Phytosociology of the Terrestrial Vegetation along the Coasts of the Peninsular Thailand

Chukiat Laongpol

A Thesis Submitted in Fulfillment of the Requirements
for the Degree of Doctor of Philosophy in Biology
Prince of Songkla University
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ชื่อวิทยานิพนธ์ การศึกษาสังคมพืชบนบกตามแนวชายฝั่งคาบสมุทรไทย
ผู้เขียน นายชูเกียรติ ละอองผล
สาขาวิชา ชีววิทยา
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บทคัดย่อ

ศึกษาสังคมพืชตามธรรมชาติตลอดแนวชายฝั่งของของคาบสมุทรไทย ตั้งแต่เดือนตุลาคม 2549 ถึงเดือนพฤษภาคม 2553 บรรยายลักษณะโครงสร้างสังคมพืชที่พบตามแนวชายฝั่ง ในรูปขององค์ประกอบของพรรณไม้ และภาพตัดขวางของสังคมพืชชายฝั่ง และจากการวิเคราะห์ สังคมพืชตามวิธีของ Zürich-Montpellier School (Braun-Blanquet method) แบ่งสังคมพืช ออก ได้เป็น 28 สังคมย่อย ประกอบด้วย 21 สังคมพืช (community) และ 7 สังคมพืชย่อย ซึ่งจัดกลุ่มสังคมพืชดังกล่าวได้เป็น 3 กลุ่ม คือ สังคมพืชทุ่งหญ้าชายฝั่ง (Coastal Grassland Vegetation) สังคมพืชไม้พุ่มชายฝั่ง (Coastal Scrub Vegetation) และสังคมพืชไม้ยืนต้นชายฝั่ง (Coastal Woodland Vegetation) จากการวิเคราะห์ดินจัดอยู่ในชุดดิน "Arenosol" เนื่องจากดินมีอัตราการผุพังอยู่กับที่สูงและมีความอุดมสมบูรณ์ต่ำ การดำรงอยู่ของพืชจึงอยู่ในระบบหมุนเวียนแร่ธาติแบบปิด (closed nutrient cycle) โดยไม่มีความสัมพันธ์ที่ชัดเจนกับคุณสมบัติทางกายภาพและตุณสมบัติทางเคมีของดิน นอกจากกับโซเดียมไอออน (Na^+) และคลอไรด์ไอออน (Cl^-) จากการวิเคราะห์ด้วยวิธี DCA analysis สังคมพืชแบ่งออกเป็น 3 กลุ่ม สอดคล้องกับธรณีสัณฐาน (landforms) ต่างๆ ได้แก่ สังคมพืชที่อยู่บนธรณีสัณฐานเนินทรายที่เกิดจากอิทธิพลของลม (Eolian Landform) สังคมพืชบนธรณีสัณฐานชายหาดในบริเวณที่เป็นอ่าว และสังคมพืชบนธรณีสัณฐานสันทรายชายฝั่งที่อยู่ด้านในแผ่นดิน และจากการวิเคราะห์ด้วยวิธี CCA analysis สนับสนุนรูปแบบการกระจายของชนิดพันธุ์พืช ซึ่งมีส่วนสัมพันธ์กับปริมาณโซเดียมไอออน และคลอไรด์ไอออนในดิน ซึ่งชี้ให้เห็นว่า ละอองน้ำเค็ม (salt spray) ที่พัดมากับลมทะเล อาจมีอิทธิพลกับการกระจายของชนิดพันธุ์ และ/หรือ ในทางกลับกัน

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ABSTRACT

A vegetation study along the coasts of peninsular Thailand was conducted from October 2006 to May 2010. Thirteen sites were selected. The study documented all the natural vegetation on sandy habitats by describing them in terms of species composition as well as their profiles. A phytosociological classification of the coastal forest vegetation was done according to the Braun-Blanquet method (Zürich-Montpellier School). The plant communities could be classified into twenty-eight community i.e. twenty-one community and seven sub-communities, which could be grouped into three main categories: 1) Coastal Grassland Vegetation; 2). Coastal Scrub Vegetation; 3) Coastal Woodland Vegetation. All soils fall into the Arenosol category according to FAO. Due to high weathering rates and consequently a poor nutrient supply from the partly Hyperalbic Arenosols, vegetation relies on a closed nutrient cycle. No clear relation to physical or chemical soil properties, except to extractable Na^+ and Cl^-, could be found. The DCA analyses of some selected parameters separates the sites into three groups according to the land forms i.e. the sand dune site (the Eolian Landform), the gulf sandy beach site and the inland sandbar site. The CCA analyses support these distribution patterns of sites which correlates with concentrations of Na^+ and Cl^- in the soil. That indicates that sea salt spray may have some impact on the distribution of plant species on sand bars/ dunes along the coasts and/or vise versa.

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Chukiat Laongpol

September, 2010

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CHAPTER 1
INTRODUCTION

The peninsular Thailand lies in the northern part of the Malay Peninsula, as the whole peninsular Thailand and Malaysia extends down from the Kra Isthmus in Thailand to Malaysia. The Thai part of the peninsula, bordered by the Thai gulf (Pacific Ocean) on the east and Andaman Sea (Indian Ocean) on the west, is subdivided into three topographic regions: the mountain ranges; the Gulf coastal plain and the Andaman coastal plain. There are three mountain ranges in peninsular Thailand: the Phuket, the Nakhon Si Thammarat and the Sankala Khiri ranges. There is also a wide coastal plain, stretched along the east coast of the peninsula, which is a shoreline of emergence. The sediments deposited along this shoreline, produced many sandbars and offshore bars (Pongsaputra, 1991). On the other hand, the Andaman coast, on the west side, is a shoreline of submergence. Most of the coastal plain on this west coast is narrow, flanked by steep slopes. Besides, there are few rivers, running across the Gulf coastal plain and many short rivers/streams across the Andaman coastal plain. From these varieties of unique topographic features, there are various plant communities/vegetation that could develop in such habitats. However, among the various plant communities/vegetation in the various habitats in the Peninsular Thailand, the terrestrial vegetation, developed on the sandy soil/ sandbars, is one of the most interesting communities in terms of flora and physiognomy. In any case, it is such a pity that very limited information had been achieved from such vegetation comparing with other types of vegetation, i.e. mangrove, peat swamp, moist-evergreen forests etc. as there is not much economic value in terms of woods, though many rare and valuable woody tree species are also common in such habitat. Nonetheless, it is of importance in terms of biodiversity and plant genetic resource conservation. It is to be concerned here also that most of the natural (original?) terrestrial vegetation on the sandy soil/sandbars along the coasts on both sides of the Peninsula has been depleted by human activities. Agriculture and land development for various purposes are the major causes for those destructions. Unfortunately that most of the areas, where this vegetation occurs, have not been included in the reserved

areas, i.e. National Park; Wildlife Sanctuary etc. Only very few patches of them are included in some National parks. Therefore, most of the natural vegetation on these sandy soil/sandbars/sand-dune/ beach along the coast is left as isolated patches (small or large). Nevertheless, these left patches are very essential as they represent the former continuing areas of the former vegetation. They are also the most important sources of genetic diversity of the plants in that vegetation of this kind which is going to be soon disappeared from their natural habitats forever. The real ecological value of this interesting kind of vegetation has been neither put in account nor studied systematically so far.

OBJECTIVE

1. To account all the remnant patches of the terrestrial vegetation in terms of phytosociology.
2. To gain information on structure and distribution of the relics of natural terrestrial vegetation along the coasts on both sides of the Peninsular Thailand.
3. To classify vegetation sites and their relating to some aspects of the physical environment.

LITERATURE REVIEW

Former studies of the terrestrial coastal vegetation in Thailand have focused only on the sandy beach, close to the seashore. Some of those areas are parts of the coastal sandbars (those closest to the sea), which were previously created by sea currents. However, there have been very few studies describing the vegetation and flora of those coastal sandbars from more stable sites slightly inland in the peninsula. The following works have considered some aspects of the terrestrial coastal vegetation on the main-land and island in Thailand.

Maxwell (1974) investigated the vascular flora of Satta-hip, Chon Buri province. Five hundred and fifty-eight species of vascular plants in one hundred and twelve familes were recorded, of which, three species were regared as new records to Thailand. The vegetation was divided into seven primary and three secondary floristic zones.

Smitinand (1977) surveyed the vegetation of the Surin islands, Ranong province. The vegetation was classified into four types. The (coastal) beach forest was mentioned as one of the four types, and this study included a list of the plants found.

Congdon (1982) studied the vegetation of Tarutao Nationnal Park, Satun province. Ten vegetation types including the coastal heath forest were enumerated together with a vegetation map of the island. Eight hundred and sixty nine species including the coastal elements were recorded.

Santisuk (1999) studied the littoral vegetation on sa-mae-san and surrounding island, Chon buri province. The vegetation was divided into five types, with photographs and short descriptions of the plant species found.

Chamchumroon (2001) investigated the flora of beach forest in Koh Lanta and Koh Rok, Koh Lanta National Park, Krabi province. Sixty-eight plant species in forty families were listed.

Thunthwanich (2001) studied the vegetation and environmental gradients across the beach forest in Sirinath National park, Phuket province. The beach vegetation was divided into four zones. One hundred and four species in fifty-two families of vascular plant were recorded.

Sridith (2002) surveyed the vegetation on the coastal sandbars in Songkhla province. Ninety-eight species of vascular plants were recorded. Vegetation profiles were developed for the study plots at Ban Ta-ling Chan, Chana district.

Sridith and Laongpol (2003) studied some natural plant communities of the sandbars along eastern coast of peninsular Thailand in three provinces: Nakhon Si Thammarat, Songkhla and Narathiwat. Nine plant communities had been defined together with species list in each study site and rough comments of status of plant communities.

Laongpol, Suzuki and Sridith (2005) had enumerated the plant species on sandbars along the coast of Narathiwat province. One hundred and fifty-eight

species were recorded. The occurrence and abundance of plant species in the study sites were discussed.

Suzuki, Laongpol and Sridith (2005) studied vegetation of coastal dunes at Narathiwat province. Three types of vegetation had been classified and the profiles of the natural vegetation gradient across the sandbars had also been presented.

Hayasaka and Fujiwara (2005) explored species composition and environment factors, including human impacts on coastal sand dunes and maritime strand-forests in southern Thailand. Most of the general coastal species use thalassochory (seed dispersal by sea currents) and are distributed from tropical to subtropical regions, including Okinawa islands of Japan.

Laongpol *et al.* (2009) studied plant community structure of the coastal vegetation of peninsular Thailand. The coastal vegetation on the sandy ground could be divided into two groups, i.e., the vegetation on the sandbar, due to the sedimentation from sea current and the vegetation on the sandbar, due to the wind. The profiles of the actual and expected natural vegetation on the sandbars and sand dunes along the sandy coast were proposed.

CHAPTER 2
MATERIAL AND METHODS

STUDY AREA

The peninsular Thailand lies in the northern part of the Malay peninsula which extends down from Kra Isthmus at about latitude of 10 N. to Malaysia which comprises 14 provinces of southern Thailand. The total area is 70,705 km^2 approximately.

The study areas, confined to the patches of the natural vegetation on the coastal sandy beaches/dunes/bars along the length of both the east coast of the peninsula which comprise four provinces, i.e. Chumphon, Surat Thani, Nakhon Si Thammarat and Songkhla. Furthurmore the west coast of the peninsula which comprises six provinces namely Ranong, Phangnga, Phuket, Krabi, Trang and Satun. (Figure 1).

Climate

The climate of the area is equatorial monsoon (Am) climate according to Köppen-Geiger classification of climate regions (Kottek *et. al.*, 2006). They defined this climate type through the mean temperature between 22-35 °C, The region is under the influence of the southwest and northwest monsoons, which create two distinct seasons, wet and dry. The average annual rainfall is normally above 2,000 mm per year.

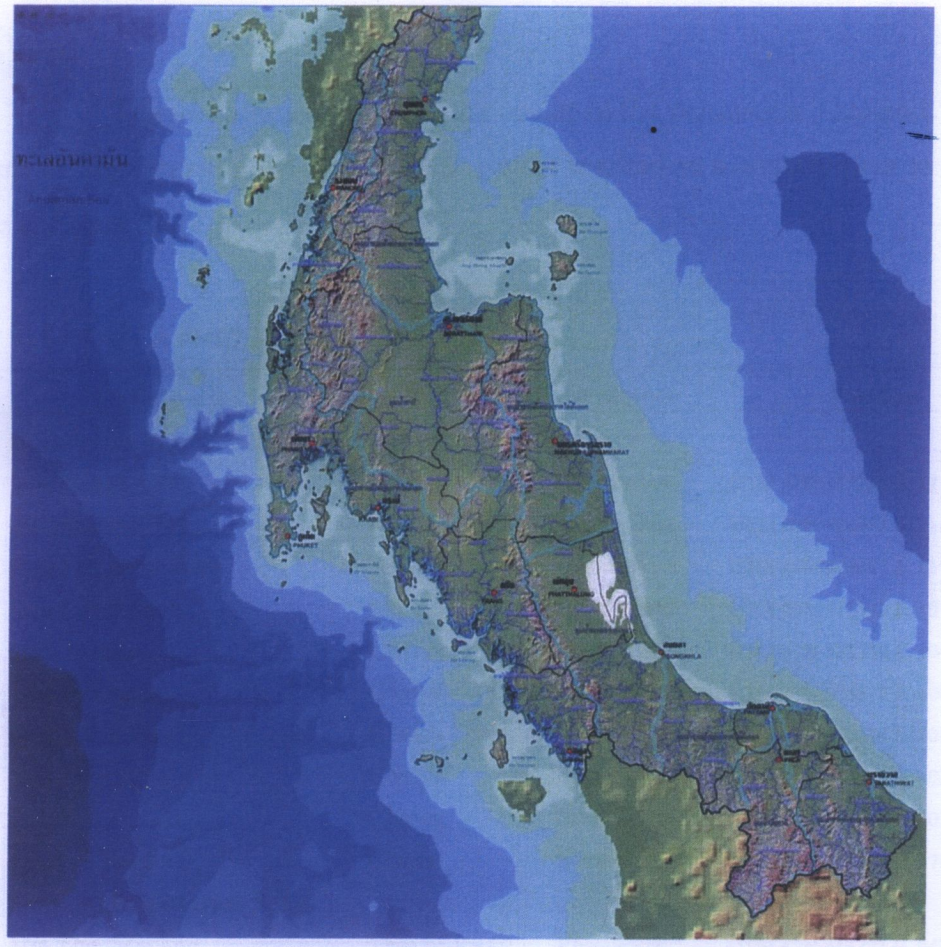


Figure 1. Topographic map of peninsular Thailand.

Study sites

Thirteen study sites along the coasts of the peninsular Thailand, both on the Gulf of Thailand and the Andaman Sea were marked as the study sites as follows (Table 1, Figure 2).

Table 1. List of 13 study sites.

No.	Study sites	District	Province	Position
	Sites on the gulf of Thailand			
1	Ban Bangboet	Pathio	Chumphon	UTM 47N 553235 E, 1213774 N
2	Ao Phanang Tak	Mueang	Chumphon	UTM 47N 526443 E, 1161688 N
3	Ban Pak Nam Tako	Thung Tako	Chumphon	UTM 47N 514587 E, 1116976 N
4	Ban Laem Santi	Lamae	Chumphon	UTM 47N 515385 E, 1077929 N
5	Ban Takrop	Chaiya	Surat Thani	UTM 47N 528536 E, 1044394 N
6	Ban Plongmai	Chaiya	Surat Thani	UTM 47N 528877 E, 1043970 N
7	Ban Laem Pho 1	Chaiya	Surat Thani	UTM 47N 530370 E, 1038346 N
8	Ban Laem Pho 2	Chaiya	Surat Thani	UTM 47N 530396 E, 1037905 N
9	Ban Nuea	Chaiya	Surat Thani	UTM 47N 528815 E, 1036563 N
10	Ban Na Thap	Chana	Songkhla	UTM 47N 685627 E, 779003 N
	Sites on the Andaman Sea			
11	Hat Thai Mueang	Thai Mueang	Phangnga	UTM 47N 413271 E, 943898 N
12	Hat Thung Thale	Koh Lanta	Krabi	UTM 47N 504874 E, 855453 N
13	Hat Yong Ling	Sikao	Trang	UTM 47N 540944 E, 812158 N

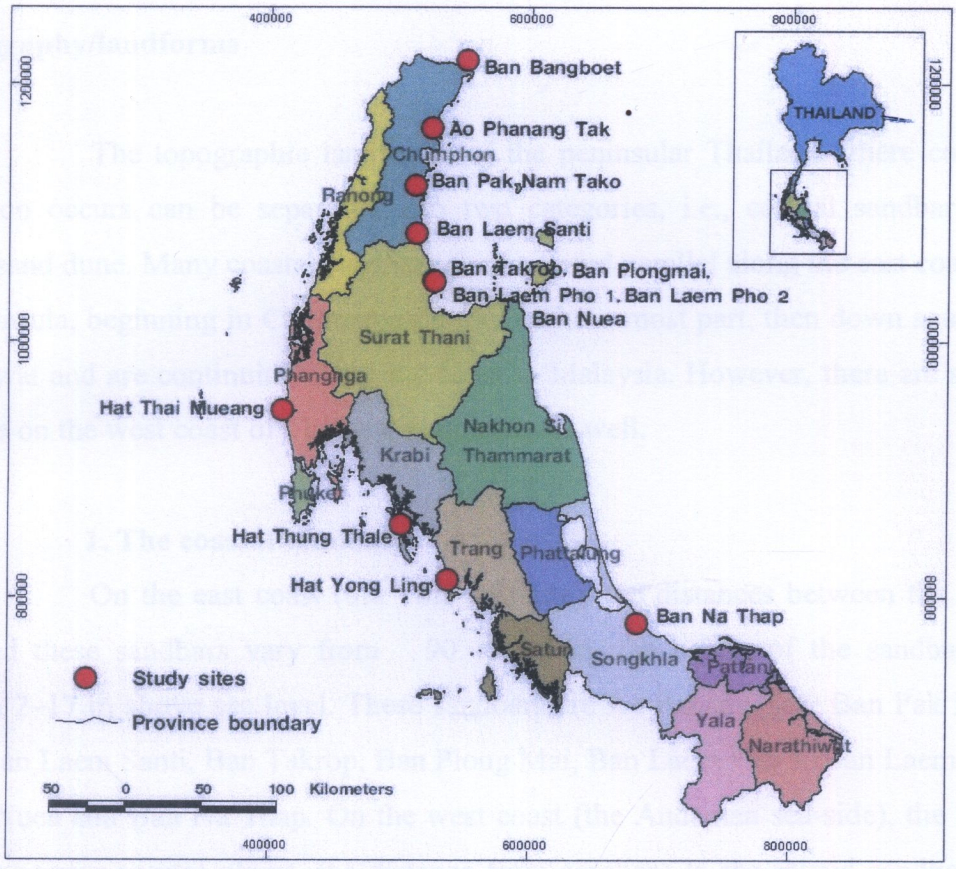


Figure 2. Map of peninsular Thailand showing the 13 study sites.

Physiography/landforms

The topographic landforms of the peninsular Thailand where coastal vegetation occurs can be separated into two categories, i.e., coastal sandbar and coastal sand dune. Many coastal sandbars can be found parallel along the east coast of the peninsula, beginning in Chumphon on the northern-most part, then down south to Narathiwat and are continuing along the coast to Malaysia. However, there are some sandbars on the west coast of Thailand peninsular as well.

1. The coastal sandbars

On the east coast (the Thai gulf-site), the distances between the tidal zone and these sandbars vary from 90 –3000 m, the height of the sandbars is between 2–17 m above sea level. These sandbars are Ao Panang Tak, Ban Pak Nam Tako, Ban Laem Santi, Ban Takrop, Ban Plong Mai, Ban Laem Pho 1, Ban Laem Pho 2, Ban Nuea and Ban Na Thap. On the west coast (the Andaman sea-side), the sand bars are narrow coastal plains, the distance from seashore to the inland sandbars is about 600 – 2000 m. These sandbars are Hat Thai Mueang, Hat Thung Thale and Hat Yong Ling (Table 2, Figure 3, 4).

2. The coastal sand dunes

There is only one site with coastal sand dunes in Peninsular Thailand at Ban Bangboet, Pathio district in the Chumphon province. The Bangboet sand dunes lie on the seashore, just next to the tidal zone. The site is situated right in the northern most part of peninsular Thailand. The sand dune complex is composed of many sand dunes of different sizes. Each is composed of wind-blown sand particles. The dunes vary from few meters to half a kilometer across and 10-30 m high. The highest one is 33 m (Table 2, Figure 5, 6).

Table 2. The geography of the study sites.

Study sites	District	Province	Distance from the sea (m)	Elevation (m)
Sites on the gulf of Thailand				
Ban Bangboet	Pathio	Chumphon	600	20-33
Ao Phanang Tak	Mueang	Chumphon	90	2
Ban Pak Nam Tako	Thung Tako	Chumphon	1,600	2
Ban Laem Santi	Lamae	Chumphon	600	8
Ban Takrop	Chaiya	Surat Thani	300	13
Ban Plongmai	Chaiya	Surat Thani	400	12
Ban Laem Pho 1	Chaiya	Surat Thani	400	12
Ban Laem Pho 2	Chaiya	Surat Thani	200	12
Ban Nuea	Chaiya	Surat Thani	600	12
Ban Na Thap	Chana	Songkhla	3,000	17
Sites on the Andaman Sea				
Hat Thai Mueang	Thai Mueang	Phangnga	600	4
Hat Thung Thale	Ko Lanta	Krabi	2,000	2
Hat Yong Ling	Sikao	Trang	600	2

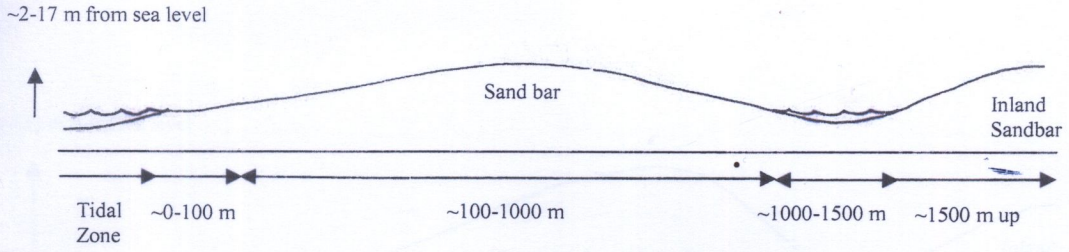


Figure 3. General diagram of coastal sandbar landform of peninsular Thailand.

Figure 4. The coastal sandbar landform at Hat Thai Mueang, Thai Mueang district, Phangnga province.

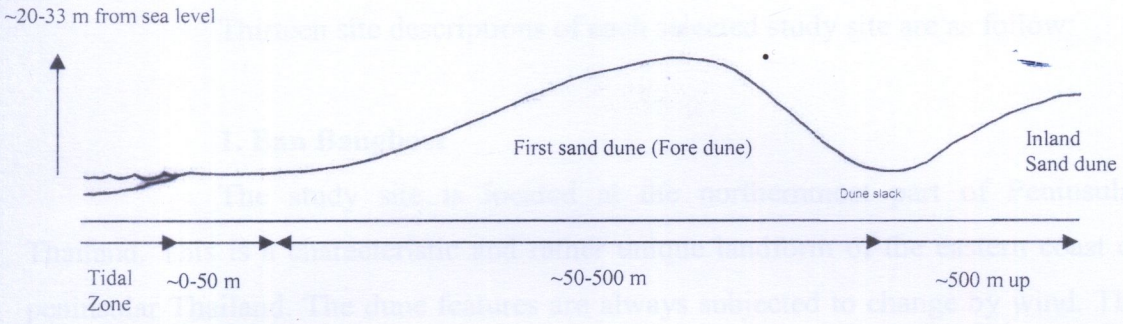


Figure 5. General diagram of coastal sand dune landform of peninsular Thailand.

Figure 6. The coastal sand dune landform at Ban Bangboet, Pathio district, Chumphon province.

Site descriptions

Thirteen site descriptions of each selected study site are as follow:

1. Ban Bangboet

The study site is located at the northernmost part of Peninsular Thailand. This is a characteristic and rather unique landform of the eastern coast of peninsular Thailand. The dune features are always subjected to change by wind. The wind is building up the continuing sand dune complex which is about 500 m in length, parallel along the coast, 200 m across and about 20-33 m high. In given places, the natural vegetation has developed. The vegetation is composed of coastal dune grassland and coastal dune scrub. In the coastal dune scrub, there is litter on the surface soil about 2-3 cm deep. The area is exposed to the sunlight, and the site is quite dry. This area is used for recreation and less disturbed (Table 3).

2. Ao Panang Tak

The study site is located on the sandy beach next to the tidal zone. There is coastal vegetation which consists of the coastal grassland, the coastal scrub and the coastal woodland vegetation. All occur in a narrow strip next to each other, beginning from the tidal zone with grassland, scrub and woodland respectively. The woodland is secondary and has more litter than any other sites. Its litter depth is about 6-8 cm with some epiphytic species found right on the ground litter. The area is highly disturbed. The local inhabitants/others have been transplanting many big trees for ornamental purpose and using the land for many purposes, e.g., recreation, construction and cattle etc. (Table 3).

3. Ban Pak Nam Tako

This study site is located on the inland sandbar, 1.6 km far from the tidal zone and rather close to the nearby swampy area (*Melaleuca cajuputi* community and other secondary peat swamp forests). The vegetation found is a secondary one. Some epiphytes in the vegetation could be seen. And a litter layer is about 2-3 cm deep. The site is rather wind exposed, so some effects from wind on the vegetation might be expected here. The inhabitants have been using the shrubby trees in the

vegetation for fuel wood. The surrounding areas were disturbed for oil palm plantation (Table 3).

4. Ban Laem Santi

This study site is located on a large area of a coastal sandbar, about 580 m far from the sea. The vegetation is composed of secondary woodland which has a thin litter layer on the ground surface, about 3-4 cm deep. Many epiphytes could be found in the vegetation. Most tall trees and shrubs have been cut for fuel wood and charcoal production and the surrounding area was disturbed for construction and agricultural purposes, e.g., oil palm plantation, etc. (Table 3).

5. Ban Takrop

This site is located on the fore dune next to the sea (the first dune). There is the secondary woodland vegetation on this dune, which has a litter layer on the ground surface about 8-9 cm deep. There should be some impact from wind on this vegetation. The inhabitants use big trees for fuel wood, charcoal and have been using the land for housing (Table 3).

6. Ban Plongmai

This study site is located on the fore dune which is close to the swampy areas (*Melaleuca cajuputi* community and mangrove forest). There is the secondary forest which has a litter layer on ground surface, about 8-9 cm deep. Many epiphytes are seen in the vegetation. The local people use big trees for construction timber and charcoal making and use the land for housing (Table 3).

7. Ban Laem Pho 1

This study site is located at the fore dune close to the swampy area (*Melaleuca cajuputi* community). It is a sandy dry habitat. There is litter layer about 4 cm deep with few epiphyte species found on the ground floor. Most tall trees and shrubs have been cut for woods and charcoals and the surrounding area was disturbed for communities setting and agricultural purpose such as oil palm plantation (Table 3).

8. Ban Laem Pho 2

This study site is located on the fore dune. This is a dry habitat close to the swamp areas (*Melaleuca cajuputi* community). There is secondary woodland vegetation which has a litter at ground surface about 5 cm deep. Few epiphytes may be found in the vegetation of this site. Most tall trees and shrubs have been cut for fuel woods and construction timber (Table 3).

9. Ban Nuea

This study site is located at the inland sandbar. This is a dry habitat close to the swampy areas (*Melaleuca cajuputi* community and mangrove forest). There is the secondary forest which has a litter layer on the ground surface about 5 cm deep. This area has been disturbed by local people for a long time. Most tall trees and shrubs have been cut for woods and charcoals. The surrounding area was disturbed for construction and agricultural purposes, e.g., as oil palm plantation (Table 3).

10. Ban Na Thap

The study site is located on the inland sandbar, 3.1 km far from the sea. There is a remnant patch of fragmentary natural forest which is composed mainly of dipterocarps. There is an 8 cm thick litter layer (leaf litter) on the ground surface and a thick fibrous root system near the soil surface. Many epiphytes could be found in such vegetation. Though the study site is rather small, it is rather a good remnant patch, however, as it was less disturbed due to the fact that it is located in a local public cemetery (Thai traditional cemetery). The surrounding areas have been strongly influenced by human activities such as oil palm and rubber plantations (Table 3).

11. Hat Thai Mueang

The site is located on the coastal sandbar of the west coast of Peninsular Thailand. The vegetation occurring in this area is more or less natural. The site is rather humid (in the dry season), compared with other sites. There is a thick litter layer about 8-10 cm deep on the ground surface. There are many orchid and bryophyte species on the ground at this site (Table 3).

12. Hat Thung Thale

The study site on the sandy dry habitat of the coastal dune area, located at the inland sand dune 625 m far from the sea. This study site is a narrow-small area of sand dune between a mangrove forest and *Melaleuca cajuputi* community. The litter layer is about 4 centimeters thick. It is a local public cemetery. The surrounding area strongly influenced by human activities such as crop, oil palm plantation and rubber plantation (Table 3).

13. Hat Yong Ling

The study site is located on the inland sand dune about 625 m far from the sea. This study site is a narrow stripe of sand dune between the mangrove forest and the *Melaleuca cajuputi* community. There is litter layer on the ground surface about 4 cm deep. The surrounding areas have been strongly influenced by human activities e.g. crop, oil palm plantation, etc. (Table 3)

Soil

The study was confined to "Arenosols", according to the world reference base for soil resources (2006), Arenosals in the humid tropic are either young soils in coarsely textured alluvial, lacustrine or aeolian deposits, or they are very old soils in residual acid rock weathering that lost all primary minerals other than (coarse grained) quartz in the course of an impressive pedogenetic history. (Food and Agriculture organization of the United Nations (FAO), 2006b.)

Table 3. The selected environmental factors of the study sites.

Study sites	Litter (cm)				Wind exposure	Epiphyte	Disturbance	Land use	
	L	Lv	F	H				study sites	Surrounding area
Sites on the gulf of Thailand									f, u
Ban Bangboet	2	<1	<0.5	-	3	0	2	r	f, u
Ao Panang Tak	3	3-5	<0.5	-	1	2	3	a4, o, u	a2, a4, o, r, u
Ban Pak Nam Tako	2	1	<1	-	2	2	3	w	a1, a2
Ban Laem Santi	3	1	<1	-	1	3	3	w	a1
Ban Takrop	5-6	1	2	-	2	1	3	w	a1, u
Ban Plongmai	5	1	1	-	2	3	3	w	a1, u
Ban Laem Pho 1	3	1	<1	-	3	2	3	w	a1, u
Ban Laem Pho 2	3	1	1	-	3	2	3	w	a1, u
Ban Nuea	5	3-5	<1	-	3	0	3	w, m	a1,a2, a3, c, u
Ban Na Thap	5	2	1	-	1	3	1	c	m
Sites on the Andaman Sea									
Had Thai Mueang	2	1	1	-	2	3	2	f, r	a2, r, u
Hat Tung Thalae	2	1	1	-	3	2	3	f	u
Had Yong Ling	2	1	1	-	3	2	3	f	a2, a4, r

Litter: L = fresh fallen/intact leaf litter, Lv = slightly altered leaves, F = decayed leaves, H = humification layer

Wind exposure: 0 = no, 1 = low, 2 = moderate, 3 = much

Epiphytes: 0 = none, 1 = few, 2 = moderate, 3 = many

Disturbance: 0 = no, 1 = low, 2 = moderate, 3 = high

Land use: a1= oil palm plant plantation, a2 = coconut plantation, a3 = shrimp farm, a4 = cattle, c = cemetery, f = forest or protected area, o = extraction of plants for ornamental purpose, r = recreation, u = communities setting, w = wood cutting, m= others

INVENTORY

Exploring the patches of (more or less) natural terrestrial vegetation along the seashore of the Peninsular Thailand (both Andaman Sea and Gulf of Thailand); marking the places suitable as the research study sites.

Note:The natural vegetation is plant communities which have developed in an area without/less human inference such as farming or land development.

DATA COLLECTING

1. Plant collecting

1.1 Plant specimens were collected at intervals from all study sites for identification.

1.2 Plant collections were made with field notes of selected interesting species and these were correlated with their photographs.

1.3 Specimen processing followed the directions specified in "The Herbarium Handbook" (Bridson and Forman, 1999).

1.4 Voucher specimens were kept at the Herbarium, Department of Biology, Prince of Songkla University, Hat Yai, Songkhla (PSU) and the Forest Herbarium (BKF), Department of National Parks, Wildlife and Plants Conservation, Ministry of Natural Resources, Phaholyothin Rd., Bangkok.

2. Vegetation data collecting

2.1 The vegetation was studied in accordance with the concepts and methods of the Zülich-Montpellier School (Braun-Blanquet, 1964; Miyawaki and Suzuki, 1980)

2.2 Study plots were laid out in the selected study sites. It was determined that each stand selected had to cover a minimum survey space in a habitat which showed homogeneous physiognomy. Thus, the stands were even. All of the species within the stand were checked to make a complete species list by layer. Multistructural communities were divided into two or three layers according to the stands: tree, shrub and herb layers. The Braun-Blanquet method was employed to

determine comprehensively the cover class (cover degree-abundance scale) and sociability of the species in each layer.

The cover degree-abundance scale applied is the one originally proposed by Braun-Blanquet (1964):

5 any number of individuals covering more than 3/4 of the area

4 any number of individuals covering 1/2 to 3/4 of the area

3 any number of individuals covering 1/4 to 1/2 of the area

2 great abundance of individuals or covering at least 1/20 of the area

1 plentiful but of small cover value

\+ sparsely or very sparsely present, covering very small or insignificant area

Another quantitative estimate per species is the sociability rating. The sociability scale used is the one originally proposed by Braun-Blanquet (1964):

5 growing in very extensive patches or covering the sample area in one large population

4 growing in large groups or colonies, forming patchy carpets, fairly extensive

3 growing in small patches, troops, cushions

2 growing in small groups or tufts or clumps

1 growing singly (the foliage of one plant does not touch another)

2.3 Tree species were recorded together with data on position, crown height, crown area and diameter at breast height (dbh) in order to draw profile diagrams of the vegetation.

