>Carallia brachiata</i> Merr.	Tromeng	S
Rutaceae	<i>Acronychia pedunculata</i> Miq.	Kromol	S P U

Table 3 (Continued)

Family	Species	Vernacular name	Habitat
Sapindaceae	<i>Mischocarpus sundaicus</i> Blume	Sandek	S P U
Sapindaceae	<i>Xerospermum noronhianum</i> Blume	Mean prey	S P
Simaroubaceae	<i>Brucea amarissima</i> Desv. ex Gomes	Roliey smorong	S P U
Simaroubaceae	<i>Irvingia malayana</i> Oliver ex A.Benn.	Chambak	P U
Simaroubaceae	<i>Simaroubaceae</i> sp.	Antungsor	S
Sterculiaceae	<i>Heritiera javanica</i> (Blume) Kosterm.	Don chem	P
Sterculiaceae	<i>Macaranga triloba</i> Müll. Arg.	Pang/Pang tuk	S
Sterculiaceae	<i>Sterculia gilva</i> Miq.	Samrong chorm	S
Tilliaceae	<i>Grewia asiatica</i> Wall.	Poplea prous	P
Tilliaceae sp.		Unknown to locals	S
Verbenaceae	<i>Vitex glabrata</i> R. Br.	Popoul tuk	S P
Unidentified	mid-story tree, rare in swamp	Romeat	S
Unidentified	mid-story tree	Sroka trokuot	S P
Unidentified	mid-story tree, fairly common in swamp	Ta lei	S
Unidentified	large tree, to 50 m tall, buttress roots, rare	unknown to locals	S
Monocotyledons			
Agavaceae	<i>Dracaena gracilis</i> Wall.	Tbal dek	P
Cyperaceae	<i>Hypolythrum nemorum</i> (Vahl) Spreng.	Traset	S
Cyperaceae	<i>Mapania macrocephala</i> K. Schum. ex Warb	Traset cheum	S
Orchidaceae	<i>Bulbophyllum</i> sect. <i>sestoshilos</i> (Breda) Bth & Hk. f.	n.a.	P
Palmae	<i>Areca triandra</i> Roxb.	Sla chanab (janah)	S
Palmae	<i>Calamus palustris</i> Griff.	Phdau chvaing	S P
Palmae	<i>Calamus tetradactylus</i> Hance	Phdau sung	S P
Palmae	<i>Caryota urens</i> L.	Tunsàè	P
Palmae	<i>Daemonorops jenkinsianus</i> Mart.	Phdau som	S P
Palmae	<i>Licuala spinosa</i> Thunb.	Pha-ao	S
Palmae	<i>Livistona saribus</i> Merr. ex A. Chev.	Chrè (Triek)	S
Zingiberaceae	<i>Amomum</i> sp.	n.a.	P
Gymnosperms			
Gnetaceae	<i>Gnetum montanum</i> Markgr.	Khlot	S
Pteridophytes			
Blechnaceae	<i>Stenochlaena palustris</i> (Burm) Bedd.	Voa phruok	S
Dicksoniaceae	<i>Cibotium barometz</i> (L.) J. Sm.	Promoy damrey	S

Anker is thanked for her illustration. Please note that copyright is reserved to the photos in Fig. 2–5.

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