2.4 Photographs were taken showing the general structure of the study sites.

3. Environmental data collecting

3.1 Soil description was conducted on soil pit according to the FAO Guidelines for Soil Description (FAO, 2006a). The Soil classification follows the World Referance Base for Soil Resources (FAO, 2006b).

3.2 Soil sampling and sample preparation

Soil samples were taken by means of a spade from diagnosed horizons (mineral horizons down to 70 cm depth).

3.3 Water sampling and sample preparation

Water sample were taken from the natural pond of study sites. The samples were transferred into 1.0 L polyethylene bottles.

3.4 The following data were collected: disturbance, wind speed, and land use.

DATA ANALYSIS

1. Flora analysis

1.1 All plant collections were identified as far as possible with the available taxonomic literatures at PSU.

1.2 Specimens with a doubtful identification were compared with named ones from various herbaria (PSU, BKF).

1.3 All voucher specimens have been deposited at PSU and BKF.

2. Vegetation analysis

2.1 Analyses were made according to the concepts and methods of the Zurich-Montpellier School, base on the work of Braun-Blanquet (Braun-Blanquet, 1964; Miyawaki and Suzuki, 1980). The data of releves collected in the field surveys were put together into a raw table. The raw table was then rearranged into a differential table. Finally, the vegetations were classified into communities, considering all the data available.

2.2 Profile diagrams of selected study sites were prepared together with photographs.

3 Environmental analyses

3.1 Soil analysis

Physical and chemical soil analyses

Soil sample have been air dried at PSU and sent to the laboratory of the Institute of Forest Ecology, BOKU for chemical and the Institute of Applied Geology, BOKU for analyses of particle size distribution and mineralogy analyses. The roots were sorted out, the proportions of coarse and fine soil were separated by dry sieving (2 mm) and the mass values of the compartments, as well as the conversion factors for the calculation of the oven dry masses, were determined.

Table 3 and 4 show the parameters analyzed in the individual organic and mineral soil layers and the methods used for analysis. The pH values were principally measured in suspensions of fresh fine soil samples. C_{tot} was analyzed in oven-dry samples. Exchangeable cations as well as the water-extractable anion content in the mineral soil were determined in air-dried samples. For the illustration, all the results were converted to an oven-dry base.

Table 4: Chemical analysis

Parameter	*Extraction and analytical method*	*Standard*
pH-value	suspension in deionised water and 0.01 m $CaCl_2$, electrometrically	Austrian Standard L1083
C, S	Leco S/C 444; $C_{org}=C_{tot} - C_{CaCO3}$	Austrian Standard L1080
N	Microkjeldahl Kjeltec 2300	Austrian Standard L1082
Exchangeable cations	0.1 m $BaCl_2$-extract, Element detection: simultaneous ICP-OES (Perkin Elmer Optima 3000 XL); Calculation of CEC_{eff} on the sum of ion equivalents	Austrian Standard L1086
Water extractable anions	Hot water extract (10 g soil in 100 ml water); analyzed by ion chromatography Dionex DX 100	

Table 5: Distribution of grain size and mineralogical analyses.

Parameter	*Preparation, measurement procedure*
Distribution of grain sizes in fine soil	Wet sieving (> 40 µm), automatic sedimentation analysis (< 40 µm); Sedigraph 5000 ET (Micromeritics) after oxidation of organic components (10 % H_2O_2) and treatment of the sample with ultrasonic (0.5 ‰ Calgon as disperging medium); classification according to Austrian Standard B 4412 (CS: 2000 – 630 µm, MS: 630 – 200 µm, FS: 200 – 63 µm, CSi: 63 – 20 µm, MSi: 20 – 6.3 µm, FSi: 6.3 – 2 µm, CC: 2 – 0.63 µm, MC: 0.63 – 0.2 µm, FC: < 0.2 µm); due to the low fine silt and clay content in the most samples the sieving procedure was stopped at 20 µm
Total mineral content	X-ray diffraction device (Philips PW 1710, Bragg Brentano geometry, Cu K α radiation, 45 kV, 40 mA); 1° 2 Theta - 70° 2 Theta Identification & semiquant. mineral determination)

3.2 Water analysis

The water samples were sent to the Central analytical center, Faculty of Natural Resources, Prince of Songkla University. The electrical conductivity (EC) was measured using a microprocessor conductivity meter and pH with microprocessor meter (Laorngsiriwong, 2007).

4. Statistic analysis

4.1 Vegetation-Environmental factors relationship

Detrended correspondence analysis (DCA) was applied to analyse the variation of species composition among study sites, and Canonical correspondence analysis (CCA) (Jongman *et al.*, 1997) was applied to study the relationship between vegetation and soil properties. Both analyses were undertaken using the program package PC-ORD for Windows–version 5.19 (McCune and Mefford, 2006).

CHAPTER 3
PLANT COMMUNITY STRUCTURE

RESULTS

Floristic study

The study and collection of vascular plants on sandbars along the coasts of the peninsular Thailand was undertaken from October 2006 to May 2008. Two hundred and seventeen species of vascular plants were recorded belonging to eighty-one families and one hundred and eighty-one genera. It is included 159 species of dicots, 40 species of monocots and 18 species of non-flowering plants (Table 6-8).

Table 6. List of dicotyledonous species on sandbars along the coast of the peninsular Thailand.

Family	Species	Vernacular	Habit
Acanthaceae	*Thunbergia fragrans* Roxb.	Hu pakka	C
Aizoaceae	*Sesuvium portulacastrum* (L.) L.	Phak bia thale	H
Amaranthaceae	*Gomphrena celosioides* Mart.	Ban mai ru roi pa	H
Anarcadiaceae	*Lannea coromendelica* (Houtt.) Merr.	Kuk	ST
	Mangifera indica L.	Mamuang	T
Ancistrocladaceae	*Ancistrocladus tectorius* (Lour.) Merr.	Lin kwang	C
Annonaceae	*Polyalthia evecta* (Pierre) Finet & Gagnep.	Nom noi	S
Apocynaceae	*Aganosma marginata* (Roxb.) G.Don	Mok khruea	C
	Alyxia reinwardtii Blume	Chalut	C
	Cerbera manghas L.	Tin pet sai	ST
	Cerbera odollam Gaertn.	Tin pet thale	C
	Holarrhena curtisii King & Gamble	Phut thung	ST
	Ichnocarpus frutescens (L.) W.T.Aiton	Khruea pla song daeng	S
	Spirolobium cambodianum Baill.	Phetchahueng takkat	S
	Willughbeia coriacea Wall.	Khui	C
Aquifoliaceae	*Ilex cymosa* Blume	Sai khi tai	ST
Asclepiadaceae	*Dischidia major* (Vahl.) Merr.	Chuk rohini	CrH
	Hoya diversifolia Blume	Lin khwai	C
	Hoya parasitica (Roxb.) Wall. ex Traill	Nom phi chit	C

Table 6. (continued)

Family	Species	Vernacular	Habit
Asclepiadaceae	*Streptocaulon juventas* (Lour.) Merr.	Thao prasong	C
Caryophyllaceae	*Polycarpaea corymbosa* (L.) Lam.	Soi thong sai	H
Celastraceae	*Euonymus cochinchinensis* Pierre	Kra chap nok	ST
	Pleurostylia opposita (Wall.) Alston	Daeng hin	ST
	Salacia chinensis L.	Kam phaeng chet chan	S
Combretaceae	*Terminalia catappa* L.	Hu kwang	T
Connaraceae	*Connarus semidecandrus* Jack	Thopthaep khruea	C
Convolvulaceae	*Argyreia mollis* (Burm.f.) Choisy	Khruea phu ngoen	HC
	Ipomoea imperati (Vahl) Griseb	Phak bung thale khao	CrH
	Ipomoea pes-caprae (L.) R.Br.	Phak bung thale	CrH
	Merremia hirta (L.) Merr.	Chingcho nuan	HC
Cucurbitaceae	*Scopellaria marginata* (Blume) W.J. de Wilde & Duyfjes	-	C
Dilleniaceae	*Tetracera indica* (Christm. & Panz.) Merr.	Thao ora khon	C
	Tetracera loureiri (Finet & Gagnep.) Pierre ex Craib	Rot su khon	C
Dipterocarpaceae	*Anisoptera costata* Korth.	Krabak	T
	Cotylelobium lanceolatum Craib	Khiam	T
	Dipterocarpus alatus Roxb. ex G.Don	Yang na	T
	Dipterocarpus chartaceus Symington	Yang wat	T
	Dipterocarpus obtusifoius Teijsm.ex Miq.	Hiang	T
	Hopea odorata Roxb.	Ta khian thong	T
	Shorea roxburghii G.Don	Phayom	T
	Vatica harmandiana Pierre	Sadao pak	T
Ebenaceae	*Diospyros areolata* King & Gamble	Ma phlap	ST
	Diospyros ferrea (Willd.) Bakh.	Lambit	S
Elaeocarpaceae	*Elaeocarpus robustus* Roxb.	Sathon rok	T
Epacridaceae	*Styphelia malayana* (Jack) Spring	Khet takhap	S
Ericaceae	*Vaccinium bracteatum* Thunb.	Thing thuat	S
Erythroxylaceae	*Erythroxylum cuneatum* (Miq.) Kurz	Krai thong	S
Euphorbiaceae	*Antidesma ghaesembilla* Gaertn.	Mao khai pla	S
	Aporosa sp.	-	S
	Breynia racemosa (Blume) Mull.Arg.	Kang pla	S
	Breynia glauca Craib	Ra ngap phit	S

Table 6. (continued)

Family	Species	Vernacular	Habit
Euphorbiaceae	*Chaetocarpus castanocarpus* (Roxb.) Thwaites	Samphao	ST
	Cleistanthus sp.	-	S
	Euphorbia atoto G. Forst.	Nam nom ratchasi thale	H
	Glochidion rubrum Blume	Kradum phi	S
	Hymenocardia wallichii Tul.	Faep nam	S
	Microstachys chamaelea (L.) Müll. Arg.	Soi nok	S
	Phyllanthus oxyphyllus Miq.	Yai chung lan	S
	Shirakiopsis indica (Willd.) Esser	Samo thale	ST
	Suregada multiflorum (A.Juss.) Baill.	Khan thong phayabat	S
Flacourtiaceae	*Casearia grewiifolia* Vent.	Kruai pa	ST
	Flacourtia indica (Burm.f.) Merr.	Ta khop pa	S
	Scolopia macrophylla (Wight & Arn.) Clos	Ta khop pa	ST
Gentianaceae	*Fagraea fragrans* Roxb.	Kan krao	T
Gesneriaceae	*Aeschynanthus fulgens* Wall. ex R.Br.	-	H
Goodeniaceae	*Scaevola taccada* (Gaertn.) Roxb.	Rak thale	S
Guttiferae	*Calophyllum inophyllum* L.	Kra thing	T
	Calophyllum pulcherrimum Wall.	Tanghon	T
	Cratoxylum cochinchinense (Lour.) Blume	Tio kliang	ST
	Garcinia cowa Roxb. ex DC.	Cha muang	ST
	Garcinia hombroniana Pierre	Wa	T
Labiatae	*Clerodendrum inerme* (L.) Gaertn.	Sam ma nga	S
	Leucas zeylanica (L.) R.Br.	Ya prik	H
	Platostoma cochinchinense (Lour.) A.J.Paton	Hang suea	H
	Premna obtusifolia R. Br.	Cha lueat	C
	Vitex pinnata L.	Tin nok	ST
	Vitex rotundifolia L.f.	Khon thi so thale	CrS
Lauraceae	*Cassytha filiformis* L.	Sangwan phra in	C
	Neolitsea zeylanica (Nees) Merr.	Ian	ST
	Litsea glutinosa (Lour.) C.B.Rob	Mi men	ST
Lecythidaceae	*Barringtonia asiatica* (L.) Kurz	Chik le	ST
Leguminosae-	*Sindora siamensis* Teijsm. & Miq.	Ma kha tae	S
Caesalpinioideae	*Caesalpinia bonduc* (L.) Roxb.	Sawat	C
Leguminosae-	*Abrus precatorius* L.	Ma klam ta nu	C
Papilionoideae	*Canavalia rosea* (Sw.) DC.	Thua khla	HC
	Derris indica Bennet	Yi nam	ST

Table 6. (continued)

Family	Species	Vernacular	Habit
Leguminosae-	*Dicerma biarticulatum* (L.) DC.	Kraduk ueng	H
Papilionoideae	*Dunbaria bella* Prain	Khang khrang	C
	Sophora tomentosa L.	Sara phat phit	S
	Vigna marina (Burm.) Merr.	-	H
Loranthaceae	*Amylotheca duthieana* (King) Danser	-	Pa
	Dendrophthoe pentandra (L.) Miq.	Kafak ma muang	Pa
	Macrosolen cochinchinensis (Lour.) Tiegh.	Prathat nuan	Pa
Malvaceae	*Hibiscus tiliaceus* L.	Po Thale	ST
	Thespesia populnea (L.) Soland. ex Corr.	Pho Thale	ST
Melastomataceae	*Melastoma malabathricum* L.	Khlong khleng	S
	Melastoma sanguineum Sims	Mang khre chang	S
	Memecylon edule Roxb.	Phlong mueat	S
	Memecylon ovatum Sm.	Phlong kin luk	S
	Memecylon scutellatum Naudin	Mueat chi	S/ST
Menispermaceae	*Tiliacora triandra* (Colebr.) Diels	Thao yanang	C
Moraceae	*Streblus asper* Lour.	Khoi	ST
Myristicaceae	*Knema globularia* (Lam.) Warb.	Lueat raet	ST
Myrsinaceae	*Ardisia crenata* Sims	Ta kai bai kwang	S
	Ardisia elliptica Thunb.	Ram yai	S
Myrtaceae	*Rapanea porteriana* (A.DC.) Mez	Rang ka thae	ST
	Rhodamnia cinerea Jack	Cha aeng	S
	Rhodomyrtus tomentosa (Aiton) Hassk.	Phruat	S
	Syzygium grande (Wight) Walp.	Mao	T
	Syzygium gratum (Wight) S.N. Mitra	Samet chun	ST
Ochnaceae	*Ochna integerrima* (Lour.) Merr.	Tan lueang	S
	Brackenridgea palustris Bartell.	Daeng lueat nok	S
Olacaceae	*Olax psittacorum* (Willd.)Vahl	Nam chai khrai	C
Oleaceae	*Jasminum decussatum* Wall. ex G.Don	Khiao ngu	C
	Olea brachiata (Lour.) Merr.	Ket san	ST
Opiliaceae	*Champereia manillana* (Blume) Merr.	Phak wan pa	S
	Cansjera rheedei J.F.Gmel.	Nang chum	C
Passifloraceae	*Adenia penangiana* (G.Don) W.J. de Wilde	Pakka	C
Pittosporaceae	*Pittosporum ferrugineum* W.T.Aiton	Sum ton	ST
Rhamnaceae	*Colubrina asiatica* L. ex Brougn.	Khan song	S
	Cansjera rheedei J.F.Gmel.	Nang chum	C

Table 6. (continued)

Family	Species	Vernacular	Habit
Passifloraceae	*Adenia penangiana* (G.Don) W.J. de Wilde	Pakka	C
Pittosporaceae	*Pittosporum ferrugineum* W.T.Aiton	Sum ton	ST
Rhamnaceae	*Colubrina asiatica* L. ex Brougn.	Khan song	S
	Ziziphus oenoplia (L.) Mill.	Lep yiao	S
Rhizophoraceae	*Carallia brachiata* (Lour.) Merr.	Chiang phra nang ae	ST
Rubiaceae	*Catunaregam tomentosa* (Blume ex DC.) Tirveng.	Ma khet	S
	Chassalia curviflora (Wall.) Thwaites	khem phra ram	S
	Guettarda speciosa L.	Kongkang hu chang	S
	Gynochthodes sublanceota Miq.	Phan samo	C
	Hydnophytum formicarum Jack	Hua roi ru	H
	Hydrophylax maritima L.f.	-	H
	Ixora javanica (Blume) DC.	Khem thong	S
	Ixora cibdela Craib	Khem pa	S
	Lucinaea morindae DC.	Yo yan	C
	Morinda elliptica Ridl.	Yo thuean	S
	Oxyceros longiflora (Lam.) T. Yamaz.	Khao ngua phueak	S
	Prismatomeris tetrandra (Roxb.) K.Schum.	Ta lai	S
	Psychotria sarmentosa Blume	Duk kai yan	C
Rubiaceae	*Psydrax nitida* (Craib) K.M. Wong	Kapa	S
	Tarenna adangensis (Ridl.) Ridl.	Khem khao dam	S
	Tarenna wallichii (Hook.f.) Ridl.	Chan thana bai lek	S
Rutaceae	*Acronychia pedunculata* (L.) Miq.	Ka uam	ST
	Atalantia monophylla (DC.) Correa	Manao phi	ST
	Micromelum minutum (G.Forst.) Wight & Arn.	Hatsa khun	ST
Santalaceae	*Dendrotrophe buxifolia* (Blume) Miq.	Ti mia muea yang	PaS
	Dendrotrophe varians (Blume) Miq.	Yan ti mia	PaS
Sapindaceae	*Allophylus cobbe* (L.) Raeusch	To sai	S
	Guioa pleuropteris (Blume) Radlk.	Som ling	ST
	Lepisanthes rubiginosa (Roxb.) Leenh.	Ma huat	ST
	Mischocarpus sundaicus Blume	Khao kwang	ST
	Dodonae viscosa Jacq.	Chumhet le	S
Sapotaceae	*Pouteria obovata* (R.Br.) Baehni	Nga sai	ST
Simaroubaceae	*Brucea javanica* (L.) Merr.	Ratchadat	S
	Eurycoma longifolia Jack	Pla lai phueak	S

Table 6. (continued)

Family	Species	Vernacular	Habit
Stemonaceae	*Stemona tuberosa* Lour.	Mueat kliang	C
Symplocaceae	*Symplocos cochinchinensis* (Lour.) S. Moore	Mueat Dong	S/ST
Taccaceae	*Tacca integrifolia* Ker Gawl.	Wan phangphon	H
Theaceae	*Schima wallichii* (DC.) Korth.	Mangtan	ST
Thymelaeaceae	*Wikstroemia ridleyi* Gamble	Po fan	S
Tiliaceae	*Microcos tomentosa* Sm.	Phlapphla	ST
	Triumfetta grandidens Hance	Po yan	HC
Verbenaceae	*Phyla nodiflora* (L.) Greene	Ya klet pla	H
Viscaceae	*Viscum articulatum* Burm.f.	Kafak tin pu	Pa

Habit: C= Climber, CrS= Creeping Shrub, F= Fern, G= Grass, H= Herb, HC= Herbaceous Climber, O= Orchid, Pa= Parasite, S= Shrub, ST= Shrubby Tree, T= Tree, TerO= Terestrial Orchid

Table 7. List of monocotyledonous species on sandbars along the coast of the peninsular Thailand.

Family	Species	Vernacular	Habit
Amaryllidaceae	*Crinum northianum* Baker	Phlueng le	H
Araceae	*Alocasia* sp.	-	H
Colchicaceae	*Gloriosa superba* L.	Dong dueng	HC
Commelinaceae	*Cyanotis cristata* Roem. & Schult.	Ya hua rak noi	H
Cyperaceae	*Cyperus rotundus* L.	Ya haeo mu	H
	Cyperus stoloniferus Retz.	Kok sai	H
	Fimbristylis sericea R.Br.	Kok chai hat	H
	Remirea maritima Aubl.	Kok mari	H
Dioscoreaceae	*Dioscorea bulbifera* L.	Wan phra chim	HC
	Dioscorea sp.	Man khan khao	C
Gramineae	*Chrysopogon orientalis* A.Camus	Ya phung chu	G
	Ischaemum muticum L.	Ya wai tham	G
	Spinifex littoreus Merr.	Ya loi lom	G
	Zoysia matrella (L.) Merr.	Ya nuan noi	G
Hemerocallidaceae	*Dianella ensifolia* (L.) DC.	Ya nu ton	H
Orchidaceae	*Acriopsis indica* Wight	Chuk phram	O
	Acriopsis ridleyi Hook.f.	-	O
	Arachnis flosaeris (L.) Rchb.f.	Ueang malaeng po	O
	Bromheadia finlaysoniana (Lindl.) Rchb.f.	Kluai mai din	TerO
	Bulbophyllum planibulbe Ridl.	-	O
	Cleisomeria lanatum (Lindl.) Lindl. ex G.Don	Kor kwang	O
	Cymbidium findlaysonianum Lindl.	Kare karon pak pet	O
	Dendrobium crumenatum Sw.	Wai tamoi	O
	Dendrobium indivisum (Blume) Miq.	Tan sian mai	O
	Dendrobium pachyphyllum (Kuntze) Bakh.f.	Ueang noi	O
	Dendrobium secundum (Blume) Lindl.	Ueang praeng si fun	O
	Doritis pulcherrima Lindl.	Ma wing	TerO
	Eria affinis Griff.	Ueang nim	O
	Eria lasiopetala (Willd.) Ormerod	Ueang bai si	O
	Eria pulchella Lindl.	Nuan phong	O
	Eulophia andamanensis Rchb.f.	Mu kling	TerO
	Habenaria khasiana Hook.f.	-	O
	Liparis downii Ridl.	-	O

Table 7. (continued)

Family	Species	Vernacular	Habit
Orchidaceae	*Luisia curtisii* Seidenf.	Kho sing	O
	Oxystophyllum carnosum Blume	-	O
	Pachystoma pubescens Blume	Haeo cha khru	TerO
	Thrixspermum calceolus (Lindl.) Rchb.f.	-	O
	Trichotosia velutina (Lodd. ex Lindl.) Kraenzl.	Sam phram	O
	Vanilla aphylla Blume	Thao ngu khiao	O
Pandanaceae	*Pandanus odoratissimus* L.f.	Lam chiak	S

Habit: C= Climber, CrS= Creeping Shrub, F= Fern, G= Grass, H= Herb, HC= Herbaceous Climber, O= Orchid, Pa= Parasite, S= Shrub, ST= Shrubby Tree, T= Tree, TerO= Terestrial Orchid

Table 9. List of plant species found in each study sites.

Family	Species	Habit	Study Site													Voucher
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Acanthaceae	*Thunbergia fragrans* Roxb.	C	X	X									X			-
Aizoaceae	*Sesuvium portulacastrum* (L.) L.	H											X	X	X	*Laongpol* 866
Amaranthaceae	*Gomphrena celosioides* Mart.	H				X	X	X	X	X	X					*Laongpol* 703.475
Amaryllidaceae	*Crinum northianum* Baker	H		X							X		X	X	X	-
Anacardiaceae	*Lannea coromendelica* (Houtt.) Merr.	ST		X	X	X	X	X	X	X	X					-
	Mangifera indica L.	T	X	X	X	X	X	X	X	X	X		X			-
Ancistrocladaceae	*Ancistrocladus tectorius* (Lour.) Merr.	C	X	X		X						X	X			-
Annonaceae	*Polyalthia evecta* (Pierre) Finet & Gagnep.	S			X	X	X	X	X	X	X					*Laongpol* 504.353
Apocynaceae	*Aganosma marginata* (Roxb.) G.Don	C	X	X		X	X	X	X	X	X	X	X	X	X	*Laongpol* 521.359

Habit: C= Climber, CrS= Creeping Shrub, F= Fern, G= Grass, H= Herb, HC= Herbaceous Climber, O= Orchid, Pa= Parasite, S= Shrub, ST= Shrubby Tree, T= Tree, TerO=Terestrial Orchid

Study Site: 1= Ban Bangboet, Pathio district; 2= Ao Phanang Tak, Mueang Chumphon district; 3= Ban Pak Nam Tako, Thung Tako district; 4= Ban Laem Santi, Lamae district, Chumphon province; 5= Ban Takrop; 6= Ban Plongmai; 7= Ban Laem Phol; 8= Ban Laem Pho 2; 9= Ban Nuea, Chaiya district, Sarat Thani province; 10= Ban Nathup, Chana district, Songkhla province; 11= Hat Thai mueang, Thai Mueang district, Phangnga province; 12= Hat Thung Tale, Ko Lanta district, Krabi province; 13= Hat Yong Ling, Sikao district, Trang province.

Voucher: No voucher is available for many plant species due to incomplete collections (Without flowers or fruits) or damage during transportation or during processing. (In such case, photographs were used for reference).

Table 9. (continued)

Family	Species	Habit	Study Site													Voucher
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Apocynaceae	*Alyxia reinwardtii* Blume	C	X	X	X	X	X	X	X	X	X	X	X	X	X	*Laongpol* 718
	Cerbera manghus L.	ST												X		-
	Cerbera odollam Gaertn.	ST		X									X	X	X	*Laongpol* 576
	Holarrhena curtisii King & Gamble	S		X		X							X	X		*Laongpol* 727
	Ichnocarpus frutescens (L.)W.T. Aiton	C									X					-
	Spirolobium cambodianum Baill.	S			X	X						X		X	X	*Laongpol* 535
	Willughbeia coriacea Wall.	C	X						X	X			X	X		*Laongpol* 997
Aquiforiaceae	*Ilex cymosa* Blume	ST									X	X	X			*Laongpol* 365, 384
Araceae	*Alocasia* sp.	H									X					-
Asclepiadaceae	*Dischidia major* (Vahl) Merr.	CrH	X	X	X	X	X	X	X	X	X	X	X	X	X	-
	Hoya diversifolia Blume	C										X				
	Hoya parasitica (Roxb.) Wall. ex Traill	C	X	X	X	X	X	X	X	X	X	X	X	X	X	-
	Streptocaulon juventas (Lour.) Merr.	C				X					X					*Laongpol* 781
Caryophyllaceae	*Polycarpaea corymbosa* (L.) Lam.	H	X													-
Celastraceae	*Euonymus cochinchinensis* Pierre	ST	X	X									X			-
	Pleurostylia opposita (Wall.) Alston	ST		X									X			*Laongpol* 660, 661
	Salacia chinensis L.	S	X	X												*Laongpol* 522, 588
Colchicaceae	*Gloriosa superba* L.	HC	X				X	X				X				*Laongpol* 998,351

Table 9. (continued)

Family	Species	Habit	Study Site													Voucher
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Combretaceae	*Terminalia catappa* L.	T	X	X									X	X	X	-
Commelinaceae	*Cyanotis cristata* Roem. & Schult.	H											X			-
Connaraceae	*Connarus semidecandrus* Jack	C	X										X			*Laongpol* 1001,355
Convolvulaceae	*Argyreia mollis* (Burm.f.) Choisy	HC	X										X			-
	Ipomoea imperati (Vahl) Griseb.	CrH	X	X									X		X	*Laongpol* 994
	Ipomoea pes-caprae (L.) R.Br.	CrH	X	X									X	X	X	*Laongpol* 833
	Merremia hirta Blume	HC											X			-
Cucurbitaceae	*Scopellaria marginata* (Blume) W.J. de Wilde & Duyfjes	C												X		-
Cyperaceae	*Cyperus rotundus* L.	H		X												-
	Cyperus stoloniferus Retz.	H	X	X												*Laongpol* 995
	Fimbristylis sericea R.Br.	H	X	X												*Laongpol* 638, 771, 854
	Remirea maritima Aubl.	H		X												-
Davalliaceae	*Davallia denticulata* (Burm.f.) Mett. ex Kuhn	F	X	X	X	X	X	X	X	X	X	X	X	X	X	*Laongpol* 557
	Davallia solida (G. Forst.) Sw.	F										X				*Laongpol* 557
	Humata heterophylla (Smith) Desv.	F											X	X	X	*Laongpol* 758
	Humata pectinata (Sw.) Desv.	F											X	X	X	*Laongpol* 757

Table 9. (continued)

Family	Species	Habit	Study Site													Voucher
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Dilleniaceae	*Tetracera indica* (Christm. & Panz.) Merr.	C	X	X	X	X	X	X	X	X	X	X	X	X	X	*Laongpol* 623
	Tetracera loureiri (Finet & Gagnep.) Pierre ex Craib	C	X	X	X	X					X	X	X			*Laongpol* 582
Dioscoreaceae	*Dioscorea bulbifera* L.	HC		X												-
	Dioscorea sp.	C		X												-
Dipterocarpaceae	*Anisoptera costata* Korth.	T				X										-
	Cotylelobium lanceolatum Craib	T	X	X		X	X	X	X	X	X		X			*Laongpol* 474,383
	Dipterocarpus alatus Roxb. ex G.Don	T		X							X		X			-
	Dipterocarpus chartaceus Symington	T									X	X				-
	Dipterocarpus obtusifolius Teijsm. ex Miq.	T										X				*Laongpol* 560
	Hopea odorata Roxb.	T		X		X	X	X	X		X					-
	Shorea roxburghii G.Don	T		X		X	X	X	X	X	X	X	X			-
	Vatica harmandiana Pierre	T	X	X		X	X	X	X	X	X		X	X	X	*Laongpol 721*
Ebenaceae	*Diospyros areolata* King & Gamble	ST											X		X	*Laongpol 834*
	Diospyros ferrea (Willd.) Bakh.	S	X	X	X	X	X	X	X	X	X		X	X	X	*Laongpol 652*
Elaeocarpaceae	*Elaeocarpus robustus* Roxb.	T											X			*Laongpol 836*
Epacridaceae	*Styphelia malayana* (Jack) Spreng	S											X	X	X	*Laongpol 741,382*

Table 9. (continued)

Family	Species	Habit	Study Site													Voucher
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Ericaceae	*Vaccinium bracteatum* Thunb.	S			X	X		X			X	X	X	X	X	*Laongpol* 804
Erythroxylaceae	*Erythroxylum cuneatum* (Miq.) Kurz	S	X	X				X	X				X			*Laongpol* 642
Euphorbiaceae	*Antidesma ghaesembilla* Gaertn.	S		X									X			*Laongpol* 525
	Aporosa sp.	S									X					-
	Breynia glauca Craib	S											X			-
	Breynia racemosa (Blume) Mull.Arg.	S	X	X			X	X								-
	Chaetocarpus castanocarpus (Roxb.) Thwaites	ST	X	X	X	X	X	X	X	X	X	X	X	X	X	*Laongpol* 617
	Cleistanthus sp.	S		X												-
	Euphorbia atoto G. Forst.	H		X												-
	Glochidion rubrum Blume	S	X													-
	Hymenocardia wallichii Tul.	S					X	X								*Laongpol* 723
	Microstachys chamaelea (L.) Müll. Arg.	S	X	X									X			-
	Phyllanthus oxyphyllus Miq.	S	X													-
	Shirakiopsis indica (Willd.) Esser	ST											X			-
	Suregada multiflorum (A.Jass.) Bail.	S	X	X		X	X						X			*Laongpol 663,357*
Flacourtiaceae	*Casearia grewiifolia* Vent.	ST		X												-
	Flacourtia indica (Burm.f.) Merr.	S					X	X								-

Table 9. (continued)

Family	Species	Habit	Study Site													Voucher
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Gentianaceae	*Fagraea fragrans* Roxb.	T		X	X	X	X	X	X	X	X		X			-
Gesneriaceae	*Aeschynanthus fulgens* Wall. ex R.Br.	H											X			-
Gnetaceae	*Gnetum* sp.	C	X													-
Goodeniaceae	*Scaevola taccada* (Gaertn.) Roxb.	S	X	X									X		X	*Laongpol* 630
Gramineae	*Chrysopogon orientalis* A.Camus	G	X	X	X	X	X	X	X	X	X	X	X	X	X	*Laongpol 632*
	Ischaemum muticum L.	G	X	X	X	X	X	X	X	X	X	X	X	X	X	*Laongpol 477*
	Spinifex littoreus Merr.	G	X	X									X			*Laongpol 639*
	Zoysia matrella (L.) Merr.	G		X									X			*Laongpol 581*
Guttiferae	*Calophyllum inophyllum* L.	T		X											X	-
	Calophyllum pulcherrimum Wall.	T	X	X		X	X	X				X	X			*Laongpol* 849
	Cratoxylum cochinchinense (Lour.) Blume	ST						X					X	X		*Laongpol* 724
	Garcinia cowa Roxb. ex DC.	ST		X		X						X	X	X		*Laongpol* 722
	Garcinia hombroniana Pierre	T		X		X						X	X			*Laongpol* 759
Hemerocallidaceae	*Dianella ensifolia* (L.) DC.	H	X	X	X	X	X	X	X	X	X	X	X	X	X	*Laongpol* 572
Labiatae	*Clerodendrum inerme* (L.) Gaertn.	S		X									X	X		*Laongpol* 369
	Leucas zeylanica (L.) R.Br.	H											X			-
	Platostoma cochinchinense (Lour.) A.J. Paton	H													X	-
	Premna obtusifolia R.Br.	C		X						X	X	X	X	X		-

Table 9. (continued)

Family	Species	Habit	Study Site													Voucher
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Labiatae	*Vitex pinnata* L.	T	X	X	X	X	X	X	X	X	X	X	X	X	X	-
	Vitex rotundifolia L.f.	CrS		X										X	X	*Laongpol* 999
Lauraceae	*Cassytha filiformis* L.	C	X	X									X			*Laongpol* 631
	Neolitsea zeylanica (Nees) Merr.	ST					X	X			X	X	X	X		*Laongpol* 818
	Litsea glutinosa (Lour.) C.B.Rob	ST								X						*Laongpol* 843
Lecythidaceae	*Barringtonia asiatica* (L.) Kurz	ST		X								X	X			*Laongpol* 558
Leguminosae-Caesalpinioideae	*Sindora siamensis* Teijsm. & Miq.	S	X													*Laongpol* 629
	Caesalpinia bonduc (L.) Roxb.	C		X										X		*Laongpol* 370
Leguminosae-Papilionoideae	*Abrus precatorius* L.	C		X		X		X	X	X	X	X	X			*Laongpol* 773
	Canavalia rosea (Sw.) DC.	HC		X	X								X		X	*Laongpol* 828
	Derris indica Bennet	ST	X	X									X			*Laongpol* 839,371
	Dicerma biarticulatum (L.) DC.	H											X			*Laongpol* 356
	Dunbaria bella Prain	C	X													*Laongpol* 597
	Sophora tomentosa L.	S		X												*Laongpol* 785
	Vigna marina (Burm.) Merr.	H	X	X									X			*Laongpol* 830,373
Loranthaceae	*Amylotheca duthieana* (King) Danser	H											X			-
	Dendrophthoe pentandra (L.) Miq.	Pa	X	X	X	X	X	X	X	X	X	X	X	X	X	-

Table 9. (continued)

Family	Species	Habit	Study Site													Voucher
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Loranthaceae	*Macrosolen cochinchinensis* (Lour.) Tiegh												X			-
Malvaceae	*Hibiscus tiliaceus* L.	ST		X									X		X	*Laongpol* 960
	Thespesia populnea (L.) Soland. ex Corr.	ST		X									X		X	-
Melastomataceae	*Melastoma malabathricum* L.	S	X	X	X	X	X	X	X	X	X	X	X	X	X	*Laongpol* 565
	Melastoma sanguineum Sims	S		X									X			*Laongpol* 913
	Memecylon edule Roxb.	S				X							X			-
	Memecylon ovatum Sm.	S				X							X			-
	Memecylon scutellatum Naudin	S/ST				X							X			-
Menispermaceae	*Tiliacora triandra* (Colebr.) Diels	S/ST											X			-
Moraceae	*Streblus asper* Lour.	ST		X		X	X	X								-
Myristicaceae	*Knema globularia* (Lam.) Warb.	ST	X	X	X	X		X					X			-
Myrsinaceae	*Ardisia crenata* Sims	S	X	X	X	X	X	X	X	X	X	X	X			*Laongpol* 542, 713
	Ardisia elliptica Thunb.	S											X			*Laongpol* 520
	Rapanea porteriana (A.DC.) Mez	ST	X	X	X	X	X	X	X	X	X	X	X	X	X	*Laongpol* 985
Myrtaceae	*Rhodamnia cinerea* Jack	S	X										X	X	X	*Laongpol* 646, 662,358,337

Table 9. (continued)

Family	Species	Habit	Study site													Voucher
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Myrtaceae	*Rhodomyrtus tomentosa* (Aiton) Hassk.	S	X	X	X	X	X	X	X	X	X	X	X	X	X	*Laongpol* 545, 801
	Syzygium grande (Wight) Walp.	T	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Syzygium gratum (Wight) S.N. Mitra	ST	X	X	X	X	X	X	X	X	X	X	X	X	X	*Laongpol* 559, 847
Orchidaceae	*Acriopsis indica* Wight	O											X	X		*Pattarakulpisutti* 25
	Acriopsis ridleyi Hook.f.	O	X													*Laongpol* 539
	Arachnis flosaeris (L.) Rchb.f.	O											X			*Laongpol* 738
	Bromheadia finlaysoniana (Lindl.) Rchb.f.	TerO											X			-
	Bulbophyllum planibulbe Ridl.	O											X			-
	Cleisomeria lanatum (Lindl.) Lindl. ex G.Don	O											X			*Laongpol* 458
	Cymbidium finlaysonianum Lindl.	O	X	X	X	X	X	X	X	X		X	X			*Laongpol 720*
	Dendrobium crumenatum Sw.	O	X	X		X	X	X	X	X	X	X	X	X	X	*Laongpol 805*
	Dendrobium indivisum (Blume) Miq.	O											X	X		*Laongpol* 739, 806, 810
	Dendrobium pachyphyllum (Kuntze) Bakh.f.	O						X					X			*Laongpol* 744, 753

Table 9. (continued)

Family	Species	Habit	Study site													Voucher
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Orchidaceae	*Dendrobium secundum* (Blume) Lindl.	O													X	-
	Doritis pulcherrima Lindl.	TerO			X	X		X	X				X	X	X	*Laongpol* 751
	Eria affinis Griff.	O											X			-
	Eria lasiopetala (Willd.) Ormerod	O											X			*Pattarakulpisutti* 26
	Eria pulchella Lindl.	O											X			-
	Eulophia andamanensis Rchb.f.	TerO				X	X									*Pattarakulpisutti* 1, 16
	Habenaria khasiana Hook.f.	O											X			*Laongpol* 811
	Liparis downii Ridl.	O												X		*Laongpol* 750
	Luisia curtisii Seidenf.	O						X					X			*Pattarakulpisutti* 15
	Oxystophyllum carnosum Blume	O											X			*Laongpol 740, 808*
	Pachystoma pubescens Blume	TerO													X	*Laongpol* 485
	Thrixspermum calceolus (Lindl.) Rchb.f.	O											X			*Laongpol* 742
	Trichotosia velutina (Lodd. ex Lindl.) Kraenzl.	O			X								X			*Laongpol* 752
	Vanilla aphylla Blume	O				X							X			-
Ochnaceae	*Ochna integerrima* (Lour.) Merr.	S			X	X	X	X				X	X			-
	Brackenridgea palustris Bartell.	S			X											*Laongpol* 848

Table 9. (continued)

Family	Species	Habit	Study site													Voucher
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Olacaceae	*Olax psittacorum* (Willd.)Vahl	C		X	X	X	X	X	X			X	X	X	X	-
Oleaceae	*Jasminum decussatum* Wall. ex G.Don	C		X		X				X		X	X			*Laongpol* 490
	Olea brachiata (Lour.) Merr.	ST	X	X	X	X	X	X	X	X	X	X	X	X	X	*Laongpol* 534, 715
Opiliaceae	*Champereia manillana* (Blume) Merr.	S	X	X	X	X	X	X	X	X	X	X	X	X	X	*Laongpol* 940
	Cansjera rheedei J.F.Gmel.	C	X	X	X	X	X	X				X		X	X	*Laongpol* 621
Pandanaceae	*Pandanus odoratissimus* L.f.	S	X	X									X	X	X	-
Passifloraceae	*Adenia penangiana* (G.Don) W.J. de Wilde	C													X	-
Pittosporaceae	*Pittosporum ferrugineum* W.T.Aiton	ST	X			X	X	X	X	X	X	X	X			*Laongpol* 851
Podocarpaceae	*Podocarpus neriifolius* D.Don.	T											X			*Laongpol* 930
Polypodiaceae	*Drynaria quercifolia* (L.) Sm.	F					X									*Laongpol* 956
	Drynaria sparsisora (Desv.) S.Moore	F	X	X	X	X	X	X	X	X	X	X	X	X	X	-
	Microsorium punctatum (L.) Copel	F											X			-
	Microsorum scolopendria (Burm.f.) Copel.	F					X	X				X		X	X	*Laongpol* 552
	Pyrrosia adnascens (G.Forst.) Ching	F										X	X			
	Pyrrosia longifolia (Burm.f.) Morton	F										X	X			*Laongpol 556*

Table 9. (continued)

Family	Species	Habit	Study site													Voucher
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Polypodiaceae	*Pyrrosia piloselloides* (L.) M.G.Price	F	X			X		X		X		X	X	X	X	*Laongpol* 561, 674
Rhamnaceae	*Colubrina asiatica* L. ex Brougn.	S		X												*Laongpol* 502
	Ziziphus oenoplia (L.) Mill.	S		X												*Laongpol* 507
Rhizophoraceae	*Carallia brachiata* (Lour.) Merr.	ST	X	X		X	X	X	X	X		X	X	X	X	*Laongpol* 494, 484
Rubiaceae	*Catunaregam tomentosa* (Blume ex DC.) Tirveng.	S					X	X				X	X	X	X	*Laongpol* 543, 568
	Chassalia curviflora (Wall.) Thwaites	S		X									X			*Laongpol* 531, 555
	Guettarda speciosa L.	S		X									X		X	*Laongpol* 577
	Gynochthodes sublanceota Miq.	C										X	X	X		*Laongpol* 564
	Hydnophytum formicarum Jack	H		X							X		X			-
	Hydrophylax maritima L.f.	H											X			*Laongpol* 755, 832
	Ixora javanica (Blume) DC.	S	X	X	X	X	X	X	X	X	X	X	X			*Laongpol* 816
	Ixora cibdela Craib	S	X													*Laongpol* 1000
	Lucinaea morindae DC.	C											X			-
	Morinda elliptica Ridl.	S		X	X							X	X			-

Table 9. (continued)

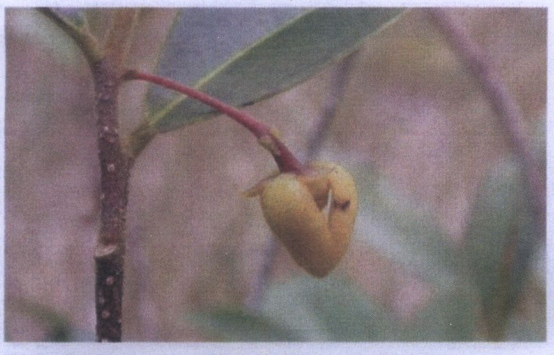
Family	Species	Habit	Study site													Voucher
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Rubiaceae	*Oxyceros longiflora* (Lam.) T.Yamaz.	S		X									X			-
	Prismatomeris tetrandra (Roxb.) K.Schum.	S		X		X	X	X				X	X			*Laongpol* 533, 602, 636
	Psychotria sarmentosa Blume	C	X	X	X	X	X	X	X	X	X	X	X	X	X	*Laongpol* 547
	Psydrax nitida (Craib) K.M.Wong	S											X	X	X	*Laongpol* 586
	Tarenna adangensis (Ridl.) Ridl.	S		X									X			-
	Tarenna wallichii (Hook.f.) Ridl.	S		X									X			*Laongpol* 587
Rutaceae	*Acronychia pedunculata* (L.) Miq.	ST		X			X	X				X	X	X	X	*Laongpol 551*
	Atalantia monophylla (DC.) Correa	ST		X						X		X	X			*Laongpol* 840
	Micromelum minutum (G.Forst.) Wight & Arn.	ST		X		X						X	X			*Laongpol* 583
Santalaceae	*Dendrotrophe buxifolia* (Blume) Miq.	PaS										X				*Laongpol* 549
	Dendrotrophe varians (Blume) Miq.	PaS						X				X				-
Sapindaceae	*Allophylus cobbe* (L.) Raeusch	S	X	X									X	X		*Laongpol* 488
	Guioa pleuropteris (Blume) Radlk.	ST		X					X	X		X	X			-
	Lepisanthes rubiginosa (Roxb.) Leenh.	ST				X					X		X			-
	Mischocarpus sundaicus Blume	ST	X	X	X	X	X	X	X	X	X	X	X	X		*Laongpol* 553
	Dodonaea viscosa Jacq.	S		X									X	X	X	*Laongpol* 379, 362,379
Sapotaceae	*Pouteria obovata* (R.Br.) Baehni	ST	X	X	X	X		X	X	X		X	X	X	X	*Laongpol* 653

Table 9. (continued)

Family	Species	Habit	Study site													Voucher
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Schizaeaceae	*Schizaea dichotoma* (L.) Sm.	F	X		X	X						X	X			*Laongpol 575*
	Schizaea digitata (L.) Sw.	F	X		X	X						X	X			*Laongpol* 574
Simaroubaceae	*Brucea javanica* (L.) Merr.	S				X										-
	Eurycoma longifolia Jack	S	X	X	X	X	X	X	X	X	X	X	X	X		*Laongpol* 563
Stemonaceae	*Stemona tuberosa* Lour.	C		X									X			*Laongpol* 503, 592
Symplocaceae	*Symplocos cochinchinensis* (Lour.) S. Moore	S/ST				X										-
Taccaceae	*Tacca integrifolia* Ker Gawl.	H		X									X			*Laongpol* 702
Theaceae	*Schima wallichii* (DC.) Korth.	ST	X	X	X	X	X	X	X	X	X		X			-
Thymelaeaceae	*Wikstroemia ridleyi* Gamble	S			X							X	X	X	X	*Laongpol 747,375*
Tiliaceae	*Microcos tomentosa* Sm.	ST		X	X	X	X	X	X	X	X	X	X			-
	Triumfetta grandidens Hance	HC		X									X			-
Verbenaceae	*Phyla nodiflora* (L.) Greene	H		X									X			-
Viscaceae	*Viscum articulatum* Burm.f.	Pa			X							X	X			-

Thunbergia fragran Roxb.

Gomphrena celosioides Mart.



Polyalthia evecta (Pierre) Finet & Gagnep.

Aganosma marginata (Roxb.) G.Don

Alyxia reinwardtii Blume

Cerbera manghas L.

Cerbera odollam Gaertn.

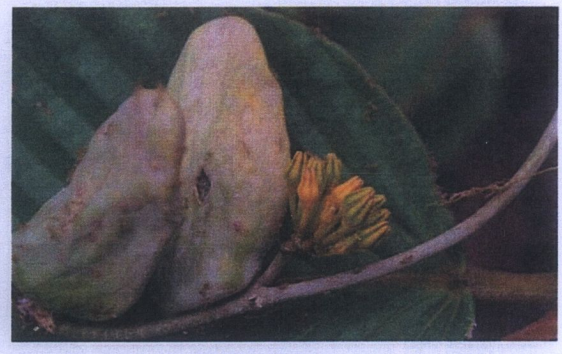
Holarrhena curtisii King & Gamble

Plate 1. Dicotyledonous plants 1.

Spirolobium cambodianum Baill.

Willughbeia coriacea Wall.

Ilex cymosa Blume

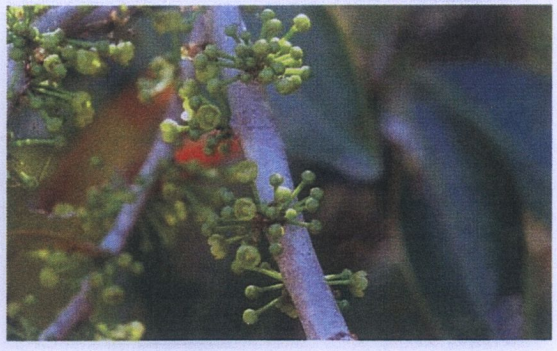


Dischidia major (Vahl.) Merr.

Hoya parasitica (Roxb.) Wall. ex Traill

Polycarpaea corymbosa (L.) Lam.

Euonymus cochinchinensis Pierre



Salacia chinensis L.

Plate 2. Dicotyledonous plants 2

Connarus semidecandrus Jack

Argyreia mollis (Burm.f.) Choisy

Ipomoea imperati (Vahl) Griseb

Ipomoea pes-caprae (L.) R.Br.

Merremia hirta (L.) Merr.

Scopellaria marginata (Blume) W.J. de Wilde & Duyfjes

Tetracera indica (Christm. & Panz.) Merr.

Tetracera loureiri (Finet & Gagnep.) Pierre ex Craib

Plate 3. Dicotyledonous plants 3.

Cotylelobium lanceolatum Craib

Dipterocarpus chartaceus Symington

Dipterocarpus obtusifoius Teijsm.ex Miq.

Vatica harmandiana Pierre

Diospyros areolata King & Gamble

Diospyros ferrea (Willd.) Bakh.

Styphelia malayana (Jack) Spring

Vaccinium bracteatum Thunb.

Plate 4. Dicotyledonous plants 4.

Erythroxylum cuneatum (Miq.) Kurz

Antidesma ghaesembilla Gaertn.

Breynia racemosa (Blume) Müll. Arg.

Microstachys chamaelea (L.) Müll. Arg.

Chaetocarpus castanocarpus (Roxb.) Thwaites

Euphorbia atoto G. Forst.

Hymenocardia wallichii Tul.

Suregada multiflorum (A. Juss.) Baill.

Plate 5. Dicotyledonous plants 5.

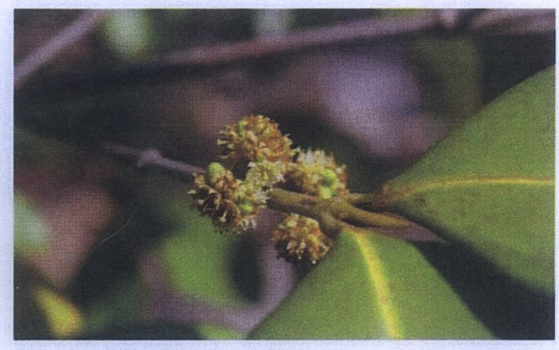
Flacourtia indica (Burm.f.) Merr.

Scolopia macrophylla (Wight & Arn.) Clos

Aeschynanthus fulgens Wall. ex R.Br.

Calophyllum inophyllum L.

Cratoxylum cochinchinense (Lour.) Blume



Garcinia hombroniana Pierre

Clerodendrum inerme (L.) Gaertn.

Platostoma cochinchinense (Lour.) A.J. Paton

Plate 6. Dicotyledonous plants 6.

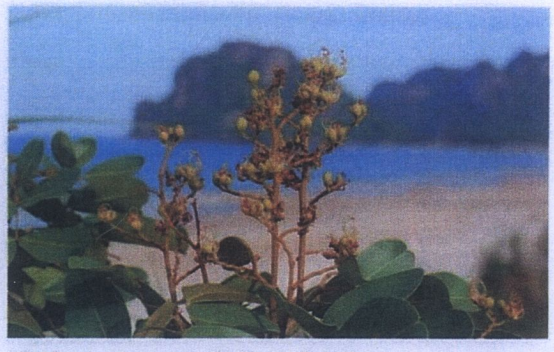
Vitex pinnata L.

Vitex rotundifolia L.f.

Neolitsea zeylanica (Nees) Merr.

Litsea glutinosa (Lour.) C.B. Rob.

Caesalpinia bonduc (L.) Roxb.



Sindora siamensis Teijsm. & Miq.

Abrus precatorius L.

Canavalia rosea (Sw.) DC.

Plate 7. Dicotyledonous plants 7.

Dunbaria bella Prain

Sophora tomentosa L.

Vigna marina (Burm.) Merr.

Amylotheca duthieana (King) Danser

Macrosolen cochinchinensis (Lour.) Tiegh.

Hibiscus tiliaceus L.

Memecylon scutellatum Naudin

Melastoma malabathricum L.

Plate 8. Dicotyledonous plants 8.

Knema globularia (Lam.) Warb.

Ardisia crenata Sims

Ardisia elliptica Thunb.

Baeckea frutescens L.

Rhodamnia cinerea Jack

Rhodomyrtus tomentosa (Aiton) Hassk.

Syzygium grande (Wight) Walp.

Syzygium gratum (Wight) S.N. Mitra

Plate 9. Dicotyledonous plants 9.

Ochna integerrima (Lour.) Merr.

Brackenridgea palustris Bartell.

Olax psittacorum (Willd.)Vahl

Olea brachiata (Lour.) Merr.

Pittosporum ferrugineum W.T.Aiton

Colubrina asiatica L. ex Brougn.

Catunaregam tomentosa (Blume ex DC.) Tirveng.

Chassalia curviflora (Wall.) Thwaites

Plate 10. Dicotyledonous plants 10.

Guettarda speciosa L.

Hydnophytum formicarum Jack

Hydrophylax maritima L.f.

Ixora cibdela Craib

Ixora javanica (Blume) DC.

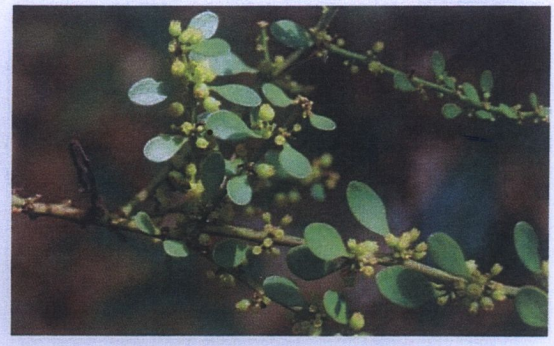
Prismatomeris tetrandra (Roxb.) K. Schum.

Psydrax nitida (Craib) K.M. Wong

Tarenna adangensis (Ridl.) Ridl.

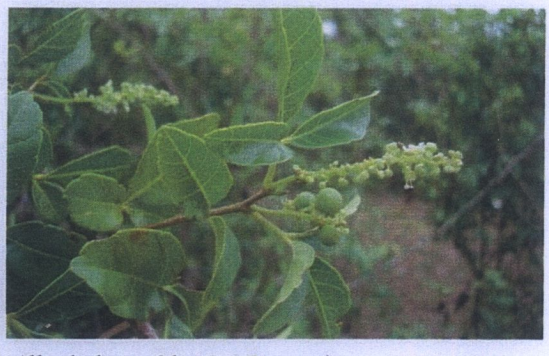
Plate 11. Dicotyledonous plants 11.

Acronychia pedunculata (L.) Miq.



Dendrotrophe buxifolia (Blume) Miq.

Dendrotrophe varians (Blume) Miq.



Allophylus cobbe (L.) Raeusch

Mischocarpus sundaicus Blume

Dodonae viscosa Jacq.

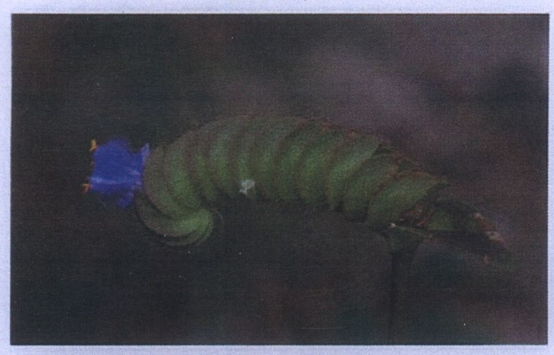
Wikstroemia ridleyi Gamble

Triumfetta grandidens Hance

Plate 12. Dicotyledonous plants 12.

Crinum northianum Baker

Gloriosa superba L.

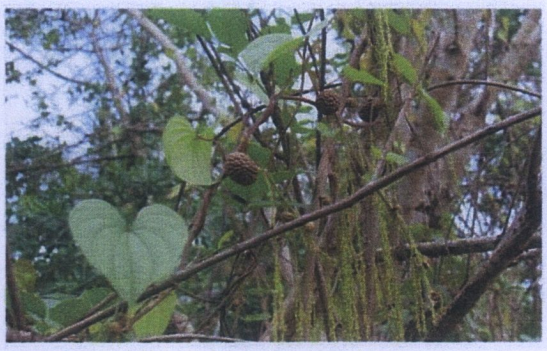


Cyanotis cristata Roem. & Schult.

Cyperus rotundus L.

Fimbristylis sericea R.Br.

Remirea maritima Aubl.



Dioscorea bulbifera L.

Dianella ensifolia (L.) DC.

Plate 13. Monocotyledonous plants 1.

Acriopsis indica Wight

Acriopsis ridleyi Hook.f.

Arachnis flosaeris (L.) Rchb.f.

Cleisomeria lanatum (Lindl.) Lindl. ex G.Don

Dendrobium crumenatum Sw.

Dendrobium indivisum (Blume) Miq.

Dendrobium pachyphyllum (Kuntze) Bakh.f.

Dendrobium secundum (Blume) Lindl.

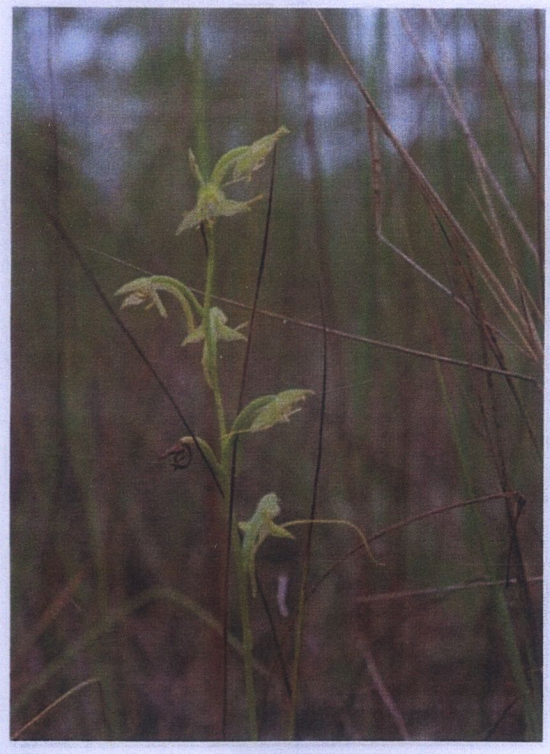
Plate 14. Monocotyledonous plants 2.

Doritis pulcherrima Lindl.

Eria lasiopetala (Willd.) Ormerod

Eria pulchella Lindl.

Eulophia andamanensis Rchb.f.



Habenaria khasiana Hook.f.

Liparis downii Ridl.

Plate 15. Monocotyledonous plants 3.

Luisia curtisii Seidenf.

Oxystophyllum carnosum Blume

Pachystoma pubescens Blume

Thrixspermum calceolus (Lindl.) Rchb.f.

Trichotosia velutina (Lodd. ex Lindl.) Kraenzl.

Vanilla aphylla Blume

Plate 16. Monocotyledonous plants 4.

Davallia denticulata (Burm.f.) Mett. ex Kuhn

Davallia solida (G.Forst) Sw.

Humata heterophylla (Smith) Desv.

Humata pectinata (Sm.) Desv.

Drynaria quercifolia (L.) Sm.

Microsorum scolopendria (Burm.f.) Copel.

Pyrrosia adnascens (G.Forst.) Ching

Pyrrosia piloselloides (L.) M.G.Price

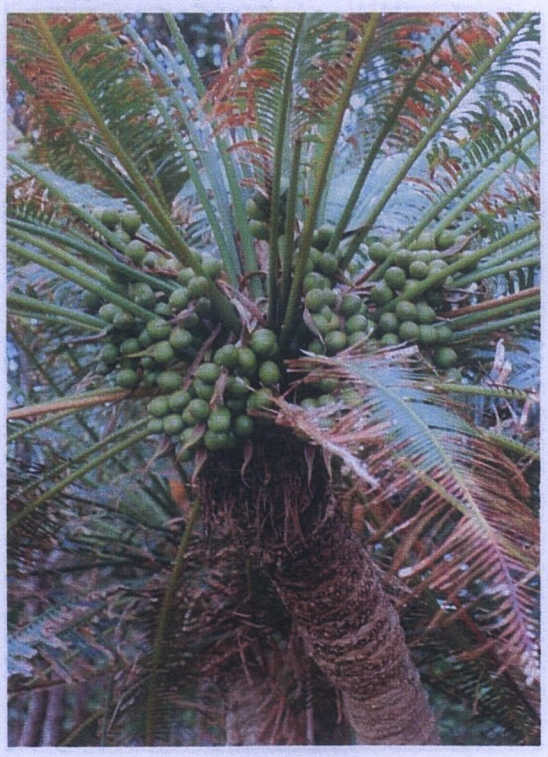
Plate 17. Non-flowering plants 1.

Pyrrosia longifolia (Burm.f.) Morton

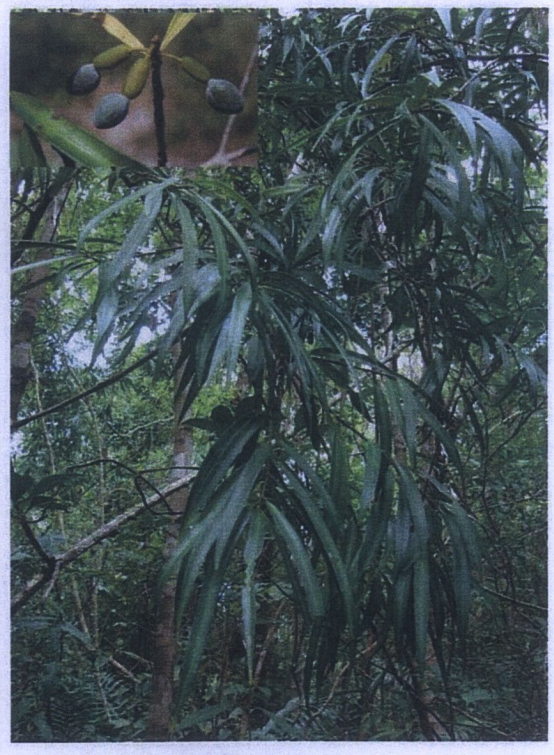
Microsorum punctatum (L.) Copel.

Schizaea dichotoma (L.) Sm.

Schizaea digitata (L.) Sw.

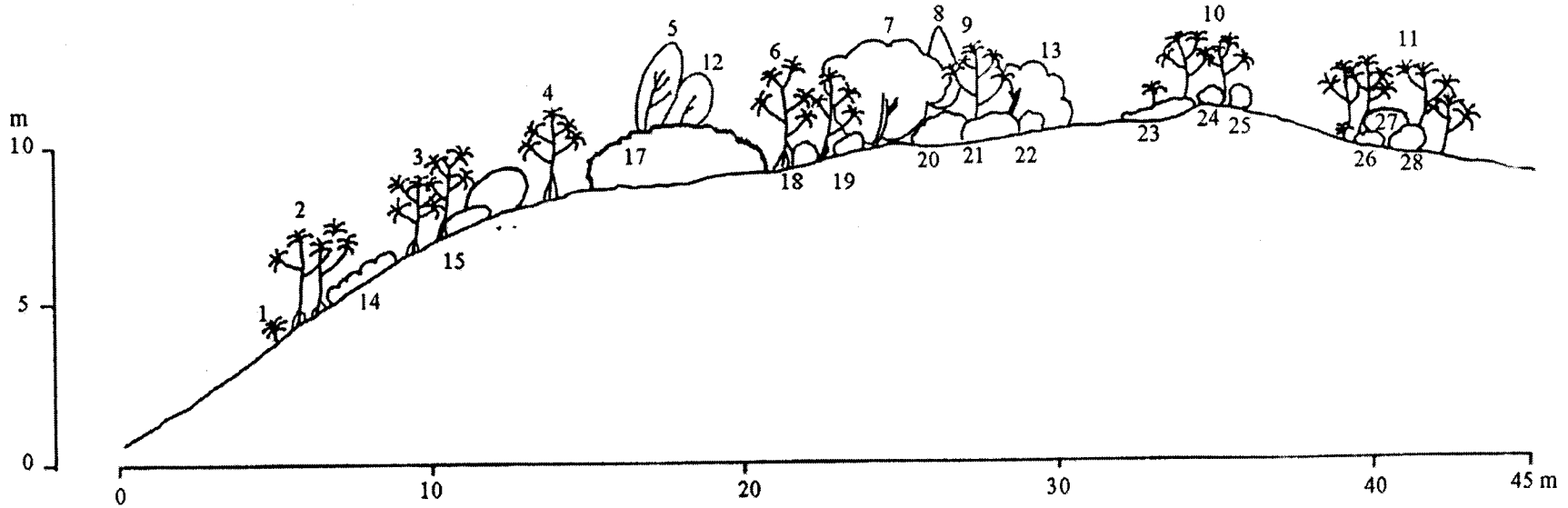


Cycas rumphii Miq.



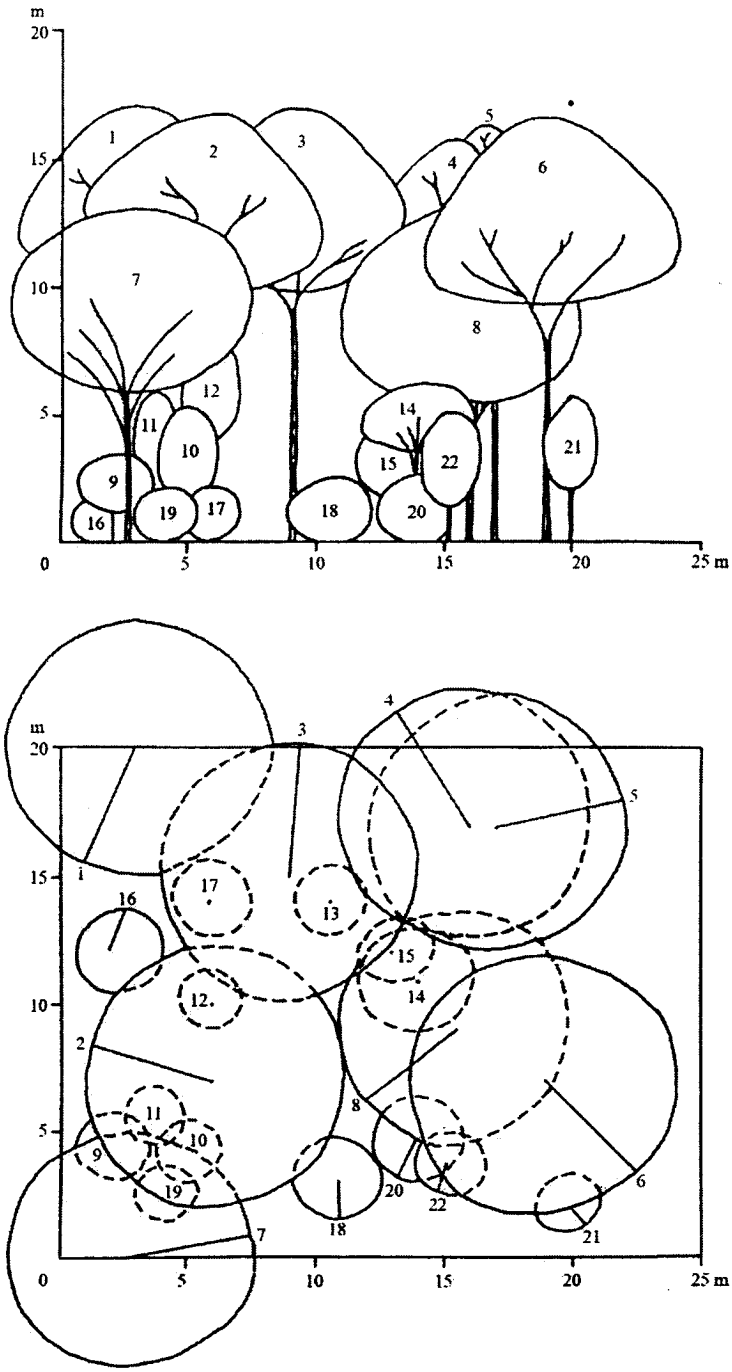
Podocarpus neriifolius D.Don.

Plate 18. Non-flowering plants 2.



1,2,3,4,6,9,10,11 *Pandanus odoratissimus* L.f.
12,16 *Syzygium gratum* (Wight) S.N. Mitra
15,25,26 *Diospyros ferrea* (Willd.) Bakh.
18,19,21,27 *Calophyllum pulcherrimum* Wall.
7,13 *Syzygium grande* (Wight) Walp.
8 *Eurycoma longifolia* Jack
20,22,24,28 *Ardisia crenata* Sims
14,23 *Tetracera indica* (Christm. & Panz.) Merr.
5 *Pouteria obovata* (R.Br.) Baehni
17 *Scaevola taccada* (Gaertn.) Roxb.

Figure 7. Profile of coastal scrub vegetation at Ban Bangboet (study site 1), Pathio district, Chumphon province.



1,2,3,4,5,6,10 *Dipterocarpus alatus* Roxb. ex G.Don.

7,8,14 *Carallia brachiata* (Lour.) Merr.

9, 22 *Syzygium grande* (Wight) Walp.

11 *Pouteria obovata* (R.Br.) Baehni

12,21 *Vatica harmandiana* Pierre

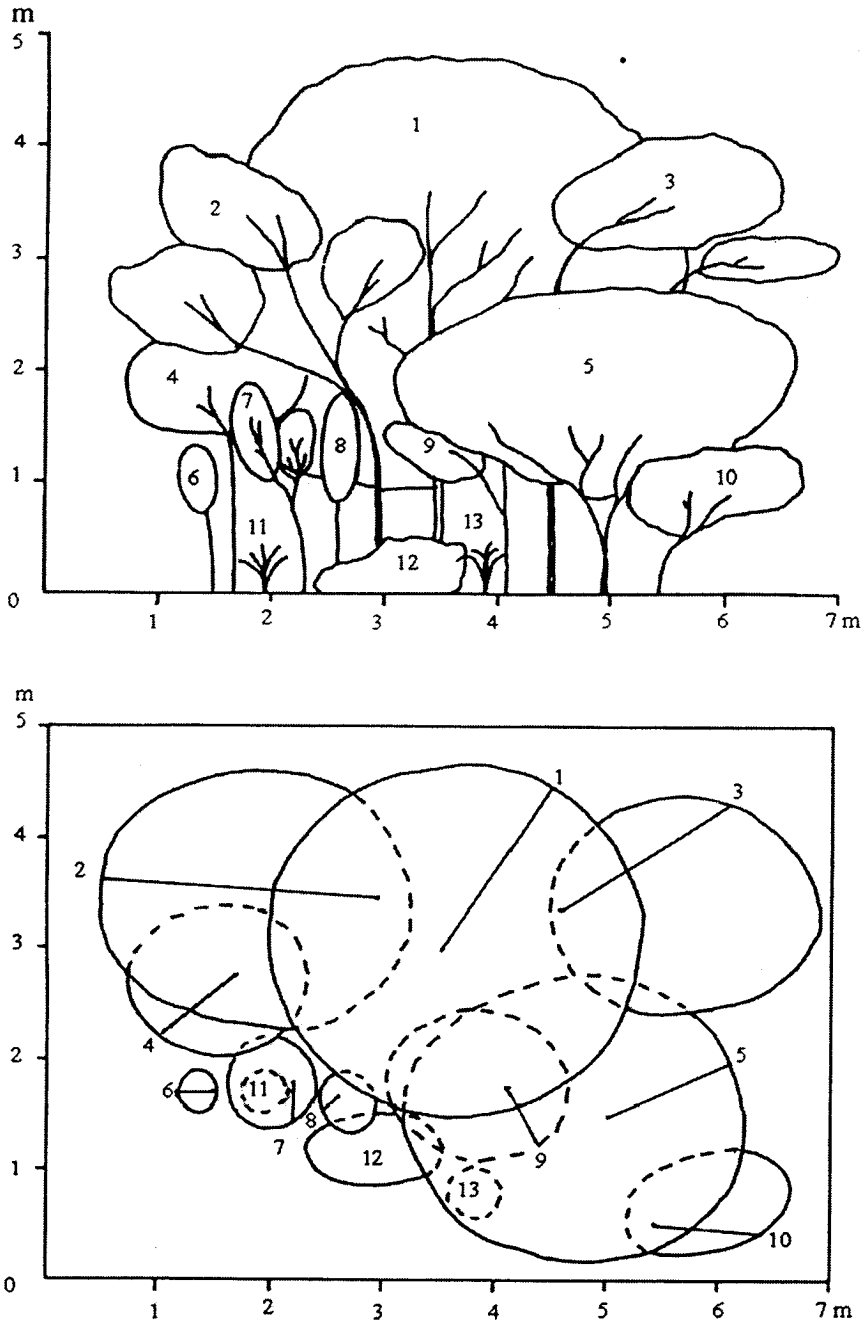
13 *Microcos tomentosa* Sm.

15 *Champereia manillana* (Blume) Merr.

16,17,18 *Rhodomyrtus tomentosa* (Aiton) Hassk.

19,20 *Breynia racemosa* (Blume) Mull. Arg.

Figure 8. Profile of coastal woodland vegetation at Ao Panang Tak (study site 2), Pathio district, Chumphon province.

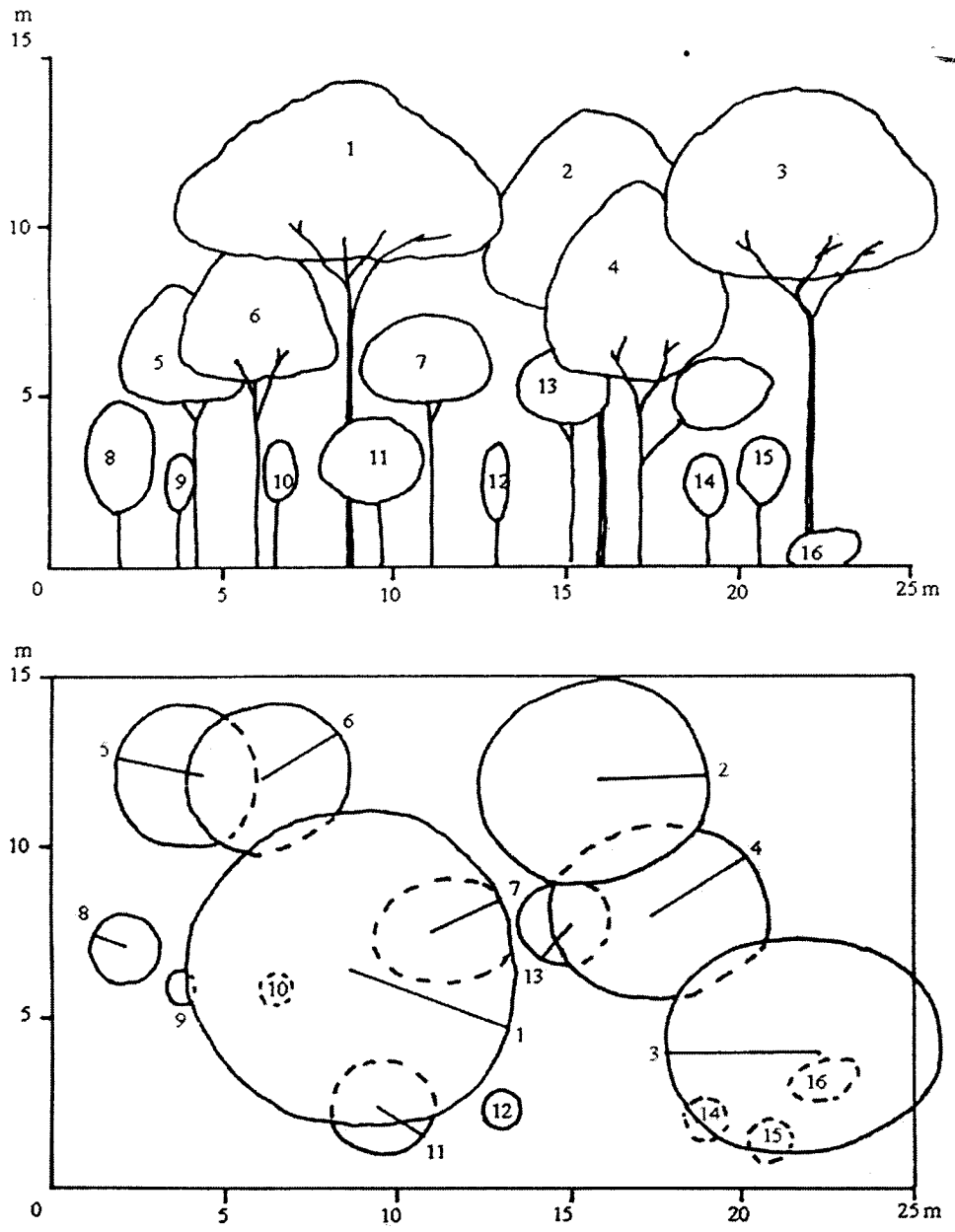


1,4,5,10 *Vatica harmandiana* Pierre 2,3,9 *Syzygium gratum* (Wight) S.N.Mitra.

6,7,8 *Eurycoma longifolia* Jack 11,13 *Dianella ensifolia* (L.) DC.

12 *Tetracera indica* (Christm. & Panz.) Merr.

Figure 9. Profile of coastal scrub vegetation at Ban Laem Pho 1 (study site 7), Chaiya district, Surat Thani province.

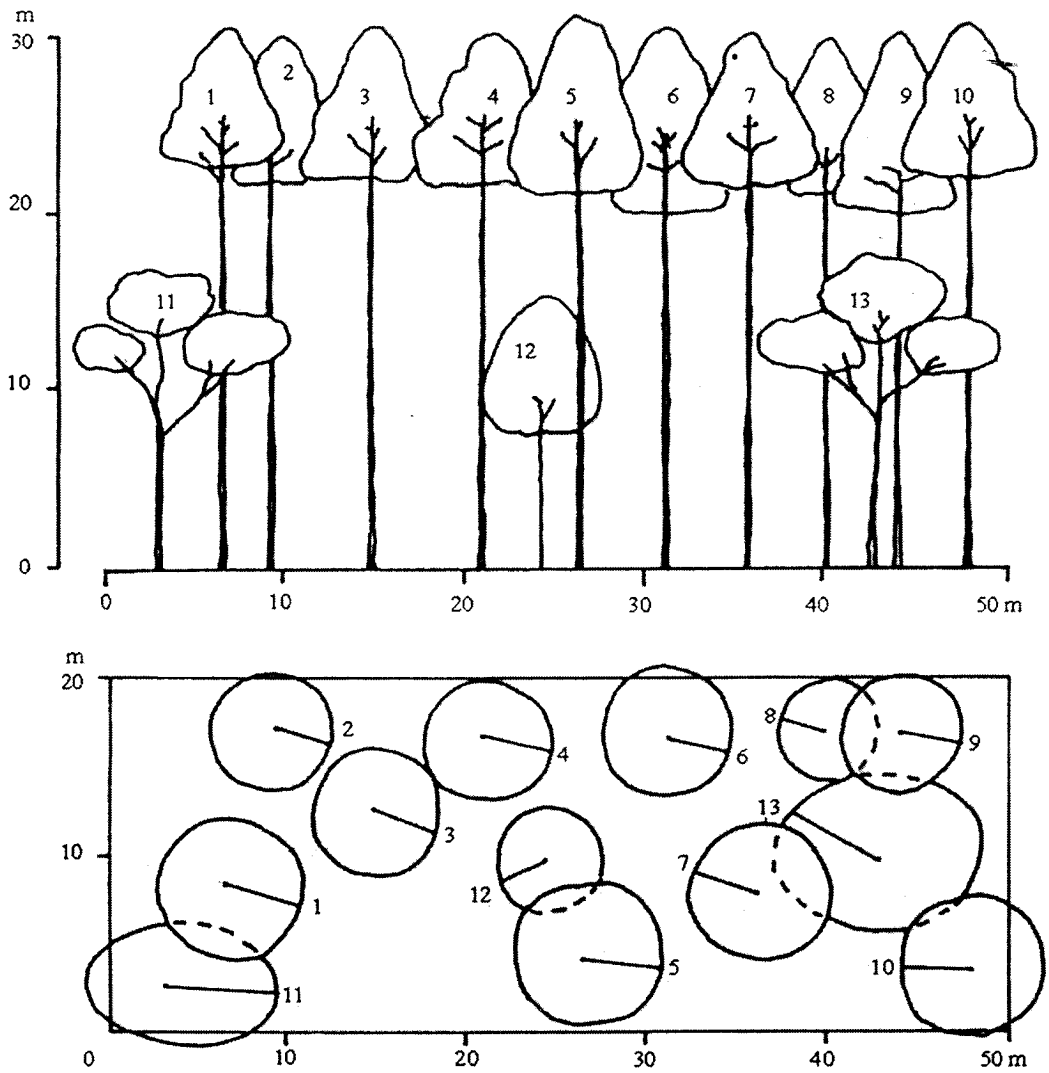


1,2,3,4,5,6 *Shorea roxburghii* G.Don — 7,8 *Vatica harmandiana* Pierre

9,10,12,14,15 *Eurycoma longifolia* Jack — 13 *Vitex pinnata* L.

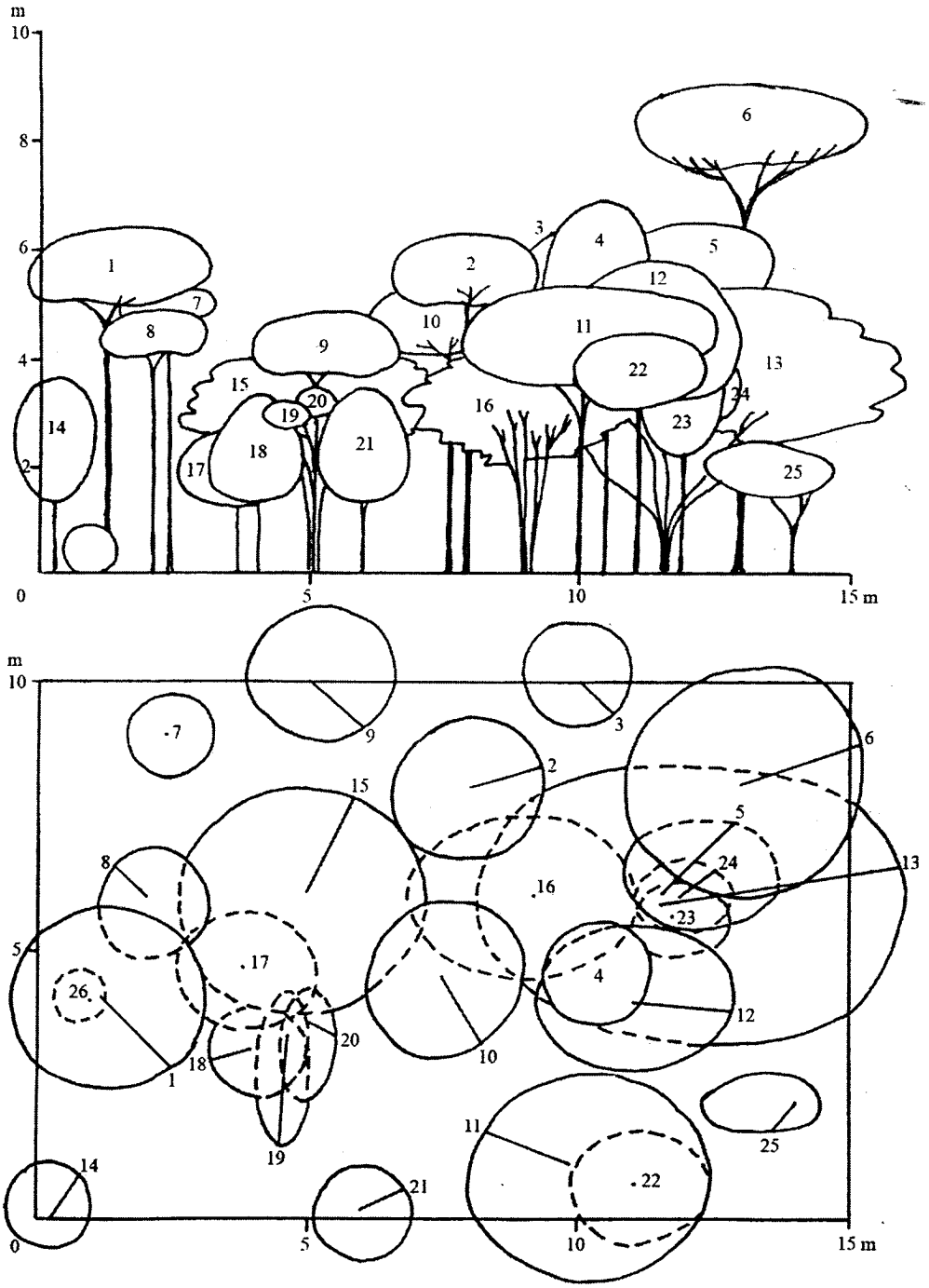
16 *Tetracera indica* (Christm. & Panz.) Merr. — 11 *Pouteria obovata* (R.Br.) Baehni

Figure 10. Profile of coastal woodland vegetation at Ban Laem Pho 2 (study site 8), Chaiya district, Surat Thani province.



1,3,4,5,6,7,8,9,10 *Dipterocarpus alatus* Roxb. ex G.Don 11,13 *Shorea roxburghii* G.Don
12 *Mangifera indica* L. 2 *Dipterocarpus chartaceus* Symington

Figure 11. Profile of coastal woodland vegetation at Ban Nuea (study site 9), Chaiya district, Surat Thani province.



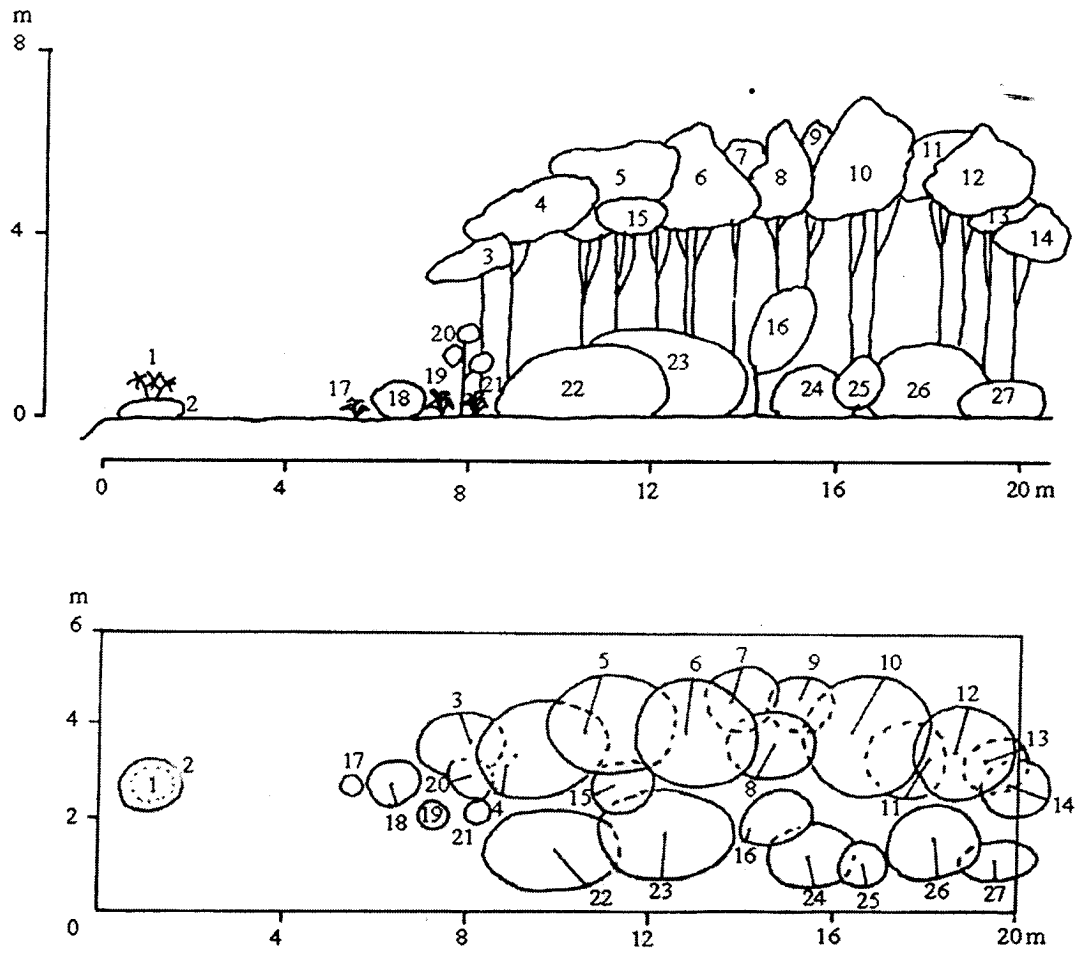
1,2,3,7,8,9,10,11,14,17,19,20,22 *Dipterocarpus obtusifolius* Teijsm. ex Miq.

4,5,6,12,24 *Syzygium grande* (Wight) Walp. 18,21,23 *Olea brachiata* (Lour.) Merr.

13 *Chaeticarpus castanocarpus* (Roxb.) 15,16 *Syzygium gratum* (Wight) S.N.Mitra.

25 *Calophyllum pulcherrimum* Wall. 26 *Prismatomeris tetranda* (Roxb.) K.Schum.

Figure 12. Profile of coastal woodland vegetation at Ban Natap (study site 10), Chana district, Songkhla province.



17,19,21 *Crinum northianum* Baker

16 *Diospyros areolata* King & Gamble

18 *Diospyros ferrea* (Willd.) Bakh.

24 *Rhodomyrtus tomentosa* (Aiton) Hassk

2,22,23,26 *Scaevola taccada* (Gaertn.) Roxb

3,4,5,6,7,8,9,10,11,12,13,14,15 *Pouteria obovata* (R.Br.) Baehni

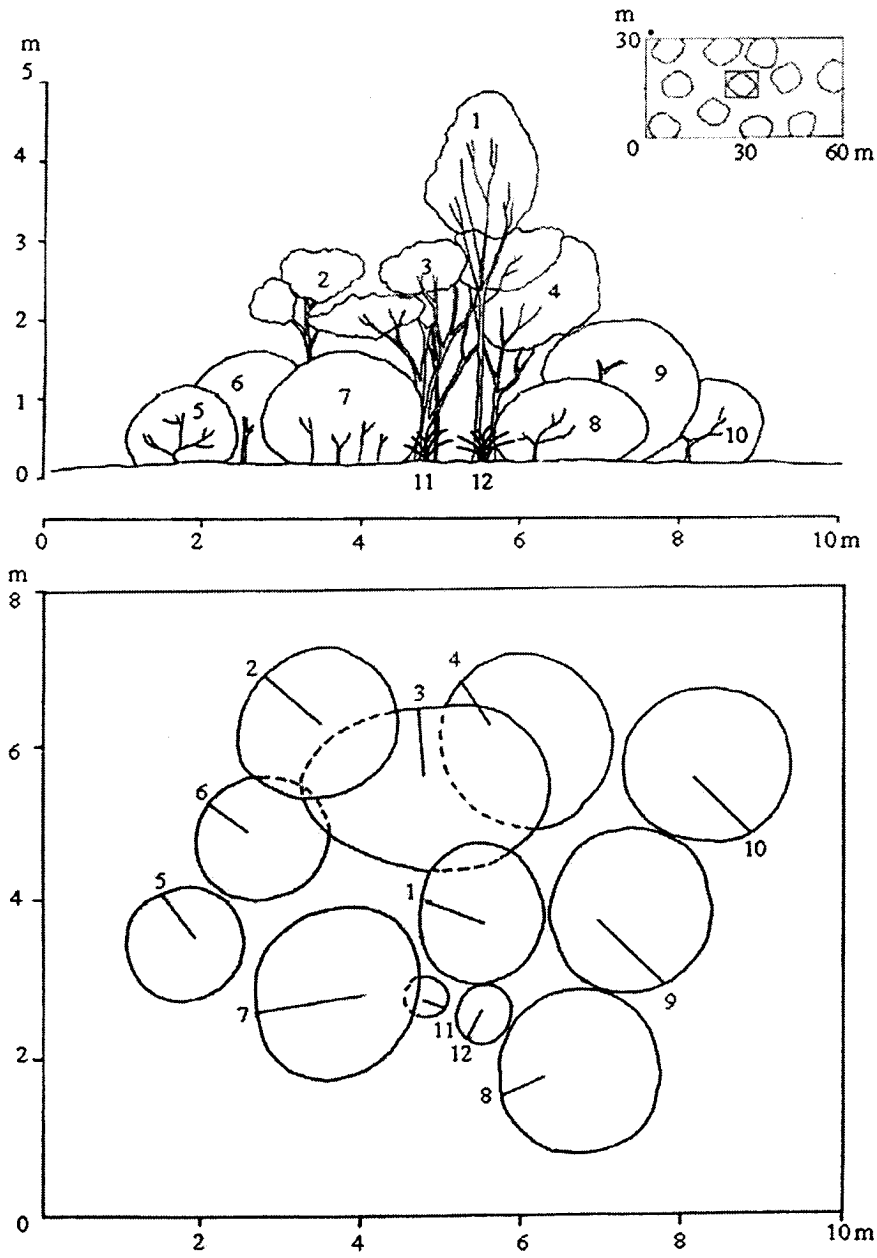
1 *Pandanus odoratissimus* L.f.

20 *Guettarda speciosa* L.

27 *Calophyllum pulcherrimum* Wall.

25 *Atalantia monophylla* (DC.) Correa

Figure 13. Profile of coastal scrub vegetation at Hat Thai Mueang (study site 11), Thai Mueang district, Phangnga province.

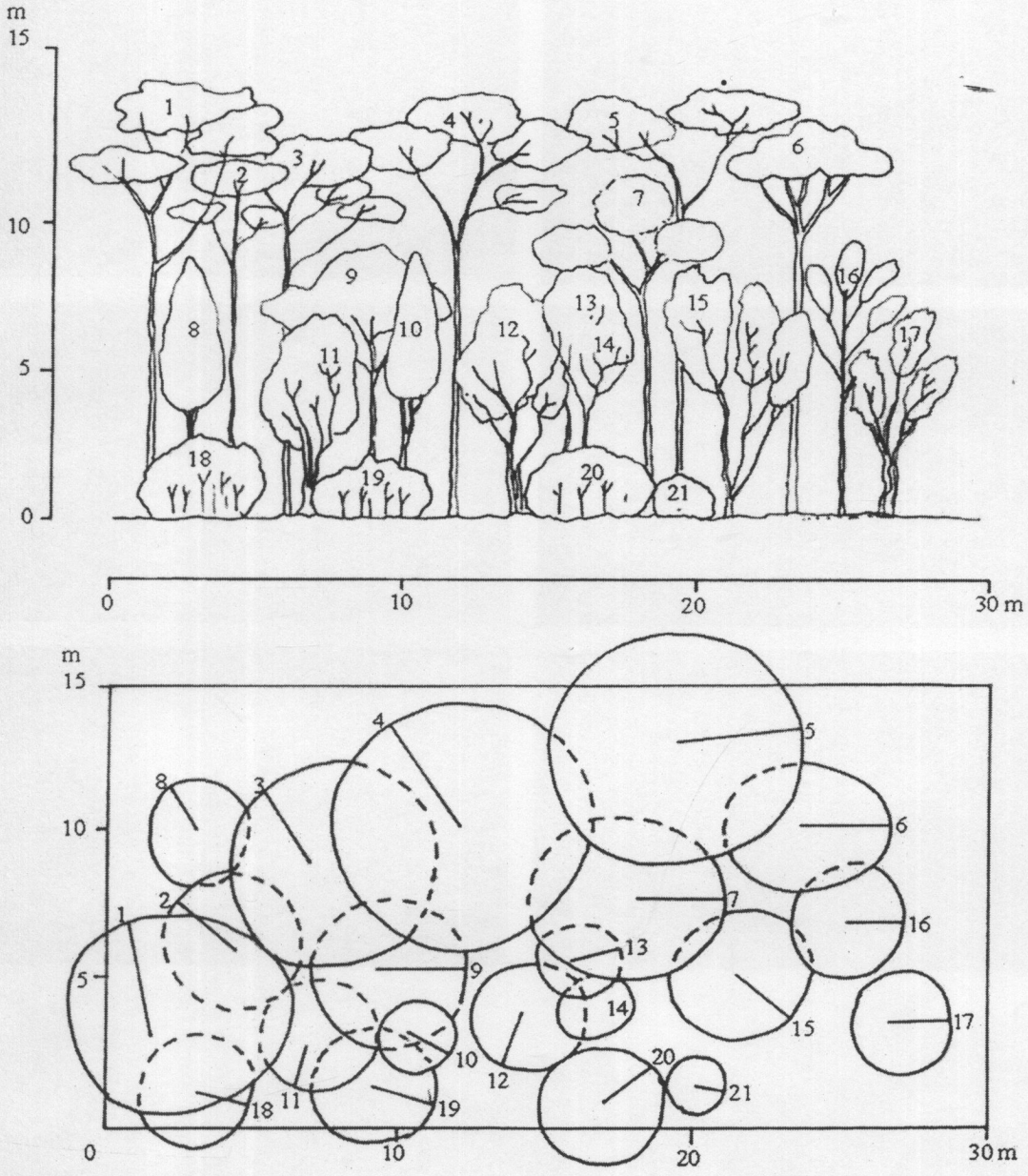


1 *Rapania porteriana* (A.DC.) Mez 2,3,4 *Syzygium gratum* (Wight) S.N.Mitra

5,8 *Styphelia malayana* (Jack) Spring 7 *Rhodamnia cinerea* Jack

6, 9,10 *Rhodomyrtus tomentosa* (Aiton) Hassk. 11,12 *Dianella ensifolia* (L.) DC.

Figure 14. Profile of coastal scrub vegetation at Hat Thai Mueang (study site 11), Thai Mueang district, Phangnga province.



1,2,3,4,5 *Shorea roxburghii* G.Don

6 *Syzygium grande* (Wight) Walp.

7 *Vitex pinnata* L.

8,10 *Vatica harmandiana* Pierre

9 *Acronychia pedunculata* (L.) Miq.

18,19,20 *Rhodamnia cinerea* Jack

21 *Rhodomyrtus tomentosa* (Aiton) Hassk.

11,12,13,14,15,16,17 *Syzygium gratum* (Wight) S.N. Mitra

Figure 15. Profile of coastal woodland vegetation at Hat Thai Mueang (study site 11), Thai Mueang district, Phangnga province.

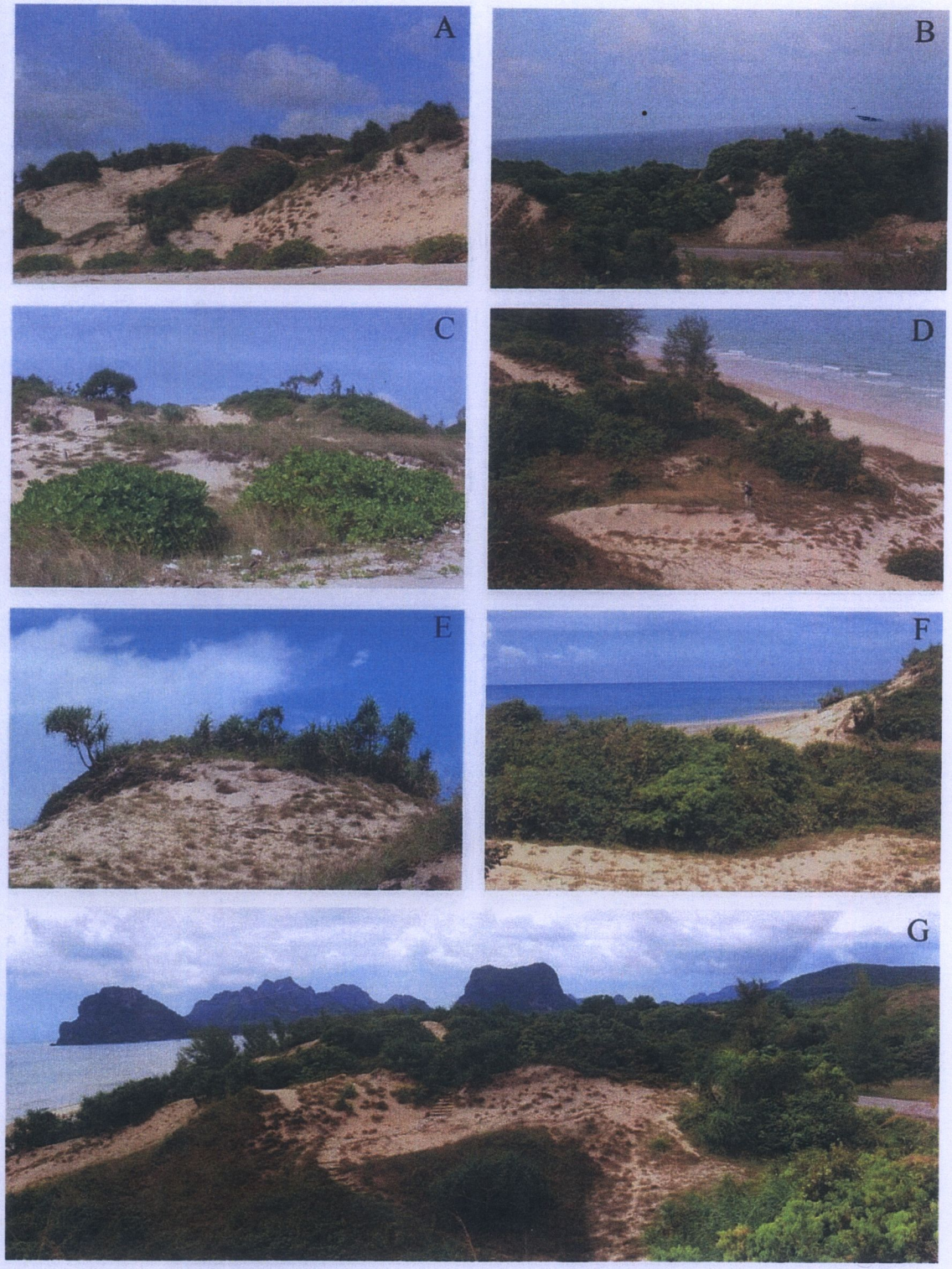


Plate 19. A-G Coastal vegetation at Ban Bangboet, Pathio district, Chumphon province. (study site 1)

Plate 20. A-G Coastal vegetation at Ao Phanang Tak, Mueang Chumphon district, Chumphon province. (study site 2)

Plate 21. A-H Coastal vegetation at Ban Pak Nam Tako, Thung Tako district, Chumphon province. (study site 3)

Plate 22. A-G Coastal vegetation at Ban Laem Santi, Lamae district, Chumphon province. (study site 4)

Plate 23. A-E Coastal vegetation at Ban Takrop, Chaiya district, Surat Thani province. (study site 5)

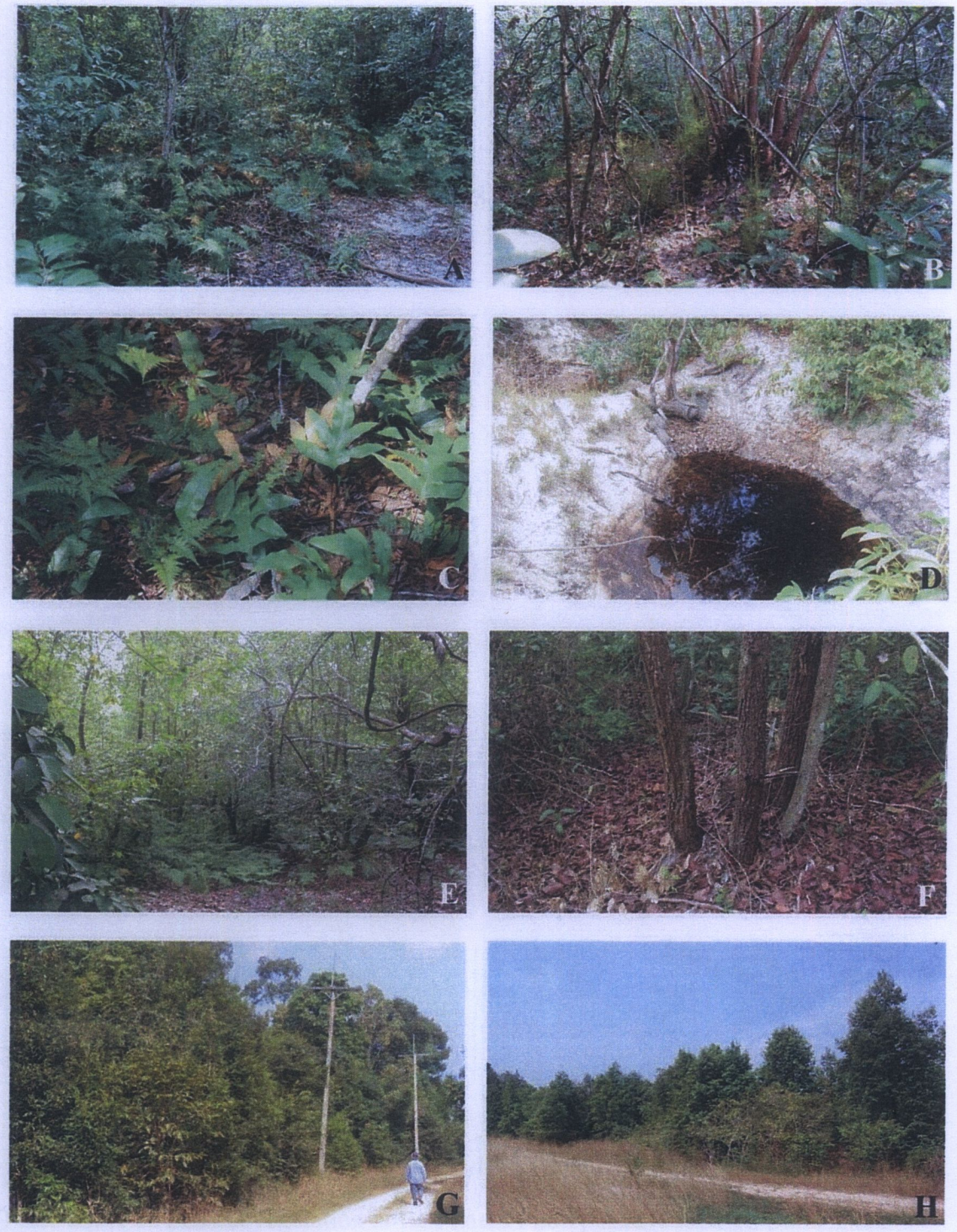


Plate 24. A-H Coastal vegetation at Ban Plongmai Chaiya district, Surat Thani province. (study site 6)

Plate 25. A-H Coastal vegetation at Ban Laem Pho 1, Chaiya district, Surat Thani province. (study site 7)

Plate 26. A-H Coastal vegetation at Ban Laem Pho 2, Chaiya district, Surat Thani province. (study site 8)

Plate 27. A-E Coastal vegetation at Ban Nuea, Chaiya district, Surat Thani province. (study site 9)

Plate 28. A-E Coastal vegetation at Ban Na Thap, Chana district, Songkhla province. (study site 10)

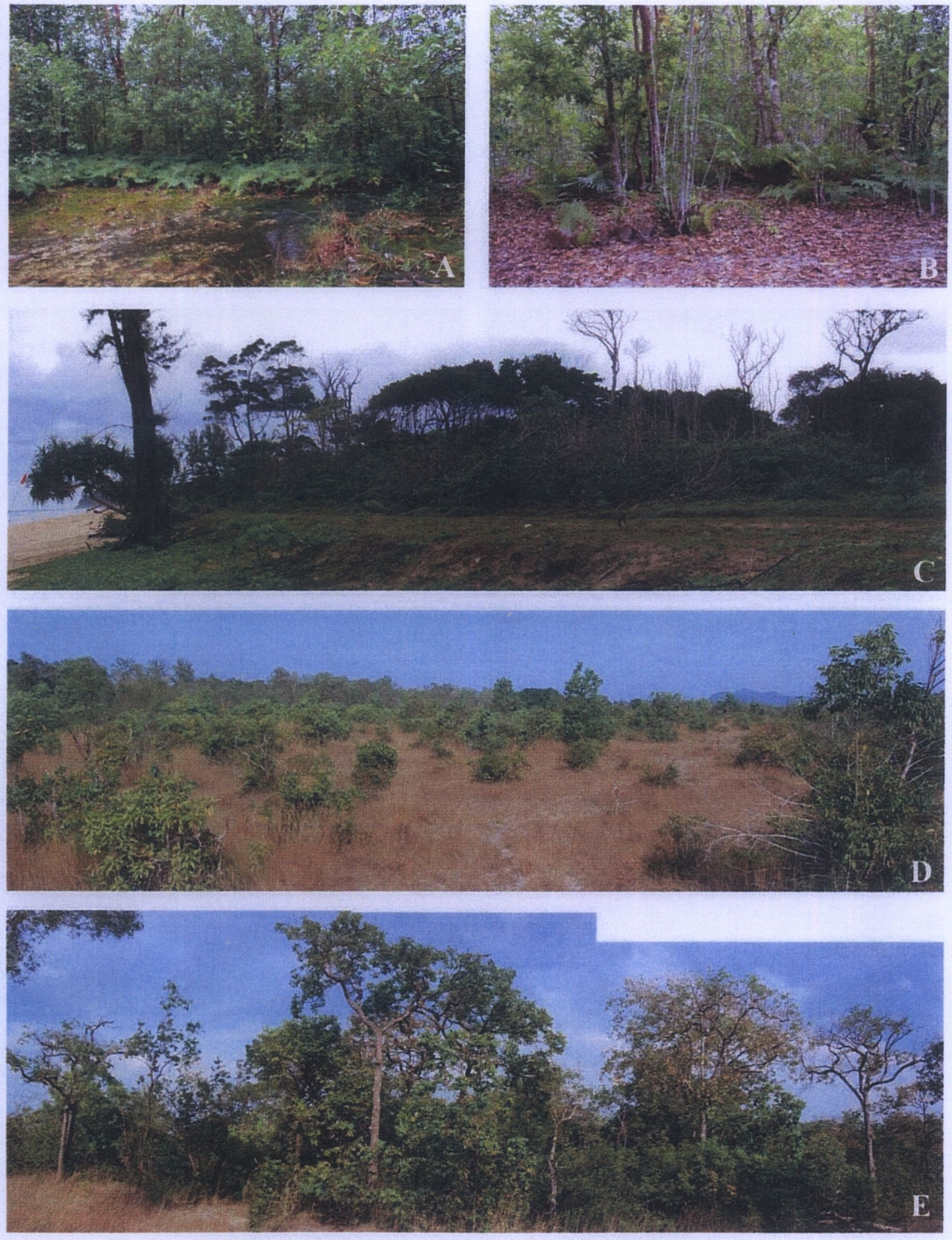


Plate 29. A-E Coastal vegetation at Hat Thai Mueang, Khao Lampi-Hat Thai Mueang National Park, Thai Mueang district, Phangnga province. (study site 11)

Plate 30. A-G Coastal vegetation at Hat Thung Thale, Thung Tale Non-hunting Areas, Ko Lanta district, Krabi province. (study site 12)

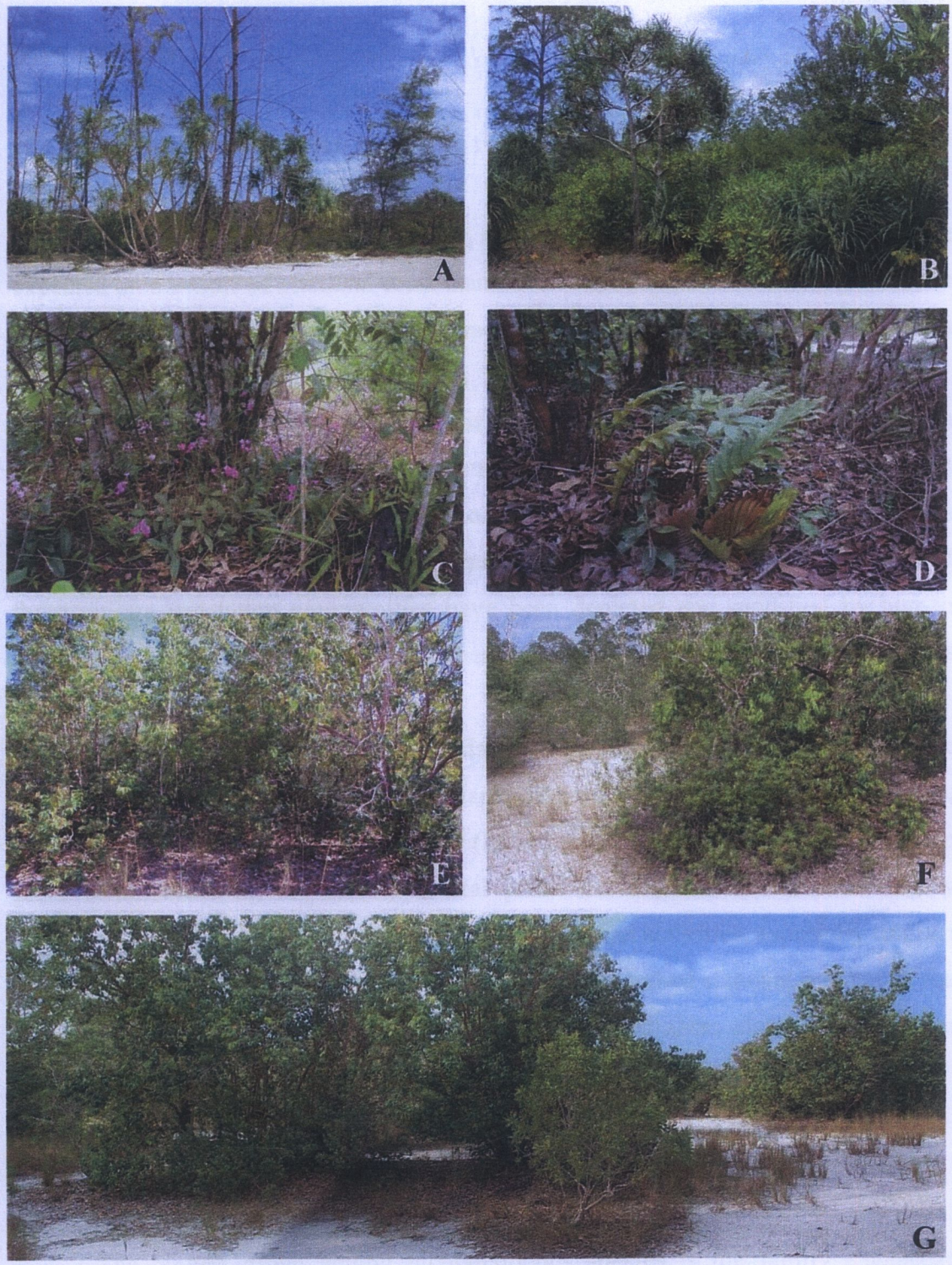


Plate 31. A-G Coastal vegetation at Hat Chao Mai National Park, Sikao district, Trang province. (study site 13)

DISCUSSION

1. Coastal plant comunities areas on the sandbars/dunes/beach in peninsular Thailand

More remnants of the peninsular natural coastal plant communities can be expected on the Gulf of Thailand coast than on the Andaman Sea coast because of the wider coastal plain of the former characterized by an emergent shoreline from Chumphon to Narathiwat (Figure 2).

The shoreline along the Gulf of Thailand is rather straight and smooth deposited sediments form many sandbars and offshore bars (Pongsaputra, 1991). On these long sandbars parallel to the coastline, unique plant communities have developed in a continuous strip from Chumphon to Narathiwat. However, most of these unique vegetation communities have been depleted and modified by human activities. As a consequence, many fragmentary remnants of those plant communities can be encountered along the coastline.

Unlike the eastern coast, the Andaman Sea coast is a submergent shoreline characterized by narrow coastal plains flanked by steep slopes, and in certain parts, sea cliffs are common in the landscape (Pongsaputra, 1991). However, the unique plant communities on the narrow coastal plains of the Andaman Sea are highly threatened or have even disappeared as a result of human activities, especially tourism and urban development. Only a few healthy or less disturbed remnant patches of the natural coastal vegetation can be witnessed in protected areas along the Andaman coast, either in national parks or non-hunting areas.

2. The Abundance of the plant species in the study areas

2.1 Flowering plants

The biggest group among dicotyledonous species is the family Rubiaceae (Table 6). Sixteen species had been recorded. The rishest group in monocotyledon species is the orchids (Table 7). Twenty-four species in eighteen genera of orchid family had been found. The interested groups of the monocotyledons are Cyperaceae and Poaceae, respectively (Table 7). They occur in the area next to the tidal zone.

1.2 Non flowering plants

On the ground layer (forest floor), there are fern species. A dominant group in the study area is the family Polypodiaceae (Table 8). There are seven species that recorded, i.e., *Drynaria quercifolia*, *Drynaria sparsisora, Microsorum scolopendria*, *Microsorum punctatum, Pyrrosia adnascens, Pyrrosia piloselloide and Pyrrosia longifolia*. Three gymnosperms were recorded in the study site, i.e., *Cycas rumphii*, *Gnetum* sp. and *Podocarpus neriifolius* (Table 8).

Species composition of the coastal plant communities on the sandbars and sand dune in peninsular Thailand

The species composition at the selected sites varies slightly from site to site according to local factors and the topography of the shoreline. However, all of the selected sites have quite a number of plant species in common. The most common species characterising the coastal plant communities on sandbars are tree species in the family Myrtaceae, i.e., *Syzygium grande* and *S. gratum* (Table 6). These two dominant species of the coastal vegetation on sandbars have also been reported by Congdon (1982), Sridith (2002), Sridith & Laongpol (2003), and Laongpol *et al.* (2005). The characteristically xeromorphic features of these plant species, such as sclerophyllous/succulent thick leaves, render them able to withstand the unfavourable environment of the coastal sandbars. In addition, there are many more plant species which can be found in common, e.g., tree species: *Chaetocarpus castanocarpus*, *Olea brachiata*, *Shorea roxburghii*; shrub species: *Melastoma malabathricum* , *Rhodomyrtus tomentosa*; climber species: *Aganosma marginata*, *Hoya parasitica*, *Psychotria sarmentosa*, *Tetracera indica* (table 6); herbaceous species: *Dianella ensifolia*, orchids: *Dendrobium crumenatum*, *Doritis pulcherima*, *Cymbidium findlaysonianum* and fern species: *Davallia denticulata*; *Drynaria sparsisora* (table 7). The term coastal heath forest mentioned by Congdon (1982) and Whitmore (1985) can also be applied to this coastal vegetation type. There is no doubt that this type of vegetation once occurred luxuriantly in a continuous strip along the coastal sandbars. Though all the remnant patches of the coastal vegetation on the sandbars, dunes and beaches on both sides of the peninsula harbour many plant species in common, only a

few are distributed on just one coast. *Hydrophylax maritima* (Rubiaceae) and *Styphelia malayana* (Epacridaceae) (Table 6), a Malesian element, for example, are distributed along the western coast of Thai-Malay peninsula to the northernmost limit in Thai Mueang beach, Phangnga province. On the eastern coast of peninsular Thailand, some Indo-Chinese elements have a southernmost limit at Bangboet, Pathio district, Chumphon province, such as *Sindora siamensis* (Fabaceae) (Table 6). It is interesting to note that *Podocarpus neriifolia* (Podocarpaceae) (Table 8), a rare gymnosperm species which is normally found in Thailand as a lower montane element above 600 m elevation, is for the first time recorded here near sea level on the coastal sandbar at Thai-Mueang beach, Phangnga province.

Vegetation profiles along the coastal sandbars in peninsular Thailand

The profiles of actual plant communities in the study areas (Figure 7–15) clearly exhibit various structures of the unique vegetation and typical floristic composition on the coastal sandbars. The vegetation can be divided into two main categories according to the topographic features of the sandbars.

1. Vegetation on coastal sandbars due to the sedimentation from sea currents

Twelve selected sites (No. 2–13) fall into this category. The vegetation of this kind, in general, can be subdivided into three main zones in accordance with previous studies of such vegetation on the eastern coast of the peninsular Thailand (Suzuki *et al.*, 2005), i.e., dune grassland communities; dune scrub communities and dune woodland communities. However, some features represent the transition between the various vegetation zones on the western coast and the eastern coast of the peninsula.

1.1 Vegetation on the eastern coast of peninsular Thailand (Figure 7–12, Plate 20-28)

The natural vegetation on the coastal sandbars of the east is likely to have extended from the North of the peninsula in Chumphon province and run continually throughout peninsular Malaysia. However, most of the natural vegetation on the eastern coast of peninsular Thailand has been depleted for a long time. Only the

remnants of the natural vegetation left in isolated patches along the coast can be recognized in some places. The remnants of such vegetation at "Chaiya sandbar" in Surat Thani province are typical of natural sandbar vegetation. In Chaiya district, many remnant patches of natural sandbar vegetation can be seen in fragmented patches along the Chaiya sandbars from Ban Takrop to Ban Nuea (Figure 9–11). The dune grassland communities, which lie next to the shoreline, consist of *Sesuvium portulacastrum*, *Ipomoea imperati*, *Ipomoea pes-caprae*, *Remirea maritima*, *Chrysopogon orientalis*, *Ischaemum muticum*, *Spinifex littoreus*, *Zoysia matrella*, *Vitex rotundifolia*, *Canavalia rosea* and *Vigna marina*. The next zone to the dune grassland is dune scrub communities (Figure 9) (site 7, Ban Laem Pho 1), which is the most distinct type and comprises many stunted shrubby tree species 5–8 m in hight, e.g., *Vatica harmandiana*, *Syzygium gratum*, *Eurycoma logifolia*, *Chaetocarpus castanocarpus*, *Lannea coromendelica*, *Rapanea porteriana*, *Olea brachiata*, *Acronychia pedunculata* and *Pouteria obovata*, shrub species such as *Salacia chinensis*, *Breynia racemosa*, *Suregada multiflorum*, *Melastoma malabathricum*, *Rhodomyrtus tomentosa*, *Catunaregam tomentosa*, *Atalantia monophylla*, *Micromelum minutum*. The ground cover consists of *Dianella ensifolia*, *Wikstroemia ridleyi*, orchids such as *Doritis pulcherrima*, ferns like *Davallia denticulata*, *Drynaria sparsisora* and vines such as *Cansjera rheedei*, *Psychotria sarmentosa*, *Dischidia major* and *Hoya parasitica* are scattered. The last zone is the dune woodland communities (Figure 8, 10, 11, 12). At Ban Laem Pho 2 (site 8) (Figure 10) which are three-storied. The canopy layer is 13–15 m in height and consists of *Shorea roxburghii*. The lower storey is 10–12 m in height and constituted by smaller trees such as *Vatica harmandiana* and *Vitex pinnata*. The undergrowth is composed of shrub species such as *Eurycoma longiflia*, *Pouteria obovata*, *Rapanea porteriana*, *Ochna integerrima*, *Ardisia crenata*, *Olea brachiata*, *Champereia manillana*, *Carallia brachiata*, *Ixora javanica*, *Micromelum minutum*, *Microcos tomentosa*, climbers such as *Tetracera indica*, *Ancistrocladus tectorius*, *Dischidia major*, *Hoya parasitica*, *Cansjera rheedei*, *Psychotria sarmentosa* and ferns such as *Davallia denticulata*, *Drynaria sparsisora*. Herbs such as *Dianella ensifolia* are also abundant. However, at the gulf at Ao Panang Tak (site 2) (Figure 8) and at the inland sanddunes at Ban Nuea (site 9) (Figure 11) and Ban Na Thap (site 10) (Figure 12), the woodland

communities possess three layers and differ slightly from the above. At Ao Panang Tak (site 2), the topmost storey there is 15-18 m in height and consists of *Dipterocarpus alatus*. The lower storey is 7-12 m in hight, consists of *Carallia brachiata, Vatica harmandiana* and *Pouteria obovata*. At Ban Nuea, the topmost storey there is 25–30 m in height, consisting of *Dipterocarpus chartaceus* and *D. alatus*. The lower layer is 15–20 m in height, comprising *Mangifera indica* and *Shorea roxburghii*. At Ban Na Thap the canopy layer is 7-9 m in height and consists of *Dipterocarpus obtusifolius*, *Syzygium grande*. The lower storey is 4-5 m in height and consists of *Dipterocarpus obtusifolius*, *Olea brachiata, Chaetocarpus castanocarpus, Syzygium gratum* and *Calophyllum pulcherimum*. The undergrowth of woodland vegetation has been disturbed by human activities, but there are some native species such as *Memecylon ovatum*, *Ardisia crenata*, *Ochna integerrima*, *Champereia manillana*, *Morinda elliptica*, *Rhodomyrtus tomentosa*, *Prismatomeris tetranda* and *Eurycoma longifolia*.

1.2 Vegetation on the western coast of the peninsular Thailand (Figures 13–15, plates 29-31)

Unlike the eastern coast of peninsular Thailand, the western coastal vegetation has developed on the narrow sandbars in small fragmented patches according to the topographic features of each coastal sandbar. However, almost all natural vegetation along the western coast of peninsular Thailand had been already destroyed or modified as a result of the tourism business, especially sea resorts. There are a few remnants of natural sandbar vegetation left in some protected areas along the coastline, such as Khao Lampi-Hat Thai Mueang National Park (site 11), Thung Thale non-hunting areas (site 12) and Hat Chao Mai National Park (site 13). The profiles of remnant patches at Hat Thai Mueang (site 11) seem to be typical representatives of sandbar vegetation along the western coast of the peninsular Thailand. Though some parts of the vegetation at Hat Thai Mueang were destroyed by the "Tsunami" tidal waves in 2005, the remaining fragmented patches left along the sandbar coast still exhibit typical sandbar vegetation along the western coast of the peninsula. The profile diagrams illustrate the structure of the plant communities in the areas from the tidal zone towards the innermost zone of the sandbar, i.e., coastal scrub (Figure 13).

The first area of coastal dune scrub community is composed of *Hydrophylax maritima*, *Ischaemum muticum*, *Crinum northianum*, *Scaevola taccada*, *Pandanus odoratissimus*, *Diospyros areolata*, *D. ferrea*, *Calophyllum pulcherimum*, *Rhodomyrtus tomentosa*, *Atalantia monophylla* and *Pouteria obovata*. On the inner dunes the coastal scrub community is scattered and separated by small patches of other plant communities (Figure 14; plate 29 D). They are formed by characteristic species of the sandbar vegetation on the western coast that differ from those on the eastern coast. Each small coastal dune scrub community is composed of tree or shrubby tree species, e.g., *Cotylelobium lanceolatum* and *Rapania porteriana* surrounded by other shrubby trees or shrub species, e.g., *Syzygium gratum*, *Styphelia malayana*, *Rhodamnia cinerea*, *Rhodomyrtus tomentosa* and some orchids, e.g., *Doritis pulcherrima*, *Dendrobium crumenatum*, *Dendrobium indivisum* and *Dendrobium pachyphyllum*. The coastal dune woodland communities (Figure 15) occur in a continual narrow strip according to the length of the dune, and possess three storeys. The canopy layer is 15–18 m in height and dominated by dipterocarp tree species, e.g., *Shorea roxburghii*. The lower tree layer is 8–10 m in height, comprising shrubby tree species, e.g., *Vatica harmandiana*, *Acronychia pedunculata*, *Pouteria obovata* and *Syzygium gratum*. The undergrowth consists of *Rhodamnia cinerea*, *Rhodomyrtus tomentosa* and *Calophyllum pulcherrimum* (for example); ferns are also frequent, such as *Drynaria sparsisora*, *Davallia denticulata*, *D. heterophylla*, *D. pectinata*, *Pyrrosia piloselloides*, *Schizaea dichotoma* and *S. digitata*.

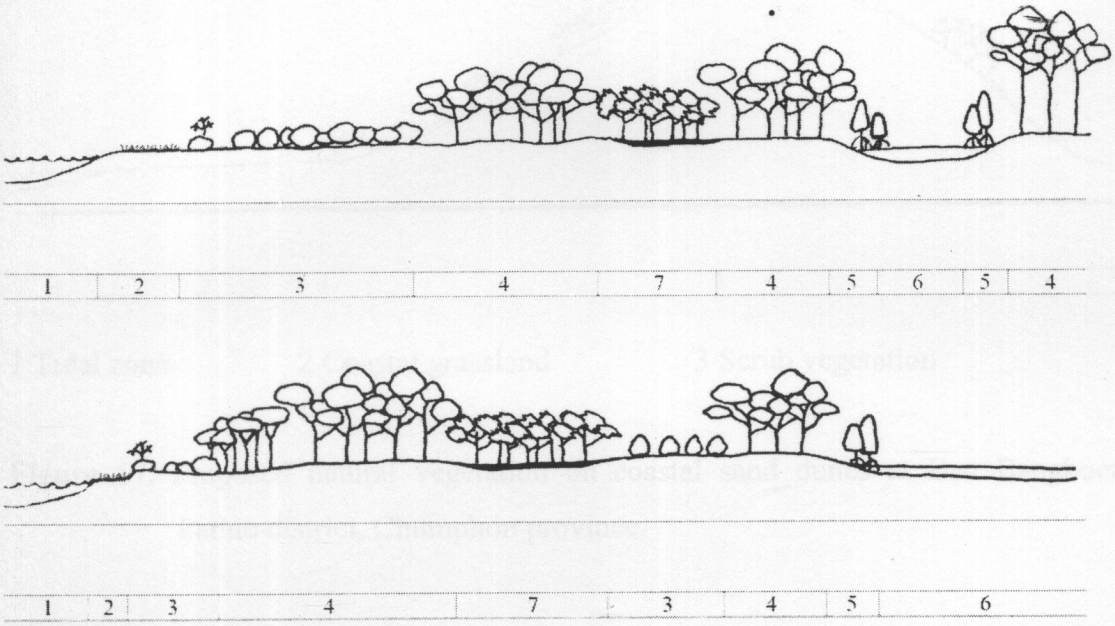
The natural vegetation profiles along the coastal sandbars of peninsular Thailand (Figure 16) may differ slightly from place to place in some details such as vegetation structure and floristic composition. However the profile of the vegetation on the sandbars along the coast shows that the gradient begins next to the tidal zone with coastal grassland in zone 2 (Figure 16), coastal scrub vegetation in zone 3 and woodland vegetation in zone 4 were found on the sandbars next to the shoreline while on the inland sandbars only woodland vegetation occurs which have also been reported by Sridith & Laongpol (2003). The establishment of the coastal dune grassland and coastal shrub communities, apart from edaphic factors, seem to be governed by strong winds from the open sea. Unlike the noticeably changeable zonations of the mangrove swamp community, the development and establishment of

coastal sandbar vegetation in term of species distribution are quite stable. In certain localities, mangrove and coastal sandbar vegetation are interrupted by a secondary swamp community dominated by pure stands of *Melaleuca cajuputi* Powell. in zone 7.

2. Vegetation on the coastal sandbars due to wind storms.

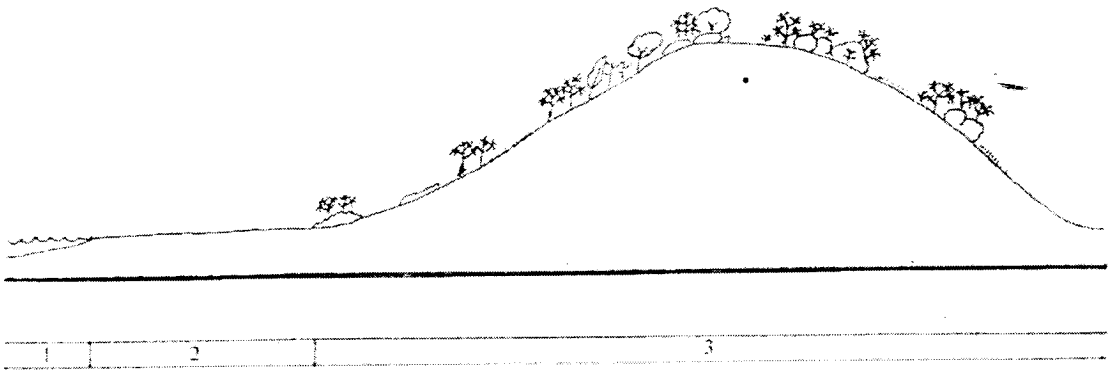
Only one site on the northernmost part of the peninsula is recognized (site 1). This is a characteristic community and unique on the plain of the eastern coast of peninsular Thailand. The site is located at Ban Bangboet, Pathio district, Chumphon province (Plate 19) characterized by the coastal sand dunes resulting from strong winds. The dune features are always subjected to change by the wind. In some places where the existing dunes are less affected by strong winds, the natural vegetation will develop quickly, as soon as the dunes are stable. Therefore, the possible and actual communities found on these unique topographic features are due to the unstable nature of the dunes. There are coastal dune grassland and coastal scrub communities. The coastal dune grassland is composed of *Ipomoea imperati*, *Ipomoea pes-caprae*, *Fimbristylis sericea* and *Cyperus stoloniferus*. Coastal scrub communities (Figure 7) are composed of shrubby tree and shrub species such as *Syzygium gratum*, *Eurycoma longifolia*, *Pouteria obovata*, *Calophyllum pulcherrimum*, *Sindora siamensis*, *Scaevola taccada*, *Pandanus odoratissimus*, *Diospyros ferrea*, *Ardisia crenata*. There are also climbers and herbs such as *Tetracera indica*, *Dunbaria bella* and *Dianella ensifolia*.

From these studies a profile of the natural vegetation on coastal sand dunes is presented (Figure 17). Sandbars were found only on the seashore, begins next to the tidal zone with narrow strip of coastal grassland and coastal scrub vegetation cover on sand dune.



1 Tidal zone
2 Coastal grassland
3 Scrub vegetation
4 Woodland vegetation
5 Mangrove forest
6 Marine swamp (under tidal condition)
7 Melaleuca (swamp) community

Figure 16. Proposed natural vegetation on the coastal sandbars of the peninsular Thailand: A. on the eastern coast at "Chaiya sandbars", Chaiya district, Surat Thani province; B. on the western coast at Hat Thai Mueang, Thai Mueang district, Phangnga province.



1 Tidal zone 2 Coastal grassland 3 Scrub vegetation

Figure 17. Proposed natural vegetation on coastal sand dunes at Ban Bangboet, Pathio district, Chumphon province.

CHAPTER 4
PHYTOSOCIOLOGY

RESULTS

The phytosociological data of the terrestrial vegetation along the coasts of the peninsular Thailand were collected from thirteen study sites from December 2006 to December 2008. The mentioned sites had been marked (Figure 2). Plant community types in each study site were analyzed according to the Braun-Blanquet Method (Zülich-Montpellier School) (Table 10-19).

Twenty-eight items of plant communities in three vegetation types, i.e., the Coastal Grassland Vegetation; the Coastal Scrub Vegetation and the Coastal Woodland Vegetation were identified including *Cyperus stoloniferus,* Vigno-ipomoetum pedis-caprae community (Ipomoea pes-caprae community), *Ischaemum mutricum* community, *Hydroyphyllex maritima* community, Glehnio-Spinificetum littorei (*Spinifex littoreus* community), *Fimbristylis sericea* community, *Dunbaria bella* community, Thareio-Viticetum routundifoliae (*Vitex rotundifolia* community), *Scaevola taccada* community, *Pandanus odoratisimus* community, *Calophyllum pulcherrimum* community, *Sindora siamensis* community, *Diospyros ferrea* community, *Polyalthia evacta* community, *Rhodomyrtus tomentosa* community, *Syzygium gratum* community, *Vacinum brateaum-Olea brachiata* sub-community, *Styphelia malayana-Rhodomnia cinerea sub-community, Micromelum minutum-Allophyllus cobbe* community, *Psychotria sarmentosa-Dipterocarpus obtusifolius* community, *Symplocos cochinchinensis-Lannea coromandelica* community, *Polyalthia evecta* sub-community, typical sub-community, *Memecylon scutellatum* sub-community, *Davallia denticulata–Vatica harmandiana* community *Rhodamnia cinerea–Syzygium gratum* community, Typical sub-community and *Styphelia malayana* sub-community.

A. Coastal Grassland Vegetation (Plate 32)

Seven plant communitiy types belong to a Dune Grassland Vegetation category:

1. *Cyperus stoloniferus* community (Table 10, Plate 33)

This is the farmost terrestrial plant community along the shoreline that occurring next to the tidal zone. It is dominated by *Cyperus stoloniferus* which are growing in dense extensive continual patches. This community had been analyzed at Ban Bangboet, Pathio district, Chumphon province and Ao Panang Tak, Mueang chumphon district, Chumphon province. The component species in this community are *Ipomoea pes-caprae* and *Canavalia rosea*. The total number of the species ranges from 1-3.

2. Vigno-ipomoetum pedis-caprae (*Canavalia rosea-Ipomoea pes-caprae* community) (Table 11, Plate 34)

This type of plant community are very common and be able to be found in all study sites of the present study. It is dominated and characterized by *Ipomoea pes-caprae* and *Canavalia rosea*, the common plant species in an open areas on the higher part (ridges) of the sandy beach or on the low dune plateau. The community height is ± 5-15 cm with 70-100 % coverage. Some other plant species which could be found are *Ischaemum muticum* and *Sessuvium portulacastrum*. The total number of plant species is 2-4.

This Vigno-Ipomoetum pedis-caprae occurs throughout the world both on the tropical and subtropical sand dunes (Suzuki *et al.* 2005). It is to be noted here also that the *Ipomoea pes-caprae* dominated community in Tropical Asia was also classified into the Vigno-ipomoetum pedis-caprae-association (Miyawaki and Suzuki, 1976).

3. *Ischaemum mutricum* community (Table 12, Plate 34)

This community has been occurring widely in all study sites next to the Vigno-ipomoetum pedis-caprae (*Canavalia rosea-Ipomoea pes-caprae* community) and is dominated by *Ischaemum muticum*. Other component species in the community are *Canavalia rosea*, *Ipomoea pes-caprae*, *I. imperati*, *Vitex rotundifolia*;

Chrysopogon orientalis and *Cyperus stoloniferus*. The total number of plant species ranges from 2-4.

4. *Hydrophyllex maritima* community (Table 12, Plate 34)

The *Hydrophyllex maritima* community was found only at the east coast of the peninsular Thailand at Hat Thai Mueang, Thai mueang district in Phangnga province. It is very exclusive and, therefore rare. The community had formed small patches in the same vegetation zone as *Ischaemum mutricum* community in other places. The companion species of the community are *Ipomoea pes-caprae*; *Canavalia rosea* and *Ischaemum muticum*. The total numbers of plant species of this community are 2-4.

5. Glehnio-Spinificetum littorei (*Spinifex littoreus* community) (Table 13, Plate 34)

This plant community is dominated and characterized by *Spinifex littoreus* which form a distinct large patch along the coasts where it occurred. It terminated the zone of coastal grassland vegetation (next to this mentioned community, the coastal vegetation would change to the coastal scrub one). The total coverage of the community could be 80-90 % and the height is 15-60 cm. Other species of this community are *Zoysia matrella*; *Ipomoea pes-caprae*; *Vitex rotundifolia* and *Sessuvium portulacastrum*. The total numbers of plant species of this community are 2-4.

According to the phytosociological comparison (Miyawaki and K. Suzuki, 1976), the Spinifex-dominated community can be sumaried into the association of Glehnio-Spinificetum littorei.

6. *Fimbristylis sericea* community (Table 14, Plate 35)

This community was found only once on the slope of a dune at Ban Bangboet, Pathio district in Chumphon province. The dominant species is *Fimbristylis sericea*. Other species found are *Ipomoea imperati and Ipomoea pes-caprae*. The community height is 30-40 cm with 70-100 % coverage. The total number of plant species ranges from 1-3.

7. *Dunbaria bella* community (Table 14, Plate 35)

This community is characterized by *Dunbaria bella* which was found only on the slope and top of sand dune at Ban Bangboet, Pathio district in Chumphon province. The companion species are *Chrysopogon oriantalis*; *Cyanotis cristata and Polycarpaea corymbosa*. The community height is 25-30 cm with 60-70% coverage. The total numbers of plant species are 2-3.

B. Coastal Scrub Vegetation

Nine plant community types belong to a Dune Scrub Vegetation category:

8. Thareio-Viticetum routundifoliae (*Vitex rotundifolia* community) (Table 15, Plate 36)

The Thareio-Viticetum routundifoliae is characterized and dominated by *Vitex rotundifolia*, which is 30-40 cm tall and and covers 50-90 %. This community was found at the edge between the Dune Grassland and the Dune Scrub Vegetation. Other species that occur in this community are *Spinifex littoreus* and *Zoysia matrella*. The total numbers of plant species are 2-4.

It is pertinent to note that the main species in this community, *Vitex rotundifolia* is a cosmopolitan one, since it is found throughout the tropical and subtropical coasts all over the world. The *Vitex rotundifilia* scrub community in the tropical Asia was classified into the Thareio-Viticetum routundifoliae (Ohba, Miyawaki and Tüxen, 1973).

9. *Scaevola taccada* community (Table 17, Plate 36)

The *Scaevora taccada* community is characterized and dominated by *Scaevola taccada* and *Pandanus odoratisimus*. The total number of plant species range from 2-10. Other plant species found are *Tetracera indica*; *Ipomoea pes-caprae*; *Cassytha filiformis* and *Vigna marina* and grass species, e.g., *Chrysopogon orientalis* and *Ischaemum mutucum*. This is composed as a dominant plant community of the first zone of coastal scrub community, next to the coastal grassland vegetation.

10. *Pandanus odoratisimus* community (Table 16, Plate 37)

This plant community is characterized by *Pandanus odoratisimus*. They were found scattering on the (wind-blown) sand dune of Ban Bangboet, Pathio in Chumphon province. The Other species are *Dianella ensifolia*; *Tetracera loureiri* and *Chrysopogon orientalis*. The total numbers of species are 3-4.

11. *Calophyllum pulcherrimum* community (Table 16, Plate 37)

This community is characterized by *Calophyllum pulcherrimum*. They were found, in the present study, only on the (wind-blown) sand dune at Ban Bangboet, Pathio in Chumphon province. Other species associated are *Dunbaria bella, Commelina* sp. etc. The total numbers of plant species are 3-4.

12. *Sindora siamensis* community (Table 16, Plate 37)

This community was found on sand dune at Ban Bangboet, Pathio in Chumphon province. This community characterize by a noticeable *Sindora siamensis*, which forms a low-open crowned community on the sand dune. This is rather characteristic as such community has never been recorded any where else in the peninsular Thailand or the adjacent areas both on the mainland South-East Asia and Islands in the same region. Other species found in the community are *Dunbaria bella Commelina* sp. etc. The total number of plant species ranges from 3-4.

13. Diospyros ferrea community (Table 16, Plate 37)

This community characterize by *Diospyros ferrea*. They were found only on the (wind-blown) sand dune at Ban Bangboet, Pathio in Chumphon province. Other species found are Chrysopogon orrientalis and Cyanotis cristata. The total numbers of plant species are 3-4.

14. *Polyalthia evacta* community (Table 16, Plate 37)

This community is characterized by *Polyalthia evacta*. Other species that could be found are *Chrysopogon orientalis*, *Cyanotis cristata and Cassytha filiformis*. This is the dominant plant community type that occurred in the zone of coastal scrub vegetation on sand dune. The total number of plant species ranges from

2-4.

15. *Rhodomyrtus tomentosa* community (Table 17, Plate 37)

This might be one of rather common (secondary) plant community on the coastal sand dunes/bars. It is characterized by *Rhodomyrtus tomentosa*. Other species found are *Erythroxylum cuneatum*; *Cassytha filiformis*; *Chrysopogon orientalis* and *Fimbristyris sericea*. This is the dominant plant community, occurring in separated patches in the coastal scrub vegetation on sand dune. The total number of plant species ranges from 4-11.

16. *Syzygium gratum* community (Table 18, Plate 36)

This community is characterized and dominated by *Syzygium gratum*, which was found at the innermost zone along the coastal areas of peninsular Thailand. The vegetation height is 2.5-10 m. The total number of plant species ranges from 10-17. The plant community was classified into two sub-community: a. *Vaccinium bracteatum-Olea brachiata* sub-community and b. *Styphelia malayana-Rhodamnia cinerea* sub- community. The *Vaccinium bracteatum-Olea brachiata* sub-community is characterized by *Vaccinium bracteatum* and *Olea brachiata*. The total numbers of plant specie is 10-17. Other species found in this sub-community are *Eurycoma longifolia*; *Cotylelobium lanceolatum*; *Rhodomyrtus tomentosa*; *Calophyllum pulcherrimum*; *Mischocarpus sandiacus* etc. The *Styphelia malayana-Rhodamnia cinerea* sub-community is characterized by *Styphelia malayana*, supposed to be a rare species in Thailand and *Rhodamnia cinerea*. The total numbers of plant species are 10-16. Other plant species that could be found in this sub-community are *Rhodomyrtus tomentosa*; *Memecylon edule*; *Doritis pulcherrima Psychotria sarmentosa* etc.

17. *Micromelum minutum-Allophyllus cobbe* community (Table 18, Plate 36)

This community is characterized by *Micromelum minutum*; and *Allophyllus cobbe*. The total number of plant species ranges from 9-11. Other plant species that could be found in this community are *Erythroxylum cuneatum*; *Casearia grewiifolia*; *Streblus asper*; *Lannea coromendelica*; *Microcos tomentosa* etc.

C. Coastal Woodland Vegetation (Coastal Forest Vegetation)

Most of the coastal areas in the peninsula Thailand were originally forested, with mangroves backed by swamp forests and terrestrial forest. However, most of the original vegetation has been cleared. But the forest vegetation on the coastal sandbars of the peninsula Thailand is slightly developed. The local people have maintained some natural coastal natural forests and trees for a long time. The forested areas serve as windbreaks and protection from blowing sand, and provide sites for a public cemetery, and other sacred places (Suzuki, Laongpol, and Sridth, 2005). The forest vegetation on the sandbars are now restricted to isolated small patches. All of the forests are similar in structure and physiognomy to lowland dipterocarp evergreen rain forest but with fewer component species per unit area and a lower canopy (maximum ca.30 meters). On the canopy layer, many tree species appear, among which *Dipterocarpus obtusifolia, Cotylelobium lanceolatum, Shorea roxburghii* and *Syzygium gratum* are most widely distributed. The forests are characterized by epiphytes (as many ferns and orchids) and climbers.

18. *Psychotria sarmentosa-Dipterocarpus obtusifolius* community (Table 19, Plate 38)

On the sandy dry habitat of the coastal dune area, the dipterocarp forests are developed. Data on vegetation at 2 sites were collected at Ban Na Thap (Chana district, Songkla province). The forests are summarized as a *Psychotria sarmentosa-Dipterocarpus obtusifolius* community. The community is characterized by the dominant *Dipterocarpus obtusifolia* and *Dendrotrophe buxifolia.* The tree-1 layer has a height of 15 m and 90 % coverage, the tre-2 layer has a heigh of 10 m and 80 %, the shrub layer has a height of 6 m and 60 % coverage, and the herb layer has a height of 1 m and 60-70 % coverage. The total number of species is 39 to 40. The main tree species, except the differential species, are *Dischidia major, Calophyllum pulcherrimum, Drynaria quercifolia, Rapanea porteriana, Chaetocarpus castanocarpus, Syzygium grande, Syzygium gratum, Olea brachiata, Dipterocarpus alatus* and *Ilex cymosa.* The shrub layer, meanwhile, consists of *Prismatomeris tetrandra, Davallia denticulata, Psychotria sarmentosa, Vaccinium bracteatum* and *Garcinia hombroniana.* The herb layer consists of *Ardisia crenata, Hoya parasitica,*

Doritis pulcherrima and *Dianella ensifolia.*

The *Dipterocarpus obtusifolia*-dominated forests were one of the common types of natural vegetation on the coastal lowland areas of peninsular Thailand in the old days, but, nowadays, the community is not distributed as widely along the coastline, and it occupies only small areas. Although the *Psychotria sarmentosa–Dipterocarpus obtusifolius* community at Ban Na Thap is strongly influenced by human activities such as agriculture, it is a fragmentary natural forest from the phytosociological viewpoint.

This community occurs on the inland sand dune, which is close to the swamp areas (*Melaleuca cajuputi* community). There is a thick litter (leaf litter) on the ground and a thick fibrous root system near the soil surface.

This study site is rather small. It is a local public cemetery (in Thai belief, the plants and trees in the cemetery should not be cut as they believe that there are spirits who protect those trees, and this is why the natural plant community patches have been kept in rather good shape). In addition, there are oil palm and rubber plantations in the surrounding areas.

19. *Symplocos cochinchinensis-Lannea coromandelica* community (Table 19, Plate 39)

The typical forest vegetation of the coastal sand bars in the northern part of peninsular Thailand is united into the *Symplocos cochinchinensis-Lannea coromandelica* community with *Symplocos cochinchinensis, Lannea coromandelica, Chassalia curviflora, Breynia glauca* and *Schima wallichii* being the differential species.

The community with rich in broad-leaved tree species, is composed of: a) tree layer-1, having a height of 15–30 m; b) tree layer-2, having a height of 10–15 m; c) a shrub layer having 4–8 m; and d) an herb layer having 1–1.5 m. The total number of component species in the association ranges from 54 to 70 based on the data collected from the 5 stations. The surveyed area of each station is 225–400 square meters. The main species of tree-1 and tree-2 layers are *Lannea coromandelica, Cotylelobium lanceolatum, Drynaria quercifolia, Mischocarpus sundaicus, Vatica*

harmandiana, Psychotria sarmentosa, Garcinia cowa, Eurycoma longifolia, Aporosa symplocoides, Schima wallichii, Cansjera rheedei, Memecylon ovatum and *Pleurostylia opposita.* The shrub layer, meanwhile, consists of *Champereia manillana, Prismatomeris tetrandra, Symplocos cochinchinensis, Abrus precatorius, Viscum articulatum, Davallia denticulate, Ochna integrrima, Vaccinium bracteatum,* and *Garcinia hombroniana.* The herb layer is mainly composed of *Chassalia curviflora, Ardisia crenata, Tetracera indica, Dianella ensifolia* and *Doritis pulcherrima.*

From the phytosociological viewpoint, the *Symplocos cochinchinensis-Lannea coromandelica* community is divided into three sub-communities: a. sub-community of *Polyalthia evecta*, b. typical sub-community, and c. sub-community of *Memecylon scutellatum.*

a. Sub-community of *Polyalthia evecta* (Table 19)

The sub-community of *Polyalthia evecta* is dominated by *Shorea roxburghii* (Dipterocarpaceae) and characterized by *Polyalthia evecta, Shorea roxburghii, Tacca integrifolia, Bridelia ovate, Vatica harmandiana, Leucas zeylanica, Triumfetta grandidens* and *Amorphophallus* sp. The *Polyalthia evecta* sub-community is composed of 4 layers. The tree-1 layer has an 18–30 m and 90–95 % coverage. The main tree species are *Shorea roxburghii, Vatica harmandiana and Lannea coromandelica.* The main species in the tree-2 layer is *Eurycoma longifolia.* The main species in the shrub layer are *Symplocos cochinchinensis, Champereia manillana* and *Garcinia hombroniana.* The main species in the herb layer are *Chassalia curviflora, Polyalthia evecta, Dianella ensifolia, Tacca integrifolia, Dioscorea pentaphylla* and *Amorphophallus* sp. Total number of component species is 54 to 63. Data on vegetation at 4 sites were collected at Ban Nuea and Ban Laem Pho 2, Chaiya district, Surat Thani province.

This community occurs on the fore-dune and inland sand dune. It is a dry habitat close to the swamp areas (*Melaleuca cajututi* community) and mangrove forest. These areas have been disturbed by local people for a long time. They use the land for sedimentation and agricultural purposes. Most of the big trees, such as *Shorea roxburghii*, have been cut for charcoal making.

b. Typical sub-community (Table 19)

The typical sub-community of the *Symplocos cochinchinensis-Lannea coromandelica* community is dominated by *Cotylelobium lanceolatum* and is composed of 3-4 layers. The tree-1 layers have a 15–20 m and 80-90 % coverage. The main tree species are *Cotylelobium lanceolatum, Drynaria quercifolia, Mischocarpus sundaicus, Canjera rheedei, Vatica harmandiana, Garcinia cowa, Hopea odorata, Garcinia hombroniana* and *Mangifera* sp. The shrub layer has a height of 6 m and 40-60 % coverage. The dominant species in this layer are *Champereia manillana, Abrus precatorius* and *Davallia denticulata.* The dominant species in the herb layer are *Dianella ensifolia, Ardisia crenata* and *Eulophia andamanensis*. Total number of component species is 65 to 70. Data on vegetation at 2 sites were collected at Ban Takrop and the forest reserve at Ban Plongmai, Chaiya district, Surat Thani province.

This community occurs at the fore-dune areas, which is close to the swamp areas (*Melaleuca cajuputi* community) and mangrove forest. It is the secondary forest on a sandy habitat that has a thin litter layer on the ground. The local people use big trees such as *Cotylelobium lanceolatum* and *Vatica harmandiana* for wood and charcoal making. Ground covers are still common in dense thickets; therefore, many epiphytes such as orchids (e.g., *Doritis pulcherrima)* as well as ferns (e.g., *Drynaria* spp.) are quite common on the ground.

c. Sub-community of *Memecylon scutellatum* (Table 19)

The sub-community of *Memecylon scutellatum* is the mixed forest vegetation with rich in broad-leaved tree species, and it is characterized by *Memecylon scutellatum, Guioa pleuropteris* and *Ancistrocladus tectorius.* The *Memecylon scutellatum* sub-community is composed of 3–4 layers. The tree layers have a 15–20 m and 40–70 % coverage. The rate which covers the upper layer is low. The main tree species are *Cotylelobium lanceolatum, Drynaria quercifolia, Schima wallichii, Memecylon scutellatum, Pittosporum ferrugineum, Cansjera rheedei, Chaetocarpus castanocarpus, Mischocarpus sundaicus, Psychotria sarmentosa, Garcinia cowa, Aporosa symplocoides, Pleurostylia opposita, Memecylon ovatum* and *Ilex cymosa*. The shrub layer has a height of 5–8 m and 30-90% coverage. The dominant species in this layer are *Champereia manillana, Prismatomeris tetrandra*

and *Symplocos cochinchinensis.* The herb layer has a height of 1.5 m and 60–80 % coverage. The dominant species in the herb layer are *Chassalia curviflora, Abrus precatorius* and *Vaccinium bracteatum.* Total number of component species is 54 to 67. Data on vegetation at 6 sites were collected at Ban Laem Santi, Lamae district, Chumphon province.

This sub-community the areas behind the beach (coastline). It is the secondary forest on a sandy habitat which has a thin litter layer on the ground. Most tall trees and shrubs have been cut for woods and charcoals, but in spite of that, some interesting ground covers, e.g., orchids, could be seen in some parts of the areas.

20. *Davallia denticulata–Vatica harmandiana* community (Table 19, Plate 40)

Secondary forests in the coastal areas at Ban Laem Pho 1 station are summarized into a *Davallia denticulata–Vatica harmandiana* community. The *Davallia denticulata–Vatica harmandiana* community is dominated by *Vatica harmandiana* of about 10–15 m in height. The community is composed of: a) a tree layer having a height of 10–15 m and 5-95 % coverage; b) a shrub layer having 8–10 m and 4–95 % coverage; and c) an herb layer having 0.5-1 m and 10–50 % coverage. The main species in the tree layer are *Drynaria quercifolia, Olea brachiata, Syzygium gratum, Psychotria sarmentosa, Vatica harmandiana* and *Cratoxylum cochinchinense.* The dominant species in the shrub layer is *Davallia denticulata.* The dominant species in the herb layer is *Dianella ensifolia.* Total number of component species is 51 to 52. Data on vegetation at 3 sites were collected at Ban Laem Pho 1, Chaiya district, Surat Thani province.

This community occurs at the foredune which is close to the swamp area (*Melaleuca cajuputi* community). It is a dry habitat with very low nutrients. There is almost no organic layer on the ground.

21. *Rhodamnia cinerea–Syzygium gratum* community (Table 19)

Secondary mixed forest vegetation with rich in broad-leaved tree species in the coastal areas at Hat Thai Mueang station are summarized into the

Rhodamnia cinerea–Syzygium gratum community. The *Rhodamnia cinerea–Syzygium gratum* community is characterized by *Rhodamnia çinerea, Arachnis flosaeris, Podocarpus neriifolius, Cycas rumphii, Dendrobium pachyphyllum* and *Dracaena* sp. Total number of component species is 46 to 61. The community is composed of: a) a tree layer having a height of 10–15 m; b) a shrub layer having 3–10m; and c) an herb layer having 0.4-1 m. The main species of tree layer are *Arachnis flosaeris, Podocarpus neriifolius, Syzygium gratum, Vatica harmandiana, Drynaria quercifolia, Psychotria sarmentosa, Eurycoma longifolia, Mischocarpus sundaicus, Dischidia major* and *Acronychia pedunculata.* The dominant species in the shrub layer are *Rhodamnia cinerea, Micromelum minutum, Alyxia reinwardtii* and *Memecylon ovatum.* The dominant species in the herb layer are *Dianella ensifolia, Doritis pulcherrima, Rhodamnia cinerea, Ardisia crenata, Thrixspermum calceolus, Doritis pulcherrima* and *Shizaea dichotoma.*

Data on vegetation at 5 sites were collected at Hat Thai Mueang (Khao Lampi-Hat Thai Mueang National Park, Thai Mueang district, Pangnga province, Thailand). From the phytosociological viewpoint, the community is divided into two sub-communities: a. the typical sub-community and b. the sub-community of *Styphelia malayana.* The typical sub-community is dominated by *Syzygium gratum* and *Vatica harmandiana.* The sub-community of *Styphelia malayana* is characterized by *Styphelia malayana, Eria affinis, Dendrobium indivisum, Bulbophyllum planibulbe, Hydrophytum formicarum* and *Thrixspermum calceolus.* The species richness of the epiphytes as many ferns and orchids, is the outstanding characteristic of the sub-community.

It is the primary coastal forest occurring on the sand dune. It is situated at the last zone concerning the coastline between the swamp area (*Melaleuca cajuputi* community) and the mangrove forest. It is rather humid (in the dry season), compared with other sites. There is a thick litter layer. There are noticeable orchids and bryophyte species on the ground in this site.

DISCUSSION

The terrestrial plant community along the coast of the peninsular Thailand could be divided into three main types according to the habits of the dominant plants species and the vegetation height: 1. Coastal Grassland Vegetation 2. Coastal Scrub Vegetation and 3. Coastal Woodland Vegetation.

1. Coastal Grassland Vegetation.

The coastal grassland vegetation established on the seashore next to the tidal zone.

In general, the coastal grassland vegetation on both sites of the Peninsular are not different. Some common plant communities could be detected on both sites ie: *Ischaemum mutricum* community Glehnio-Spinificetum littorei (*Spinifex littoreus* community) and Vigno-ipomoetum pedis-caprae (*Canavalia rosea-Ipomoea pes-caprae* community). However, slightly differences on two sites, depending on the topographic of sandbars and distribution pattern, were recorded as followed:

The Ban Bangboet (wind-blowed) sand dune

At sand dunes resulting from strong wind at Ban Bangboet, Pathio district Chumphon (east coast). There are plant communities such as *Fimbristylis sericea* community which developed especially at the steep slope facing the strong wind from the east. This community dominate by *Fimbristylis sericea*, *Ipomoea pes-caprae* and *Ipomoea imperati*a. The community at the middle and top of the dunes which dominated by *Dunbaria bella.*

The west coast sandy beach

On the sandy beach sites of the west coast of the peninsula, *Hydroyphyllex maritime* community which dominate by *Hydrophyllex maritima* were recorded in only one site at Hat Thai mueang, Thai mueang Phangnga province.

2. Coastal Scrub Vegetation

There is not much difference among the coastal scrub vegetation all over the both sites of the peninsular Thailand. This common coastal scrub vegetation is composed of plant communities, i.e., Thareio-Viticetum routundifoliae (*Vitex rotundifolia* community) *Scaevola taccada – Pandanus odoratisimus* community *Pandanus odoratisimus* community *Syzygium gratum* community etc.

In any case, the coastal scrub of the sand dune at Ban Bang Boet, which is the only biggest wind-bowled sand dune found on the east coast of the peninsular Thailand, is slightly different from the other sites. These communities are among those, i.e., *Calophyllum pulcherrimum* community *Sindora siamensis* community *Rhodomyrtus tomentosa* community and *Polyalthea evacta* community (see also in the result part).

3. Coastal Woodland Vegetation

Among researches that have been carried on at the Asian tropical zones and adjacencies (except Mangroves), we can cite Anderson (1963), Whitmore (1984), Miyawaki, Suzuki, Huhg and Kuo (1981), Nakamura and Suzuki (1984, 1986), Clifford and Specht (1979), Phengklai, Niyomdham et al. (1991). The report to be released now is about the coastal littoral forests, which consists of a dry forest vegetation, instead of a swampy one. There are no other phytosociological studies on this vegetation except for the ones published by the above-cited authors.

The coastal forest vegetation of the peninsula Thailand could be expected to be found in greater abundance on the Gulf of Thailand coast than on the Andaman Sea coast, due to the wider coastal plain of the East that is characterized by an emergent shoreline from Chumphon to Narathiwat, and continuing to Malaysia southwards.

On the eastern coast of the Peninsula Thailand, which has long sandbars parallel to the coastline, unique plant communities have developed in a continuous strip from Chumphon to Narathiwat. However, most of the natural vegetation on the eastern coast of the peninsula Thailand has been depleted for a long time. The remnants of the natural vegetation left in isolated patches along the coast can be recognized in only a few places. The remnants of such vegetation at Ban Laem Santi (Lamae district, Chumphorn province), the "Chaiya sandbar" (Chaiya district, Surat

Thani province), and Ban Na Thap (Chana district, Songkla province) represents the typical plant communities on the sandbars. Especially in Chaiya district, many remnant patches of more-or-less natural sandbar vegetation could be seen in fragmented patches along the Chaiya sandbars from Ban Takrop to Ban Nuea (Figure 1). The forest vegetation patches at some selected sites are different from site to site, according to some local factors, such as soil properties, the topographic of the shoreline, and human activities. In general, this vegetation might be classified into 6 categories: the *Psychotia sarmentosa–Dipterocarpus obtusifolius* community, the *Symplocos cochinchinensis–Lannea coromandelica* community, the Sub-community of *Polyalthia evecta*, the typical sub-community, the Sub-community of *Polyalthia evecta*, and the *Davallia denticulata–Vatica harmandiana* community.

On the western coast of peninsular Thailand, there are unique plant communities on the narrow coastal plains of the Andaman Sea coast left as separated patches at Hat Thai Mueang (Khao Lampi-Hat Thai Mueang National Park, Thai Mueang district, Phangnga province) where a *Rhodamnia cinerea–Syzygium gratum* community is occurring at the back of the sand dunes. The establishment of this plant community, apart from other edaphic factors. It might due to the distribution ranges of some elements e.g. as *Styphelia malayana*, a Malaysian element which distributed northwards along the western coast of Thai-Malay peninsula to its northernmost limit in Thai Mueang beach, Phangnga province.

However, the relationship between environmental factors and the actual plant communities should be analyzed and discussed in order to achieve a systematic site classification of the coastal sandbar vegetation of the peninsular Thailand.

Table 10. Coastal Grassland-Vegetation (1)

1-15: *Cyperus stoloniferus* community

No.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Relevé no.:	118	119	120	121	122	123	124	125	126	139	140	141	115	116	117
Location:	2	2	2	2	2	2	2	2	2	1	1	1	2	2	2
Height of vegetation (cm.):	15	15	15	10	15	10	15	15	10	10	10	10	15	15	15
Cover of vegetation (%):	70	70	70	70	70	70	70	80	70	100	100	90	100	100	100
Quadrat size (qm.):	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1
Total no. of species:	3	3	3	3	3	3	3	3	3	1	1	2	1	1	1
Differantial species of comm.:															
Cyperus stoloniferus	4.3	3.3	3.3	2.3	2.3	1.2	2.3	2.3	2.3	5.5	5.5	2.2	2.3	5.5	5.5
Companions:															
Ipomoea pes-caprea	3.2	3.3	2.2	2.2	+	2.2	2.2	+	2.2	.	.	3.2	.	.	.
Canavalia rosea	1.2	1.2	3.3	2.2	3.3	2.2	1.2	2.2	1.2	.	.	.	.	.	.

Location: 1: Ban Bangboet, 2: Ao Panang Tak, Pathio in Chumphon province.

Table 11. Coastal Grassland-Vegetation (2)

1-16: Vigno-Ipomoetum pedis-caprae (*Canavalia rosea-Ipomoea pescaprae* community)

17-21 *Hydrophyllex maritima* community

No.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Relevé no.:	142	143	144	145	146	147	148	149	150	102	103	104	127	128	197	198	151	152	153	154	155
Location	1	1	1	1	1	1	1	1	1	6	6	6	2	2	11	11	1	1	1	1	1
Height of vegetation (m.):	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Cover of vegetation (%):	70	60	70	70	80	80	80	80	80	80	70	80	80	80	100	90	70	70	70	70	70
Quadrat size (qm.):	3x3	3x3	3x3	3x3	3x3	3x3	3x3	3x3	3x3	3x3	3x3	3x3	3x3	3x3	3x3	3x3	3x3	3x3	3x3	3x3	3x3
Total no. of species:	3	3	3	3	3	4	3	3	3	2	3	3	3	3	3	3	4	3	4	4	3
Differantial species of comm.:																					
Ipomoea pes-caprea	3.2	2.2	3.3	3.2	3.2	1.2	2.2	2.2	2.2	2.3	3.3	2.2	3.3	3.3	5.5	4.4	+	.	+	1.2	.
Canavalia rosea	3.2	3.3	4.3	3.2	3.2	4.4	3.2	3.3	4.3	3.3	+	2.2	2.2	2.2	2.2	1.2	3.2	3.3	2.2	2.2	2.2
Ischaimum muticum	2.2	2.2	2.2	1.2	1.2	+	2.2	2.2	2.2	.	.	+	1.2	+	+	1.2	2.2	2.2	1.2	+	3.2
Zoysia matrella	.	.	.	.	.	.	.	.	.	2.2	2.2	2.2	.	.	.	.	.	.	.	.	.
Differantial species of comm.:																					
Hydrophyllex maritima	.	.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	3.3	3.3	2.2	2.2	3.2
Companions:																					
Sessuvium portulacastrum	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.

Location: 1: Ban Bangboet, 2: Ao Panang Tak, Pathio in Chumphon province, 6: Ban Plongmai, Chiya in Surat Thani province, 11: Hat ThaiMueang, Thai Mueang in Phangnga province.

Table 12. Coastal Grassland-Vegetation (3)

1-18: *Ischaimum muticum* community

No.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Relevé no.:	1	2	3	5	129	130	131	132	133	156	157	158	159	160	161	162	105	106	107	199	200	201
Location:	1	1	1	1	2	2	2	2	2	1	1	1	1	1	1	1	6	6	6	11	11	11
Height of vegetation (m.):	50	50	50	50	30	40	40	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Cover of vegetation (%):	90	90	90	95	70	80	80	80	90	80	70	80	70	80	80	80	70	80	80	80	80	70
Quadrat size (qm.):	2x2	2x2	2x2	2x2	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1	1x1
Total no. of species:	4	5	5	5	3	4	4	3	3	3	3	3	2	4	2	2	3	3	2	2	2	2
Differantial species of comm.:																						
Ischaimum muticum	4.4	4.4	2.2	4.4	3.3	3.3	3.3	4.4	4.4	1.2	2.2	3.3	4.4	3.3	3.3	3.2	2.2	2.2	3.3	2.3	4.4	2.2
Companions:																						
Spinifex littoreus	2.2	2.2	2.2	3.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cassytha filiformis	3.3	2.2	2.2	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Canavalia rosea	.	.	.	1.1	2.2	3.3	1.2	2.2	2.3	3.3	3.2	2.2	1.2	1.2	.	.	.	.	.	.	.	.
Ipomoea pes-caprea	.	.	.	.	2.2	.	3.3	3.3	1.2	.	.	.	.	1.2	2.2	.	.	.	.	.	2.2	2.2
Chrysopogon orientalis	.	3.2	4.4	.	.	+	.	.	.	.	.	.	.	.	.	2.2	+	1.2	3.3	2.3	.	.
Ipomoea imperati	.	.	.	.	.	.	.	.	.	2.2	2.2	2.2	.	2.2	.	.	.	.	.	.	.	.
Vitex rotundifolia	.	.	.	.	.	1.2	1.2	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cyperus stoloniferus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.2	2.2	.	.	.	.

Location: 1: Ban Bangboet, 2: Ao Panang Tak, Pathio in Chumphon province, 6: Ban Plongmai, Chiya in Surat Thani province,

11: Hat Thai Mueang, Thai Mueang in Phangnga province.

Table 13. Coastal Grassland-Vegetation (4)
1-6: Glehnio-Spinificetum littorei (*Spinifex littoreus* community)

No.	1	2	3	4	5	6
Relevé no.	23	24	25	163	108	109
Location:	2	2	2	1	6	6
Height of vegetation (cm.):	40	50	50	50	50	50
Cover of vegetation (%)	80	90	90	80	80	80
Quadrat size (qm.):	4x4	5x5	4x4	4x4	4x4	4x4
Total no. of species:	3	3	3	2	3	4
Differantial species of comm.:						
Spinifex littoreus	4.4	4.4	4.4	3.3	5.4	4.4
Companions:						
Zoysia matrella	2.1	2.2	2.2	.	5.4	2.2
Ipomoea pes-caprea	.	.	.	1.2	.	+
Vitex rotundifolia	.	.	.	.	2.2	.
Crotaralia sp.	2.2	2.1	2.2	.	.	.
Sessuvium portulacastrum	.	.	.	.	.	+

Location: 1: Ban Bangboet, 2: Ao Panang Tak, Pathio in Chumphon province, 6: Ban Plongmai, Chiya in Surat Thani province.

Table 14. Coastal Grassland-Vegetation (5)

1-6: *Fimbristylis sericea* community

7-11: *Dunbaria bella* community

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Relevé no.	164	165	166	167	168	169	170	171	172	173	174	175	176	177
Location:	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Height of vegetation (cm.):	30	30	30	30	30	30	30	30	30	40	30	40	30	30
Cover of vegetation (%)	80	80	80	80	80	80	80	80	80	60	60	70	60	60
Quadrat size (qm.):	1X1	1X1	1X1	1X1	2x2	2x2	2x2	2x2	2x2	2x2	2x2	2x2	2x2	2x2
Total no. of species:	1	1	1	2	2	2	2	2	2	3	2	3	2	2
Differantial species of comm.:														
Fimbristylis sericea	3.3	2.2	3.3	2.2	2.2	2.2	3.3	3.3	3.3	.	.	.	.	.
Ipomoea imperarti	.	.	.	2.2	2.2	+	.	.	.	.	.	.	.	.
Ipomoes pes-paprae	.	.	.	.	.	.	1.2	2.2	2.2	.	.	.	.	.
Differantial species of comm.:														
Dunbaria bella	.	.	.	.	.	.	.	.	.	3.3	3.3	4.4	2.3	3.3
Companions:														
Chrysopogon orientalis	.	.	.	.	.	.	.	.	.	1.2	2.2	1.2	+	1.2
Cyanotis cristata	.	.	.	.	.	.	.	.	.	1.2	.	1.2	.	.
Polycarpaea corymbosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Location: 1: Ban Bangboet, Pathio district in Chumphon province.

Table 15. Coastal Scrub-Vegetation (1)

1-10: Thuareio-Viticetum rotundifoliae (*Vitex rotundifolia* community)

No.:	1	2	3	4	5	6	7	8	9	10
Relevé no.:	134	135	136	137	138	110	111	112	113	114
Location:	2	2	2	2	2	6	6	6	6	6
Height of vegetation (m.):	30	30	40	30	30	30	30	30	30	30
Cover of vegetation (%):	90	90	100	100	80	80	70	80	100	100
Quadrat size (qm.):	3x3	3x3	3x3	3x3	3x3	3x3	3x3	3x3	3x3	3x3
Total no. of species:	3	3	2	2	2	3	3	3	2	2
Differantial species of comm.:										
Vitex rotundifolia	4.4	3.3	5.5	5.4	4,4	3.3	2.3	4.4	5.5	5.5
Companions:										
Canavalia rosea	2.2	1.2	.	1.2	.	1.2	.	1.2	.	.
Ipomoea pes-caprea	.	1.2	.	.	.	.	.	+	.	.
Ischaimum muticum	+	.	+	.	2.2	.	.	.	.	.
Chrysopogon oriantalis	.	.	.	.	.	+	1.2	12	1.2	+
Vigna marina	.	.	.	.	.	.	+	.	.	.

Location: 2: Ao Panang Tak,Pathio in Chumphon province, 6: Ban Plongmai, Chiya in Surat Thani province.

Table 16. Coastal Scrub-Vegetation (2)

1-3: *Pandanus odoratisimus* community

4-7: *Calophyllum pulsherimun* community

8-10: *Cindora siamensis* community

11-15: *Diospyros ferrea* community

16-19: *Polyaithia evacta* community

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Relevé no.	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196
Location:	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Height of vegetation (m.):	3	4	3	1.5	1.5	0.6	2	0.6	0.6	0.6	1.5	1.5	1.5	1.5	1.5	0.5	0.7	0.5	0.3
Cover of vegetation (%)	90	90	90	95	80	80	95	60	80	80	80	80	80	80	80	80	80	80	70
Quadrat size (qm.):	5x5	5x5	5x5	3x3	3x3	3x3	4x4	4x4	4x4	4x4	4x4	4x4	4x4	4x4	4x4	4x4	4x4	4x4	4x4
Total no. of species:	5	4	4	1	1	1	2	2	2	3	3	3	3	3	3	3	4	2	2
Differantial species of comm.:																			
Pandanus odoratisimus	4.1	4.1	4.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Calophyllum pulsherimun	.	.	.	4.1	4.1	4.1	4.2	.	.	.	.	.	.	.	.	.	.	.	.
Sindora siamensis	+	.	.	.	+	+		4.1	4.1	4.1	.	.	.	.	.	.	.	.	.
Diospyros ferrea	.	.	.	.	.	.	.	.	.	.	4.1	4.1	4.1	3.1	3.1	.	.	.	.
Polyalthia evecta	.	.	.	2.2	.	.	.	.	.	.	+	+	.	.	.	4.1	3.1	4.1	4.1
Companions:																			
Chrysopogon orientalis	1.2	1.2	1.2	2.2	2.2	2.2	2.2	2.3	3.3	3.3	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Cyanotis cristata	.	.	.	.	1.2	2.2	.	.	+	1.2	.	.	+	2.2	2.2	1.2	1.2	.	.
Cassytha filifomis	.	+	.	+	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.
Tetracera indica	2.2	3.3	2.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dilanella ensifolia	1.2	1.2	1.2	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.

Location: 1: Ban Bangboet, Pathio in Chumphon province.

Table 17. Coastal Scrub- Vegetation (3)

1-5: *Rhodomyrtus tomentosa* community

6-21: *Scaevola taccada* community

No.:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Releve no.:	97	92	94	96	93	43	44	42	41	45	287	48	46	47	21	20	286	50	51	52	49
Location:	1	1	1	1	1	1	1	1	1	1	21	1	1	1	2	2	21	1	1	1	1
Height of shrub layer (m.):	1	1	1	1	1	5-8	4-6	5-8	4-6	4-6	6	1.5	3	3	10	10	7	1.5	1.5	1.7	1.5
Cover of shrub (%)	90	90	90	90	95	70	80	100	95	90	95	70	80	90	90	90	80	90	95	95	90
Height of herb layer (m.):	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5
Cover of herb (%)	10	15	15	10	10	10	10	15	10	10	3	10	15	15	10	10	10	10	10	10	15
Quadrat size (qm.):	3x6	2x6	3x6	5x5	3x6	10	10	25	25	8x12	10x10	4x6	8x5	7x4	8x8	10x10	10x10	5x6	5x6	6x8	5x6
Total no. of species:	4	5	6	7	8	7	8	9	10	10	2	4	7	7	7	8	4	5	6	6	8
Differantial species of community:																					
Rhodomyrtus tomentosa	5.5	4.4	5.5	5.5	4.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fimbristyris sericea	2.2	3.3	2.2	2.2	3.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Differantial species of community:																					
Scaevola taccada	.	.	.	.	.	4.4	4.4	4.4	3.3	3.3	5.5	4.4	4.4	4.4	4.4	4.4	5.4	4.4	4.4	4.4	4.4
Chrysopogon orientalis	.	.	.	.	.	2.2	2.2	2.2	2.2	1.2	.	4.4	1.2	1.2	.	.	.	4.4	4.4	4.4	2.2
Ischaemum muticum	.	.	.	.	.	2.2	1.2	1.2	1.2	1.2	.	1.2	1.2	1.2	.	.	.	1.2	1.2	1.2	1.2
Pandanus odoratissimus	.	.	.	.	.	3.2	2.1	2.1	4.4	3.3	.	.	.	.	.	.	.	.	.	.	.
Tetracera indica	.	.	.	.	.	.	1.2	2.4	.	1.2	.	.	.	.	.	.	.	.	.	.	.
Vigna marina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4.4	4.4	.	.	.	.	.
Zoysia matrella	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+.2	1.2	1.2	1.2	1.2
Fimbristylis sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.2	1.2	1.2	1.2

Table 17. (continued)

Cassytha filiformis	.	+	.	.	2.2	+	1.2	.	1.2	1.2	.	.	.	+	.	2.1		.	.	.	+
Ipomea pes-caprae	.	.	.	.	.	3.3	.	.	1.2	1.2	.	2.2	3.3	+	.	.	.	.	+	.	+
Ch. Laongpol 635	.	.	.	.	.	1.2	1.2	1.2	1.2	1.2	.	.	1.2	1.2	.	.	.	.	.	.	.
Chrysopogon orientalis	3.3	2.2	2.2	3.3	2.2	.	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.
Hibiscus tiliaceus		.	.	.	.	.	+	+	.	.	.	.	.	.		.	.	.	.	.	.
Allophylus cobbe	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.3	2.2	.	.	.	.	.
Terminalia catappa	.	.	.	.	.	.	.	.	1.1	.	.	.	.	.	1.1	1.1	+.2	.	.	.	.
Erythroxylum cuneatum	.	.	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Ardisia crenata	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lannea coromendelica	.	.	.	.	.	.	2.2	.	.	3.3	.	.	.	.	2.2	.	.	.	.	.	.
Commelina sp.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sindora siamensis	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cansjera rheedei	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aganosma maginata	.	.	.	+	.	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.
Micromelum minutum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Zoysia matrella	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.2	.	.	.	.	.
Clerodendrum inerme	.	.	.	.	.	.	.	3.3	.	.	.	.	+	.	.	.	.	.	.	.	.
Thespesia populnea	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.
Spinifex littileus	.	.	.	.	.	.	.	.	.	.	.	.	2.2	3.4	.	.	.	.	.	.	.
Poteria obovata	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dyospyros ferrea	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Streptocaulon juventas	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dunbaria bellta	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Eurycoma longifolia	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Champereia manillana	.	.	.		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dioscorea sp.	.	.	.		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 17. (continued)

Streblus asper	.	.	.		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Caseria grewiifolia	.	.	.		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Guioa pleuropteris	.	.	.		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Premna obtusifolia	.	.	.		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Microcos tomentosa	.	.	.		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Syzygium grande	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sesuvium portulacastrum	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Premna obtusifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1	.	.	.	.	.	.	.
Derris indica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.1	.	.	.	.	.	.
Tephrosia sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.1	.	.	.	.	.	.
Canavalia rosea (Seedling)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Dicerma biarticulatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.2
Sapindaceae sp.															2.2	2.3						
Cassytha filiformis																2.1						
Terminalia catappa															1.1	1.1						
Colubrina asiatica																						
Calophyllum inophyllum																2.2						

Location 21,KS:Ban Nam Rap (Hat Chao Mai National Park)

Table 18. Coastal Scrub- Vegetation (4)

1-26: *Syzygium gratum* community

1-16: *Vacinium bracteatum-Olea brachiata* sub-community

17-26: *Styphelia malayana-Rhodamnia cinerea* sub-community

27-31: *Micromelum minutum-Allophyllus* cobbe community

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Relevé no.	88	91	89	87	90	81	84	83	82	201	202	203	204	205	206	207	70	78	73	74	77	76	69	71	72	75	18	16	17	19	15
Location:	3	3	3	3	3	13	13	13	13	12	12	12	12	12	12	12	11	11	11	11	11	11	11	11	11	11	2	2	2	2	2
Height of scrub layer(m.):	6	6	6	6	6	9	10	10	10	5	5	8	8	6	10	10	5	3	2.5	3	2.5	8	5	7	7	5	10	5	8	10	10
Cover of shrub layer (%)	90	90	90	90	90	100	100	100	100	80	85	90	80	80	95	95	95	100	100	95	100	95	95	100	100	100	85	90	90	90	90
Height of herb layer(m.):	1	1	1	1	1	0.5	0.5	0.5	0.5	5	5	8	8	6	10	10	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Cover of herb layer(%):	50	60	60	50	50	60	60	60	60	10	10	10	10	10	10	10	10	10	10	15	10	15	15	15	10	10	10	10	10	10	10
Quadrat size (qm):	10x10	10x10	10x10	10x10	10x10	8x8	10x10	8x8	10x10	6x6	5x5	6x6	7x7	5x5	10x10	10x10	5x8	5x5	5x5	4x4	5x5	8x8	6x8	8x8	5x5	8x8	10x10	5x5	8x8	12x12	8x8
Total no. of species:	14	15	16	17	17	10	12	14	14	11	9	13	14	12	15	15	10	10	11	11	13	14	15	15	15	16	9	10	10	10	11
Differantial species of community:																															
Syzygium gratum	5.5	4.4	5.4	5.5	4.4	5.2	4.2	5.3	.	4.4	4.4	4.4	4.4	4.4	4.4	4.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	.	.	.	.	.
Alyxia reinwardtii	.	.	2.1	.	.	4.4	3.3	3.3	3.3	+	.	+	.	.	1.2	1.2	.	3.3	.	2.2	1.2	1.2	+	1.2	2.2	2.2	.	.	.	.	.
Dianella ensifolia	2.2	2.2	2.3	2.2	2.2	.	.	.	.	.	.	.	.	.	1.2	1.2	2.2	1.2	1.2	1.2	1.2	1.2	+	1.2	1.2	1.2	.	.	.	.	.
Vaccinium bracteatum	5.4	4.4	5.4	5.4	4.4	.	2.1		2.1	3.2	2.2	3.2	2.3	3.2	1.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Olea brachiata	+	2.2	2.2	2.2	2.2	2.2	1.2	2.3	2.2		+	1.2	+		+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Doritis pulcherrima	3.3	3.3	3.3	3.3	3.3	.	1.3	1.2	1.3	+			2.2	1.2	1.2	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Eurycoma longifolia	2.2	2.2	2.2	2.2	2.2	.	.	.	.	2.2	2.2	1.2	1.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cotylelobium lanceolatum	+	2.2	2.1	+	2.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Drynaria quercifolia	+	2.1	2.1	+	2.1	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dischidia major	.	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Prismatomeris tetrandra	.	.	.	.	.	2.2	.	1.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Grass sp. 1	.	.	.	.	.	1.2	1.2	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Grass sp. 2	.	.	.	.	.	1.2	1.2	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 18. (continued)

Rhodomyrtus tomentosa	2.2	3.3	2.2	2.2	3.3	.	1.2	1.2	1.2	2.2	2.2	2.2	2.2	1.2	.	.	1.2	2.2	1.2	.	2.2	1.2	1.2	1.2	+	1.2	2.2	3.3		3.3	.
Champereia manillana	2.1	2.1	2.2	2.1	2.1	.	1.2	1.2	2.2	.	.	.	.	.	1.2	+		.		1.2	.	1.2		+	2.2	1.2	1.1	2.1	2.2	.	.
Ardisia crenata	2.1	2.3	2.3	2.2	2.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1	1.1	1.1	2.1	1.1
Calophyllum pulcherimum	2.2	2.1	2.2	2.2	2.2	2.1	.	2.2	2.2	.	.	.	.	.	.	.	.	1.2	.	.	2.2	.	.	.	.	.	.	.	.	.	.
Mischocarpus sundaicus	2.2	2.2	2.2	2.2	2.1	.	.	.	.	.	.	+	+	+	2.2	2.2	.	.	.	+	+	.	.	.	.	1.2	.	.	.	.	.
Davallia denticulata	3.3	3.4	3.3	3.3	3.4	.	.	1.2	.	2.2	.	+	1.2	2.2	1.2	1.2	.	.	.	4.4	.	.	.	.	.	.	.	.	.	.	.
Rapanea porteriana	.	.	.	1.1	.	.	.	.	2.1	.	.	.	.	.	.	.	+	.	(+)	.	.	(+)	.	1.2	.	.	.	.	.	.	.
Pouteria obovata	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	1.2	+	.	+	.	1.2	1.2	+	1.1	1.1	.	.	.	2.2	.	.
Cassytha filiformis	.	.	.	+	.	.	.	.	.	+	+	+	+	+	.	.	.	2.2	+	3.3	.	2.2	.	+	.	2.2	.	1.1	.	.	.
Styphelia malayana	.	.	.	.	.	4.3	3.3	.	.	.	.	.	.	.	.	.	4.4	4.4	5.4	5.4	4.4	5.4	5.4	5.4	4.4	5.4	.	.	.	.	.
Rhodamnia cinerea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.2	3.3	2.2	2.2	3.3	2.3	2.2	2.2	2.2	2.2	.	.	.	.	.
Chrysopogon orientalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.2	3.3	2.2	2.2	2.2	1.2	3.2	2.2	2.2	+	.	.	.	.	.
Phalaenopsis pulcherrima	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.2	1.2	.	3.3	1.3	1.2	1.2	1.3	1.3	.	.	.	.	.
Psychotria sarmentosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	+	1.2	+	+	.	.	.	.	.
Memecylon edule	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.2	.	.	1.2	.	1.2	2.1	2.2	.	.	.	.	.
Differantial species of community:																															
Micromelum minutum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3.3	2.2	2.1	2.3	2.2
Allophylus cobbe	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3.3	1.1	2.2	2.3	3.3
Erythroxylum cuneatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.2	3.4	2.2	2.2
Caseria grewiifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1	.	.	1.1	2.1
Zoysia matrella	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.2	1.1	2.2	.	1.1
Streblus asper	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.2	1.1
Guioa pleuropteris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.2	1.1
Oxycetros longiflora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3.2
Litsia glutinosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1
Barringtonia asiatica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4.1
Dioscorea sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1	1.2	.	.

Table 18. (continued)

Aganosma marginata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1	1.1	.	.
Antidesma ghaesembilla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3.3	.	.
Lannea coromendelica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4.4	.	.	.	.
Catunaregam tomentosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.1	.	.	.	.
Premna obtusifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.1	.
Microcos tomentosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.1	.
Hibiscus tiliaceus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1	.
Garcinia cowa	.	.	2.1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pyrrosia piloselloides	.	.	.	.	.	.	.	1.3	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.2	.	.	.	.	.
Dendrobium crumenatum	.	.	.	.	.	.	1.2	1.2	.	.	.	.	.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poterea obovata	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Spirolobium cambodianum	.	.	.	.	.	.	.	+	+	1.2	1.2	1.2	1.2	1.2	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Psydrax nitida	.	.	.	.	.	.	2.1	.	3.2	.	.	.	.	.	2.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Wikstroemia ridleyi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.2	.	+	.	+	+	.	.	.	.	.
Dendrobium indivisum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.2	.	.	1.2	+	.	.	.	.	.	.
Dendrobium pachyphyllum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.2	.	.	+	.	.	.	.	.	.	.	.
Pyrrosia longifolia	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Arcriopsis indica	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Humata heterophylla	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Shirakiopsis indica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	(+)	.	.	.	.	.	.
Acronychia pedunculata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Erea lasiopetala	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Balbophyllum sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Chassalia curviflora	.	.	.	.	.	.	.	.	.	+	.	1.2	1.2	1.2	1.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Psydrax sp.	.	.	.	.	.	.	.	.	.	.	+	2.1	2.1	2.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Humata pectinata	.	.	.	.	.	.	.	.	.	1.2	1.2	2.2	2.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hoya parasitica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Vatica hamandiana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 19. Coastal Woodland Vegetation (coastal forest vegetation).

1-2: *Psychotria sarmentosa-Dipterocarpus obtusifolius* community(A)

3-14: *Symplocos cochinchinensis-Lannea coromendelica* community (B)

3-6: Sub-community of *Polyalthia evecta*(B1), 7-8: Typical sub-community(B2), 9-14: Sub-community of *Memecylon scutellatum*(B3)

15-17: *Davallia denticulate-Vatica harmandiana* community (C)

18-22: *Rhodamnia cinerea-Syzgium gratum* community (D)

18-19: Typical sub-community(D1), 20-22: Sub-community of *Styphelia malayana*(D2)

Column no.:		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Relevé no.:		33	34	58	59	60	61	66	67	35	36	37	38	39	40	64	65	63	85	86	68	79	80
Location:		7	7	6	6	5	5	2	3	1	1	1	1	1	1	4	4	4	8	8	8	8	8
Height of tree-1 layer (m.):		15	15	30	20	18	18	20	15	20	18	15	20	18	15	10	15	10	10	10	10	10	15
Cover of tree-1 layer (%):		90	90	90	95	95	95	80	90	50	50	50	70	50	50	5	10	95	90	90	100	100	90
Height of tree-2 layer (m.):		10	10	20	15	10	12	15	-	10	10	10	15	12	12	-	-	-	-	-	-	-	-
Cover of tree-2 layer (%):		80	80	50	10	10	10	10	-	40	80	40	70	70	70	-	-	-	-	-	-	-	-
Height of shrub layer (m.):		6	6	4	4	5	5	6	6	5	5	8	5	5	5	8	10	8	3	3	7	7	10
Cover of shrub layer (%):		60	60	10	10	50	60	40	60	80	80	90	30	70	70	95	95	4	40	40	90	90	90
Height of herb layer (m.):		1	1	1.5	1.5	1	1	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0.5	0.5	1	0.4	0.4	1	1	1
Cover of herb layer (%):		60	70	50	50	40	40	70	80	80	70	70	60	70	70	50	50	10	30	30	95	95	85
Quadrat size (qm):		20x20	15x15	20x20	20x20	15x15	15x15	900	225	20x20	20x20	20x20	20x20	15x15	15x15	15x15	15x15	20x20	15x15	15x15	20x20	20x20	20x20
Total no. of species:		40	39	61	54	62	63	65	70	67	61	58	54	57	56	51	52	51	47	46	61	61	61
Differential species of community (A):																							
Dipterocarpus obtusiforius	T1	5.5	4.5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dendrotrophe buxifolia	T1,T2	2.2	2.2	.	.	.	.	.	(+)	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Character and differential species of community (B):																							
Lannea coromandelica	T1	.	.	3.3	+	+	3.3	(+)	(+)	+	3.3	(+)	(+)	1.1	(+)	.	.	.	.	.	.	.	.
Chassalia curviflora	H	.	.	3.3	3.3	+	+	(+)	.	2.2	2.2	(+)	2.2	(+)	(+)	.	.	.	.	.	.	.	.
Symplocos cochinchinensis	S,H	.	.	2.3	±	(+)	+	.	(+)	(+)	2.2	2.2	3.2	1.1	2.2	.	.	.	.	.	.	.	.

Table 19. (continued)

Breynia glauca	S,H	.	.	+	+	+	+	+	±	.	.	.	.	.	±	.	.	.	.	.	.	.	.
Schima wallichii	T1	.	.	(+)	(+)	.	.	(+)	(+)	(+)	+	2.2	+	2.2	1.1	.	.	.	.	.	.	.	.
Differential species of sub- community(B1,B3):																							
Cyperus sp. 1	H	.	.	2.3	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poaceae sp. 1	H	.	.	2.3	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Amorphophallus sp.	H	.	.	2.2	2.2	(+)	(+)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Polyalthia evecta	H	.	.	3.3	+	(+)	(+)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bridelia ovata	S	.	.	2.3	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tacca integrifolia	H	.	.	2.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Poaceae sp. 2	H	.	.	2.3	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Leucas zeylanica	H	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Triumfetta grandidens	H	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Memecylon scutellatum	T1	.	.	.	.	.	.	.	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.
	S	.	.	.	.	.	.	.	.	2.2	3.3	+	(+)	(+)	(+)	.	.	.	.	.	.	.	.
Guioa pleuropteris	S,H	.	.	.	.	.	.	.	.	2.2	+	(+)	1.1	1.1	(+)	.	.	.	.	.	.	.	.
Ancistrocladus tectorius	T1	.	.	.	.	.	.	(+)	.	+	+	(+)	(+)	(+)	(+)	.	.	.	.	.	.	.	.
Differential species of community (D):																							
Arachnis flosaeris	T1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	(+)	(+)	5.5	5.5	4.4
Rhodamnia cinerea	S	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.2	2.2	2.3	2.3	2.2
Rhodamnia cinerea	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	(+)	(+)	2.3	2.3	2.3
Podocarpus neriifolius	T1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	(+)	(+)	+	2.2	+
Dracaena sp.	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	(+)	(+)	1.2	1.2	1.2
Dendrobium pachyphyllum	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	(+)	(+)	2.2	+	+
Cycas rumphii	S	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	(+)	(+)	+	1.2	(+)
Differential species of sub-community(D2):																							

Table 19. (continued)

Eria affinis	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.2	(+)	(+)
Dendrobium indivisum	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2.2	(+)	(+)
Bulbophyllum planibulbe	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	(+)	(+)
Styphelia malayana	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	(+)	(+)
Hydnophytum formicarum	H	.	.	.	.	.	.	.	(+)	.	.	.	.	.	.	.	.	.	.	.	1.2	(+)	(+)
Thrixspermum calceolus	H	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	(+)	2.2
Other species:																							
Chaetocarpus castanocarpus	T1,T2	2.2	(+)	(+)	(+)	±	+	(+)	+	+	+	3.3	2.2	+	2.2	(+)	+	+	(1.2)	(1.2)	(+)	(+)	(+)
Mischocarpus sundaicus	T1	+	+	(1.2)	(+)	(+)	+	2.2	2.2	+	2.2	2.2	2.2	2.2	1.1	+	+	(+)	+.2	+.2	2.2	2.2	2.3
Syzygium grande	T1	2.2	2.1	(+)	(+)	(+)	(+)	+	(+)	+	+	+	+	+	+	(+)	(+)	(+)	2.1	3.3	(+)	+	(+)
Ixora javanica	S	+	+	(+)	+	(+)	(+)	(+)	(+)	+	+	1.1	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(1.1)	(1.1)	(1.1)
Vitex pinnata	T2,S	(+)	(+)	(+)	(+)	±	(+)	(+)	(+)	(+)	(+)	+	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)
Pyrrosia piloselloides	H	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	2.2	2.2	(+)	(+)	(+)
Hoya parasitica	H	+	+	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)
Dianella ensifolia	H	+	(+)	(+)	+	2.2	2.2	+	1.2	1.1	1.1	1.1	1.1	1.1	1.2	+	1.2	1.2	2.2	+.2	1.2	(1.2)	(1.2)
Micromelum minutum	S	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	2.2	1.2	(+)
Dendrobium crumenatum	T2,S	2.3	2.3	(+)	(+)	(+)	(+)	(+)	(+)	(+)	±	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	1.2	1.2	+
Rapanea porteriana	T1,T2	2.2	(+)	(+)	.	(+)	(+)	(+)	(+)	(+)	(+)	+	(+)	(+)	1.1	1.2	1.2	+	(+)	(+)	(+)	2.2	(+)
Psychotria sarmentosa	T2	4.5	3.3	(+)	.	(+)	(+)	(+)	(+)	2.2	1.1	1.1	3.3	2.2	2.2	(+)	(+)	(+)	2.2	2.2	1.2	1.2	1.2
Champereia manillana	T1	.	.	.	.	(2.2)	(+)	(+)	(+)	+	+	+	+	+	+	(1.1)	(1.1)	(1.1)	(1.1)	(1.1)	(1.1)	(1.1)	(1.1)
	S	(+)	(+)	(+)	(+)	2.2	2.2	2.2	+	.	2.2	2.2	2.2	2.2	2.2	+	+	.	1.2	1.2	+	1.2	(+)
Acronychia pedunculata	T1	+	+	(+)	(+)	+	+	(+)	(+)	(+)	(+)	1.1	2.2	(+)	(+)	(+)	(+)	(+)	+.2	1.1	2.2	2.2	2.2
Syzygium gratum	T1	2.2	2.2	(+)	(+)	(+)	(+)	(+)	+	+	(+)	+	(+)	1.1	+	+	.	2.1	3.4	3.3	5.5	5.5	4.4
Davallia denticulata	S	(+)	2.4	(+)	.	+	1.2	3.4	4.4	(+)	(+)	(+)	1.1	1.1	1.2	3.4	3.3	2.2	(1.2)	(1.2)	2.2	+	+
Rhodomyrtus tomentosa	S,H	(+)	(+)	(+)	.	(+)	+	(+)	(+)	(+)	1.1	1.1	1.1	2.2	(+)	+	+	+	(+)	(+)	2.2	(+)	+
Eurycoma longifolia	T2	+	(+)	3.3	3.3	3.3	3.3	2.2	+	2.2	+	1.1	.	1.1	1.1	1.2	1.2	+	(+)	(+)	2.2	2.2	(1.1)

Table 19. (continued)

Microcos tomentosa	T1,S	.	.	3.3	2.2	(+)	(+)	+	(+)	(+)	(+)	(+)	±	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)
Cotylelobium lanceolatum	T1	.	.	(+)	(+)	(+)	(+)	4.3	5.5	(+)	1.1	3.3	4.3	2.2	2.2	(+)	(+)	(+)	(2.2)	(2.2)	+	(+)	(+)
Dischidia major	T1	2.2	2.2	.	.	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	1.2	1.2	(+)
Calophyllum pulcherrimum	T1,T2	2.3	2.2	(+)	(+)	.	.	±	+	+	+	(+)	(+)	1.1	(+)	(+)	1.2	+	(+)	(+)	(+)	(+)	2.2
Pouteria obovata	T1,T2	(+)	(+)	.	.	(+)	(+)	1.2	(+)	2.2	+	+	(+)	(+)	.	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)
Drynaria quercifolia	T1	2.2	2.2	.	+	+	2.2	3.4	1.2	2.2	2.2	+	+	.	.	2.3	2.3	2.3	2.2	2.2	2.2	2.2	1.2
Ilex cymosa	T1	.	.	.	.	.	.	(+)	(+)	.	.	.	.	.	.	.	.	.	.	.	(+)	(+)	+
Ilex cymosa	T2	2.2	2.2	.	.	.	.	.	.	(+)	(+)	1.1	(+)	2.2	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)
Vatica harmandiana	T1	(+)	(+)	(+)		3.3	3.4	3.3	+	+.2	1.2	.	.	.	.	5.5	5.5	4.4	3.3	3.3	3.3	3.3	2.3
Neolitsea zeylanica	T1,S	.	.	(+)	+	+	+	+	(+)	(+)	2.2	±	1.1	(+)	1.1	(+)	(+)	(+)	2.2	2.2	2.2	+	+
Morinda elliptica	S	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	.	.	(+)	(+)	(+)
Atalantia monophylla	H	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	.	.	(+)	(+)	(+)
Ardisia crenata	H	2.2	2.2	(+)	+	(+)	(+)	2.2	(+)	(+)	(+)	(+)	+	(+)	(+)	.	1.2	.	(+)	(+)	2.2	1.2	1.2
Tetracera indica	H	.	.	(+)	(+)	(+)	(+)	(+)	(+)	+	+	(+)	(+)	1.1	.	(+)	(+)	(+)	+.2	(+)	(+)	(+)	(+)
Carallia brachiata	T1,T2	2.3	(+)	3.3	2.2	+	+	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	.	.	.	(+)	(+)	(+)	(+)	(+)
Garcinia cowa	T1	.	.	.	.	+	+	2.2	2.2	(+)	+	1.1	1.1	.	.	+	+	+	(+)	(+)	+	(+)	+
Olea brachiata	T2	3.3	2.2	(+)	.	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	1.2	2.2	+	.	.	.	.	.
Tetracera loureiri	H	.	.	+	+	1.2	(+)	+	+	(+)	(+)	(+)	(+)	(+)		(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)
Garcinia hombroniana	T2,S	2.1	2.2	.	.	2.2	2.2	2.2	(+)	(+)	(+)	(+)	+	(+)	+	(+)	(+)	(+)	(+)	(+)	.	.	.
Vaccinium bracteatum	S	2.2	2.2	.	.	(+)	(+)	(+)	(+)	(+)	3.3	2.2	.	2.2	2.2	.	.	.	(+)	(+)	(+)	(+)	(+)
Doritis pulcherrima	H	2.4	2.2	.	.	.	.	.	+	(1.1)	(1.1)	(1.1)	(1.1)	1.1	+	(+)	(+)	(+)	(+)	(+)	3.3	2.3	1.2
Ochna integrrima	S,H	.	.	.	.	2.2	2.2	(+)	+	2.2	1.1	(+)	±	(+)	1.1	(+)	(+)	(+)	.	.	+	(+)	(+)
Shorea roxburghii	T1	(+)	+	2.2	5.5	5.5	5.5	(+)	(+)	.	.	.	.	.	.	+	2.2	(+)	(+)	(+)	(+)	(+)	(+)
Aporosa symplocoides	T1	.	.	(+)	.	(+)	(+)	(+)	+	3.3	2.2	2.2	2.2	2.2	1.1	.	.	.	.	.	(+)	+1	2.2
Prismatomeris tetrandra	S	2.1	2.1	+	2.2	.	.	+	(+)	2.2	2.2	2.2	3.3	2.2	2.2	.	.	.	.	.	+	(+)	(+)
Memecylon ovatum	T1,T2	.	.	(+)	(+)	.	.	.	.	2.2	(+)	+	2.2	(+)	1.1	.	.	.	.	.	.	.	.

Table 19. (continued)

Memecylon ovatum	S	.	.	2.3	+	(+)	(+)	.	.	(+)	2.2	(+)	(+)	(+)	(+)	.	.	.	.	2.2	1.2	1.2	(+)
Cansjera rheedei	T1,S	.	.	.	.	2.2	2.2	2.3	2.2	3.3	(+)	(+)	(+)	2.2	(+)	+	+	±	.	.	.	.	.
Pittosporum ferrugineum	T1	.	.	.	.	(+)	(+)	(+)	(+)	(+)	(+)	2.2	2.2	+	1.1	(+)	(+)	(+)	.	.	.	.	.
Abrus precatorius	S	.	.	.	.	(+)	(+)	1.2	(+)	(+)	(+)	1.1	3.3	(+)	1.1	(+)	(+)	(+)	.	.	.	.	.
Viscum articulatum	S	.	.	.	.	(+)	(+)		(+)	(+)	(+)	(+)	(+)	(+)	(+)	+	(+)	+	.	.	.	.	.
Microsorum scolopendria	H	.	.	.	.	(+)	(+)	(+)	(+)	+	.	.	.	.	.	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)
Stenochlaena palustris	T2,H	.	.	.	+	(+)	(+)	±	1.2	.	.	.	.	.	(+)	(+)	(+)	(+)	.	.	.	.	.
Dioscorea pentaphylla	H	.	.	2.2	2.2	2.2	+	1.2	±	.	.	+	.	.	(+)	.	.	.	.	.	.	.	.
Pleurostylia opposita	T2	.	.	.	(+)	.	.	.	(+)	2.2	2.2	2.2	(+)	(+)	(+)	.	.	.	.	.	.	.	.
Catunaregam tomentosa	T2,S	.	.	.	.	(+)	(+)	(+)	(+)	.	.	.	.	+	.	±	±	(+)	.	.	.	.	.
Mangifera sp.	T1,T2	.	.	1.2	(+)	.	.	4.3	3.3	.	.	.	.	.	.	(+)	(+)	(+)	.	.	.	.	.
Cratoxylum cochinchinense	T2	.	.	(+)	(+)	.	.	+	(+)	.	.	.	.	.	.	(1.1)	(1.1)	(1.1)	.	.	.	.	.
Cymbidium findlaysonianum	H	.	.	.	.	(+)	(+)	+	(+)	.	.	.	.	.	.	(+)	(+)	(+)	.	.	.	.	.
Alyxia reinwardtii	S	(+)	(+)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	(+)	(+)	2.2	2.2	(+)
Commelina diffusa	H	.	.	+	.	(+)	(+)	.	.	.	.	.	.	.	.	(+)	(+)	(+)	.	.	.	.	.
Schizaea dichotoma	H	.	.	.	.	.	.	.	(+)	.	.	.	.	.	.				1.2	2.2	3.3	1.2	3.3
Dischidia bengalensis	S	.	.	.	.	.	.	.		+	+	+	.	.	.	.	.	.	.	.	1.2	(+)	(+)
Willughbeia coriacea	S	.	.	.	.	.	.	.		.	.	+	.	+	1.1	.	.	.	.	.	2.2	2.2	(+)
Gomphrena celosioides	H	.	.	2.2	+	(+)	(+)	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Fragraea fragrans	S	.	.	.	.	(+)	(+)	(+)	(+)	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Melastoma sanguineum	S	.	.	.	.	.	.	(+)	(+)	.	.	.	.	.	.	.	.	.	.	.	(+)	(+)	+
Syzygium sp. 1	T2	+	+		.	.	.	.	.	.	.	.	.	+	.	(+)	(+)	(+)	.	.	.	.	.
Aganosma marginata	H	.	.	+	.	.	.	.	.	.	.	.	.	.	.	(+)	(+)	(+)	.	.	.	.	.
Schizaea digitata	H	.	.	.	.	(+)	(+)		(+)	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Gnetum sp.	S,H	.	.	.	.	.	.	.	.	1.1	+	1.1	.	.	±	.	.	.	.	.	.	.	.
Acriopsis ridleyi	S,H	±	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	(+)	(+)

Table 19. (continued)

Litsea glutinosa	H	.	.	+	.	(+)	(+)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Suregada multiflorum	H	.	.	+	.	.	.	.	.	+	1.1	.	.	.	.	.	.	.	.	.	.	.	.	.
Prrossia adnascens	S	.	+	.	.	(+)	(+)	.	.	.	.	.	.	.	.	.	.	.	.	.	+	(+)	(+)	
Flagellaria indica	S	.	.	.	.	.	.	(+)	(+)	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Calamus sp.	H	.	.	.	.	.	.	(+)	(+)	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Eulophia andamanensis	H	.	.	.	.	.	.	2.2	.	+	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.
Vanilla aphylla	S	.	.	.	.	.	.		(+)	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.
Cassytha filiformis	S	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.
Tarenna wallichii	H	.	.	(+)	(+)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dipterocarpus chartaceus	T1	.	.	3.3	.	.	.		(+)	.	.	.	.	.		.	.	.	.	.	.	.	.	.
Ipomoea sp.	H	.	.	+	.	.	.			.	.	.	.	.	(+)	.	.	.	.	.	.	.	.	.
Hopea odorata	T1	.	.	.	.	.	.	2.2	+	.	.	.	.	.		.	.	.	.	.	.	.	.	.
Elaeocarpus robustus	H	.	.	.	.	.	.	(+)	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
Phyllanthus sp.	S	.	.	.	.	.	.	(+)	.	.	.	.	.	1.1	.	.	.	.	.	.	.	.	.	.
Dendrotrophe varians	T2	2.3	.	.	.	.	.	.	(+)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Licuala sp.	S	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Syzygium sp. 2	S	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+.2	.	.	.	.	.

Species with presence 1 no.3: *Dipterocarpus alatus* T1-5.5, *Streptocaulon juventas* H-+, Poaceae sp. 3 H-+, no.4: *Ficus hispida* S-+, *Diospyros ferrea* S-+, *Allophylus cobbe* S-+, *Canthium* sp. 2 S-+, H-+, *Nephrolepis* sp. H-+, no. 6: *Ficus* sp. T2-+, no.7: *Alpina* sp. H-+, *Alocasia* sp. H-+, no.9: *Syzygium* sp. 3 T1-+, Poaceae sp. 4 S-3.2, *Cyperus* sp. 2 H-3.3, no.10: *Adenia penangiana* S-+, *Cerbera odollam* S-+, no.11: Euphorbia sp. 2 H-+, no. 12: *Ficus* sp. T1-1.1, *Brucea javanica* H-+, no. 13: *Anisoptera castata* T2-+, no.14: *Micropera pallida* H-+, no.18: *Memecylon edule* H-+.

Locality: column no. 1: Ban Laem Santi, Lamae in Chumphon province, 2:Ban Takrop, Chaiya in Surat Thani provice, 3: Ban Plongmai, Chaiya in Surat Thani province, 4: Ban Laem Pho 1, Chaiya in Surat Thani province, 5: Ban Laem Pho 2, Chaya in Surat Thani province, 6: Ban Nuea, Chaiya in Surat Thani province, 7: Ban Na Thap, Chana in Songkhla province, 8: Hat Thai Mueang, Thai Mueang in Phangnga province.

Plate 32. Coastal grassland vegetation along the coast of peninsular Thailand: A, B. Grassland vegetation at Ban Bangboet, Pathio district; C, D. Grassland vegetation at Ao Panang Tak, Mueang district Chumphon province; E, F. grassland vegetation at Ban Plongmai, Chiya district Chumphon province; G, H. Grassland vegetation at Hat Thaimuenag, Thai muenag district Phangnga province.

Plate 33. Coastal grassland vegetation: A-D. *Cyperus stoloniferus* community at Ao Panang Tak, Mueang Chumphon district, Chumphon province; E. *Cyperus stoloniferus* community at Ban Bangboet, Pathio district, Chumphon province.

Plate 34. Coastal grassland vegetation. A, B. *Ischaimum mutricum* community; C, D, E. Vigno-ipomoetum pedis-caprae (*Canavalia rosea-Ipomoea pes-caprae* community); F *Hydrophylax maritima* community; G, H. Glehnio-Spinificetum littorei (*Spinifex littoreous* community).

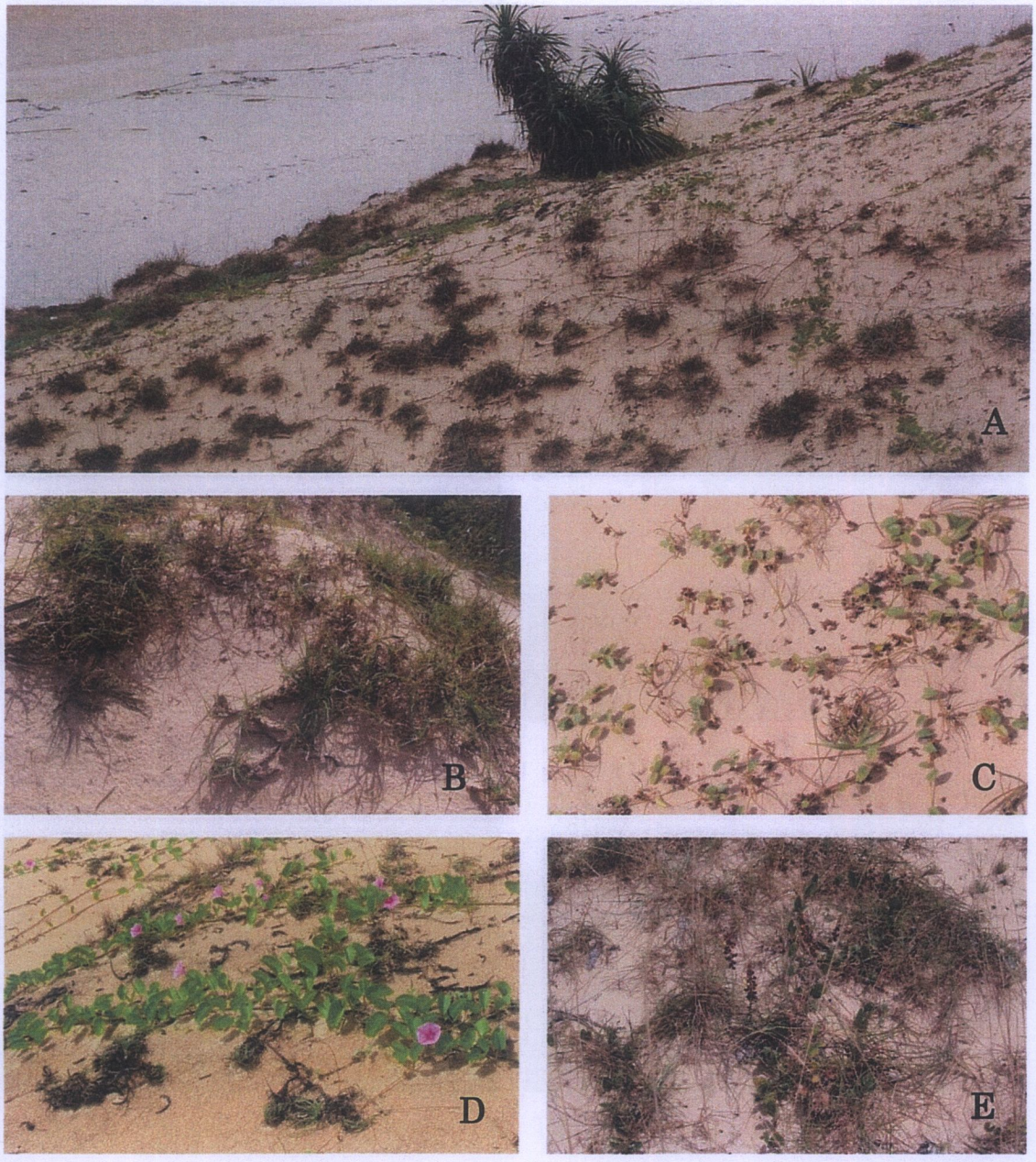


Plate 35. Coastal grassland vegetation on sand dune at Ban Bangboet, Pathio district, Chumphon province: A. Coastal grassland vegetation at the slope of sand-dune; B-D. *Fimbristylis sericea* community; E. *Dunbaria bella* community.

Plate 36. Coastal scrub vegetation: A. Thuareio-Viticetum rotundifoliae (*Vitex rotundifolia* community) at Ao Panang Tak, Chumphon province; B. *Scaevola taccada* community at Banbangboet, Chumphon province; C-E. *Syzygium gratum* community at Ban Thung Tako, Chumphon province Ban Pak Khlong, Krabi province and Hat Yong Ling, Trang province. F. *Micromelum minutum-Allophylus cobbe* community at Ao Panang Tak Chumphon province.

Plate 37. Coastal scrub vegetation on sand dune at Ban Bangboet, Pathio district, Chumphon province: A. *Pandanus odoratisimus* community; B. *Rhodomyrtus tomentosa* community; C. *Diospyros ferrea* community community; D. *Calophyllum pulcherrimum* community; E. *Polyalthia evecta* community; F. *Sindora siamensis* community.

Plate 38. Coastal woodland vegetation: A, B. *Psychotria saementosa-Dipterocarpus obtisifolius* community

Plate 39. Coastal woodland vegetation: A-C. *Symplocso cochinchinensis-Lannnea coromendelica* community.

Plate 40. Coastal woodland vegetation; A, B. *Dalvallia denticulate-Vatica harmandiana* community.

Plate 41. Coastal woodland vegetation: A, B. *Rhodamnia cinera-Syzygium gratum* community.

CHAPTER 5
SELECTED ENVIRONMENTAL PARAMETERS

RESULTS

Selected environmental parameters which might have impacts on the structure as well as the plant species composition of the terrestrial coastal vegetation on the sandbars/dunes in the Peninsular Thailand had been investigated and discussed with respect to site classification.

Environmental parameters:

1. Ground water

The ground water levels in all sites vary from 0.3-2.0 m deep from the ground surface. The electrical conductivity ranges from 3.2 to 87.9. The pH values range from 4.9-7.1 (Table 20).

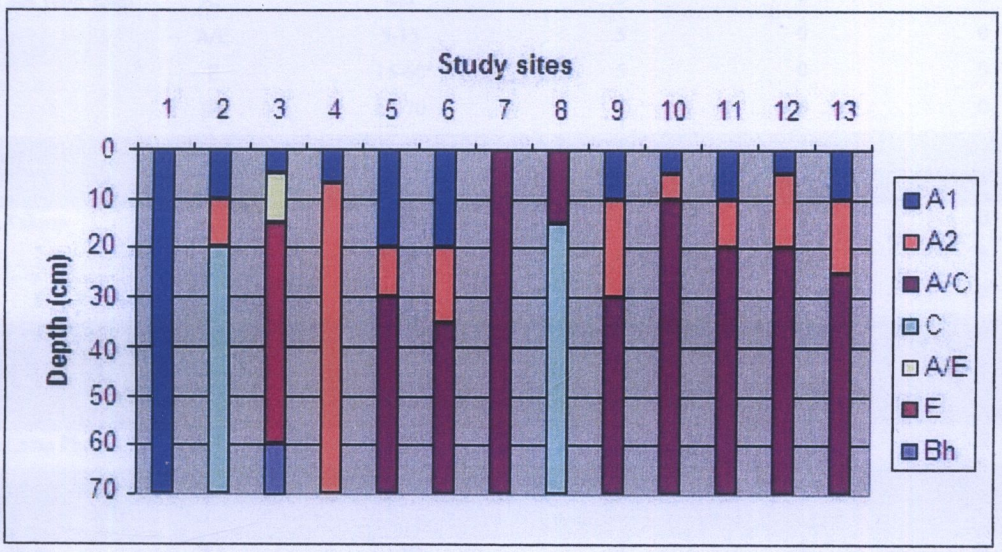
Table 20. Analytical data of groundwater.

Study sites	Depth (m)	pH	Ec (μS/cm)	Date of collection
Site on the gulf of Thailand				
Ban Bangboet	1.8	6.34	87.9	12/11/2008
Ao Phanang Tak	0.3	7.05	55.8	12/11/2008
Ban Pak Nam Tako	0.5	6.24	6.4	11/11/2008
Ban Laem Santi	2.0	6.10	10.7	11/11/2008
Ban Takrop	2.0	4.90	7.7	11/11/2008
Ban Plongmai	1.8	6.28	31.4	11/11/2008
Ban Laem Pho 1	1.3	6.74	19.2	11/11/2008
Ban Laem Pho 2	-	-	-	-
Ban Nuea	1.5	6.00	73.3	11/11/2008
Ban Na Thap	2.0	7.14	16.1	24/12/2008
Sites on the Andaman Sea				
Hat Thai Mueang	1.5	6.32	10.3	13/11/2008
Hat Thung Thale	1.0	5.37	3.2	14/11/2008
Hat Yong Ling	1.2	7.05	21.8	19/12/2008

2. Soil

2.1 Soil profile

The soil profiles of two landforms (the coastal sandbars/ and dune) are rather different (Figure 18). The soil profile of the sandbar landform could be divided into 2-4 horizons. However, in general, there are 3 horizons, i.e., A1, A2 and C horizon. In any case, it was slightly different in study sites. At the sites of Ban Laempho 2, there are A/C and C horizon and Ban Laem Santi, there are A and A/C horizon. At only the Site of Ban Laempho 1, an A/C horizon was recognized and at the site Ban Pak Nam Tako, that A1, A/E, E and Bh horizons were recognized. Whereas the sand dune landform of Ban Bangboet, there is only an A horizon.



Study sites: 1=Ban Bangboet, 2=Ao Panang Tak, 3=Ban Thung Tako, 4=Ban Laem Santi, 5=Ban Takrop, 6=Ban Plongmai, 7=Ban Laem Phol, 8=Ban Laem Pho 2, 9=Ban Nuea, 10=Ban Na Thap, 11=Hat Thai Mueang, 12=Hat Thung Thale, 13=Hat Yong Ling

Horizon: A=Mineral surface horizons with organic matter, A1=Topmost mineral surface horizons, A2=lower mineral surface horizon, Bh =Mineral subsurface horizon, with organic matter accumulation, C=Unconsolidated mineral material, E=Eluvial horizons.

Figure 18. Schematic profiles of surface soils.

2.2 The mineralogy

Three minerals could be identified in the soils of the present study: quartz, K-feldspar and plagioclase. All study sites are dominated by quartz. There is even pure quartz in five study sites, i.e., Ban Bangboet, Ban Pak Nam Tako, Ban

Nathap, Hat Thung Thale and Hat Thai Mueang; quartz and K-feldspar together were found in 7 study sites, i.e., Ao Panang Tak, Ban Takrop, Ban Plongmai, Ban Laem pho 1, Ban Laem Pho 2, Ban Nuea and Hat Yong Ling; quartz, K-felspar and plagioclase together was found in only one site at Ban Laem Santi. (Table 21)

Table 21. Mineralogy of the soil.

Study site	Horizon	Depth (cm)	Quartz	K-Feldspar	Plagioclase
Bangboet	A	0-10	5	0	0
Ao Phanang Tak	A1	0-10	4	2	0
	A2	10-20	4	2	0
	C	20-30	4	2	0
Ban Pak Nam Tako	A1	0-5	5	0	0
	A/E	5-15	5	0	0
	E	15-60	5	0	0
	Bh	60-70	5	0	0
Ban Laem Santi	A	0-7	4	3	1
	A/C	7-25	4	2	0
Ban Takrop	A1	0-20	4	2	0
	A2	20-30	4	2	0
	C	30-40	4	2	0
Ban Plongmai	A1	0-20	4	2	0
	A2	20-35	4	2	0
	C	35-40	4	2	0
Ban Laem Pho 1	A/C	0-15	4	1	0
Ban Laem Pho 2	A/C	0-15	4	1	0
	C	15-30	4	1	0
Ban Nuea	A1	0-10	4	2	0
	A2	10-30	4	2	0
	C	30-40	4	2	0
Ban Na Thap	A1	0-5	5	0	0
	A2	5-10	5	0	0
	C	10-20	5	0	0
Hat Thai Mueang	A1	0-10	5	0	0
	A2	10-20	5	0	0
	C	20-30	5	0	0
Hat Thung Thale	A1	0-5	4	0	0
	A2	5-20	4	0	0
	C	20-25	4	0	0
Hat Yong Ling	A1	0-10	4	1	0
	A2	10-25	4	0	0
	C	25-35	4	0	0

Remark: 0 = non, 1 = trace, 2 = low, 3 = medium, 4 = high 5=pure

3.3 Soil physical properties

Particle sizes distribution

The particle sizes of soil of all study sites were analyzed for six parameters, i.e., the particle size > 2 mm, coarse sand (2000-630 μm), medium sand (630-200 μm), fine sand (200-63 μm), the coarse silt (63-20 μm) and the particle size < 20 μm. (Table 17). The soil texture of all study sites is "sand" (Landon, 1991), consisting of sand particles 86.8-97.9 %, silt and clay particles 2.4-13.2 %. Particle larger than 2 mm were found in only 4 sites at Ban Takrop, Ban Plongmai, Ban Nuea and Ban Na Thap, rangeing from 0.1-0.5 %. (Table 22)

Table 22. Particle sizes distribution of the soil

Study site	Horizon	Depth	Mass (%)					
		(cm)	>2mm	cS	mS	fS	cSi	Sum <20µ
Ban Bangboet	A	0-10	0.0	0.0	41.2	52.7	0.4	5.7
Ao Phanang Tak	A1	0-10	0.0	0.2	46.9	42.4	5.9	4.5
	A2	10-20	0.0	0.2	50.5	42.6	3.1	3.6
	C	20-30	0.0	0.2	49.5	44.9	3.5	1.9
Ban Pak Nam Tako	A1	0-5	0.0	0.1	8.6	84.8	2.5	4.0
	AE	5-15	0.0	0.0	9.7	85.2	0.3	4.8
	E	15-60	0.0	0.0	10.7	86.9	0.1	2.3
	Bh	60-70	0.0	0.0	10.5	80.4	0.6	8.6
Ban Laem Santi	A	0-7	0.0	16.5	43.1	32.8	2.3	5.3
	AC	7-25	0.0	19.9	41.7	29.5	1.9	7.0
Ban Takrop	A1	0-20	0.0	36.4	58.7	1.2	0.3	3.4
	A2	20-30	0.1	35.5	60.0	1.7	0.4	2.2
	C	30-40	0.4	34.4	59.7	1.7	0.6	3.2
Ban Plongmai	A1	0-20	0.2	32.6	62.9	1.3	0.3	2.7
	A2	20-35	0.2	30.0	62.7	1.6	0.4	5.1
	C	35-40	0.3	44.7	50.3	1.4	0.3	2.9
Ban Laem Pho 1	A/C	0-15	0.0	36.4	56.5	2.0	0.2	4.9
Ban Laem Pho 2	A/C	0-15	0.0	21.1	64.3	7.0	0.5	7.2
	C	15-30	0.0	22.9	68.3	5.6	0.6	2.6
Ban Nuea	A1	0-20	1.4	13.8	51.0	23.5	3.3	6.9
[redacted]								
Hat Thai Mueang	A1	0-10	0.0	0.0	66.6	29.4	0.7	3.3
	A2	10-20	0.0	0.0	69.6	28.3	0.4	1.7
	C	20-30	0.0	0.0	70.7	26.5	1.0	1.9
Hat Thung Thale	A1	0-5	0.0	0.0	7.8	86.5	4.4	1.2
	A2	5-20	0.0	0.0	7.7	84.3	7.5	0.6
	C	20-25	0.0	0.0	8.3	86.4	3.7	1.6
Hat Yong Ling	A1	0-10	0.0	0.0	5.9	83.3	6.9	3.8
	A2	10-25	0.0	0.0	5.2	89.6	3.0	2.2
	C	25-35	0.0	0.0	5.1	89.7	4.0	1.3

3.4 Soil chemical properties

The chemical properties of the soils from all study sites were analyzed for fourteen parameters, i.e., C ranges from 0.6-71.1 mg/g, N ranges from 0.03-1.48 mg/g, C/N ratio 6.9-144.3, pH 6.3-6.8, CEC 2.0-36.3 $mmol_c/kg$, BS 1.1-31.3 %, Na 10-105 mg/kg, K 3-203 mg/kg, Ca 3-191 mg/kg, Mg 1-130 mg/kg, Al 1-272 mg/kg, Ca/Al 0.03-4.93, EC 3.5-71.9 µS/cm, Cl^- 1.2-114 mg/kg, PO_4^{3-} 0-49.2 mg/kg and SO_4^{2-} 2.5-47.2 mg/kg. (Table 23).

Table 23. Chemical properties of the soils.

Study site	Horizon	Depth (cm)	C mg/g	N mg/g	C/N ratio	pH H_2O Ex	CEC $mmol_c$ /kg	BS [%]	$Na_{exch.}$ mg/kg	$K_{exch.}$ mg/kg	$Ca_{exch.}$ mg/kg	$Mg_{exch.}$ mg/kg	$Al_{exch.}$ mg/kg	Ca/Al molar ratio	EC µS/cm	Cl^- mg/kg	PO_4^{3-} mg/kg	SO_4^{2-} mg/kg
Bangboet (1)	A	0-10	3.6	0.19	18.5	6.7	7.7	4.6	84	13	7	3	27	0.12	7.9	44.4	0.0	18.0
Bangboet (2)	A	0-10	11.6	0.63	18.5	6.5	10.3	7.9	105	42	12	20	21	0.26	11.0	47.6	0.0	18.4
Ao Phanang Tak	A1	0-10	4.7	0.27	17.1	-	11.9	9.0	22	34	117	17	17	3.09	40.1	10.9	0.0	14.3
	A2	10-20	1.2	0.08	14.3	-	6.8	4.8	19	12	54	11	10	2.37	22.3	7.3	0.0	4.2
	C	20-30	0.8	0.11	6.9	-	5.7	5.0	17	11	45	21	4	4.93	11.2	4.3	0.0	2.5
Ban Pak Nam Tako	A1	0-5	8.6	0.34	25.1	6.8	8.8	5.7	92	19	11	8	28	0.18	4.8	7.2	0.0	13.2
	AE	5-15	2.4	0.13	18.0	6.8	5.7	4.8	90	14	8	2	8	0.43	3.6	5.2	0.0	10.4
	E	15-60	0.9	0.08	10.9	6.8	3.0	2.9	52	3	9	1	1	3.30	3.5	4.8	0.0	11.2
	Bh	60-70	14.0	0.67	20.9	6.3	36.3	5.9	97	17	20	4	272	0.03	25.8	114.0	0.0	47.2
Ban Laem Santi	A	0-7	3.6	0.19	19.5	6.8	9.1	4.7	60	40	10	6	38	0.12	6.5	10.4	0.0	15.2
	AC	7-25	2.2	0.11	19.3	6.7	8.5	4.8	86	21	6	3	32	0.08	5.7	9.6	0.0	14.8
Ban Takrop	A1	0-20	3.5	0.19	18.3	-	3.8	2.6	23	19	11	7	11	0.42	12.6	2.2	6.3	5.8
	A2	20-30	0.8	0.08	10.3	-	3.4	2.3	25	22	6	4	10	0.27	9.6	3	4.2	3.5
	C	30-40	0.9	0.03	32.5	-	2.0	1.1	10	14	4	1	8	0.22	6.2	1.2	3.2	2.7
Ban Plongmai	A1	0-20	2.7	0.11	23.4	-	3.5	2.0	21	22	7	2	13	0.25	8.7	1.5	6.2	3.7
	A2	20-35	1.4	0.04	34.4	-	2.9	1.7	13	23	7	2	11	0.27	9.1	1.6	4.1	3.9
	C	35-40	0.6	0.03	20.0	-	2.8	1.3	12	12	5	3	11	0.22	9.2	2.4	0.0	3.8
Ban Laem Pho 1	A/C	0-15	4.8	0.19	24.7	6.6	6.0	4.1	41	46	11	7	17	0.29	6.4	10.0	0.0	12.4
Ban Laem Pho 2	A/C	0-15	11.0	0.68	16.1	6.7	14.6	12.5	46	84	104	39	17	2.73	7.8	13.6	11.2	15.2
	C	15-30	2.2	0.11	19.8	6.6	4.6	3.5	43	29	10	4	9	0.51	4.8	5.2	0.0	11.2

Table 23. (continued)

Study site	Horizon	Depth (cm)	C mg/g	N mg/g	C/N ratio	pH H_2O Ex	CEC $mmol_e$ /kg	BS [%]	$Na_{exch.}$ mg/kg	$K_{exch.}$ mg/kg	$Ca_{exch.}$ mg/kg	$Mg_{exch.}$ mg/kg	$Al_{exch.}$ mg/kg	Ca/Al molar ratio	EC µS/cm	Cl^- mg/kg	PO_4^{3-} mg/kg	SO_4^{2-} mg/kg
Ban Nuea (1)	A1	0-10	3.4	0.23	15.0	6.7	35.2	31.3	49	1061	29	10	34	0.37	9.4	12.8	48.4	15.2
	A2	10-30	3.4	0.16	21.6	6.7	10.2	4.8	41	93	9	3	47	0.08	7.4	8.0	28.4	14.4
Ban Nuea (2)	A1	0-10	4.5	0.28	16.1	-	14.1	10.9	16	64	135	23	28	2.20	41.1	3.9	14.1	11.0
	A2	10-30	4.8	0.24	20.0	-	12.9	6.5	31	63	50	13	56	0.40	24.9	2.4	9.0	6.8
	C	30-40	4.3	0.25	17.1	-	11.5	6.2	15	39	74	10	47	0.70	25.9	3.1	7.8	7.0
Ban Nuea (3)	A1	0-20	5.7	0.33	17.3	-	15.4	9.4	14	77	101	22	51	0.89	56.7	3.3	17.3	12.6
	A2	20-25	3.1	0.17	17.7	-	8.1	2.6	15	39	11	4	49	0.10	17.8	1.8	7.0	5.6
	C	25-40	4.1	0.15	28.0	-	11.1	2.3	18	35	7	3	79	0.04	34.2	1.8	5.4	4.7
Ban Na Thap	A1	0-5	16.0	0.50	32.2	-	25.1	7.1	53	99	18	16	162	0.05	41.5	12.9	17.7	33.5
	A2	5-10	4.6	0.18	26.0	-	13.2	2.7	23	31	10	5	94	0.05	24.5	6.4	0.0	13.6
	C	10-20	2.8	0.18	15.5	-	7.8	2.2	38	8	5	1	50	0.05	16.1	2.2	0.0	16.4
Hat Thai Mueang	A1	0-10	13.0	0.53	24.7	6.7	7.2	6.6	39	29	40	27	5	3.42	5.5	7.2	9.6	13.2
	A2	10-20	3.9	0.17	22.6	6.7	3.9	3.6	47	13	8	11	2	1.49	4.0	9.2	0.0	13.2
	C	20-30	1.9	0.08	23.0	6.3	2.5	2.3	38	6	5	4	1	1.86	3.5	6.0	0.0	10.4
Hat Thung Thale	A1	0-5	41.8	1.07	39.2	-	15.6	13.9	35	128	69	69	15	2.13	37.1	7.9	46.4	33.6
	A2	5-20	15.1	0.36	41.5	-	5.1	4.1	24	36	6	23	8	0.31	11.3	3.2	9.6	9.0
	C	20-25	7.1	0.05	144.3	-	3.8	3.3	16	31	7	18	5	0.60	8.1	3.3	4.7	5.2
Hat Yong Ling	A1	0-10	71.1	1.48	47.9	-	30.9	28.2	64	203	191	130	24	3.60	71.9	17.3	49.2	46.7
	A2	10-25	10.9	0.14	77.5	-	4.6	4.1	24	38	7	22	4	0.76	12.6	3.3	6.7	7.1
	C	25-35	3.3	0.06	53.1	-	2.2	2.1	21	16	3	7	1	1.43	4.9	2	2.6	3.0

4. The relationship between the vegetation and the soil properties.

The DCA ordination of 13 study sites and 124 species yielded the first two axes with eigenvalues of 0.66 and 0.27. The ordination of sites is in Figure 19 (Axis 1 and 2) and the species ordination is presented in Figure 20 (Axis 1 and 2) as well. (Table 24).

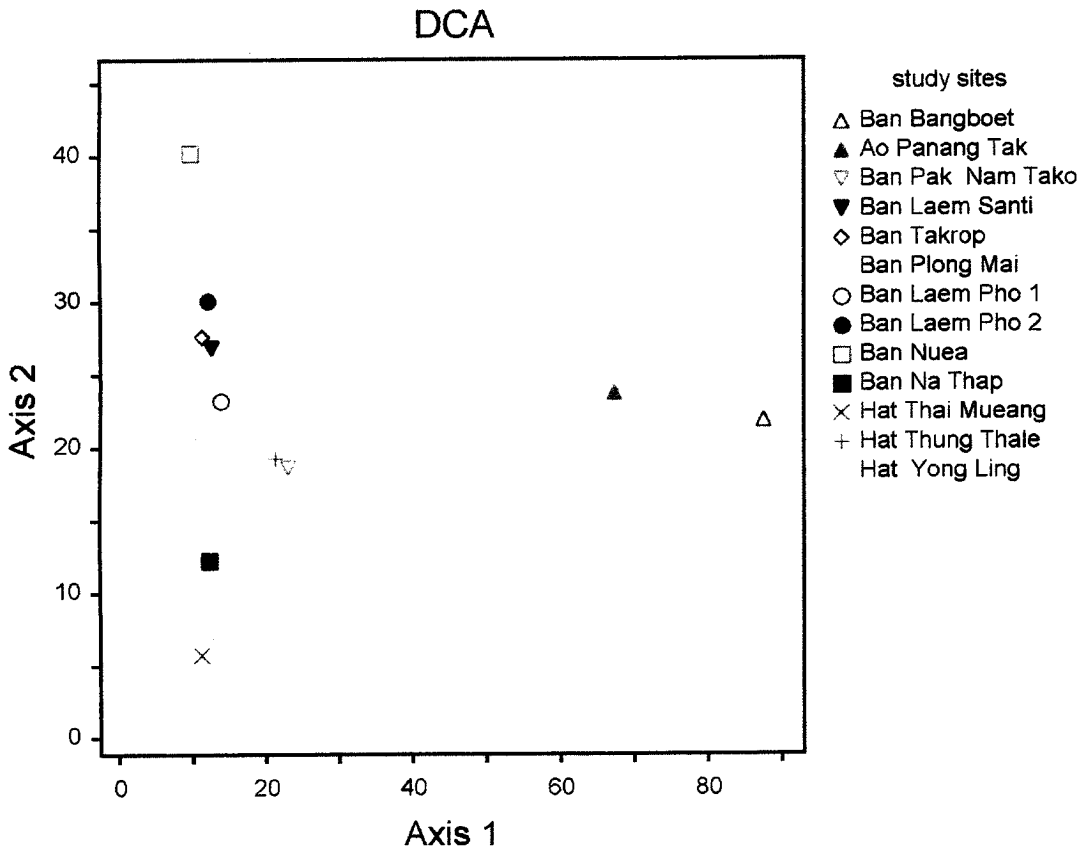


Figure 19. DCA ordination diagram for 13 study sites of the coastal vegetation.

The ordination of the study sites by using DCA are shown in Figure 19. The 13 study sites scores were plotted along Axis 1 and 2, and tended to cluster into the three groups along the first axis, i.e., sand dune vegetation (Ban Bangboet site), beach vegetation (Ao Panang Tak site) and other inland sandbars vegetation (other sites). Their respective vegetation was separated from right to left on Axis 1 with an eigenvalue = 0.65.

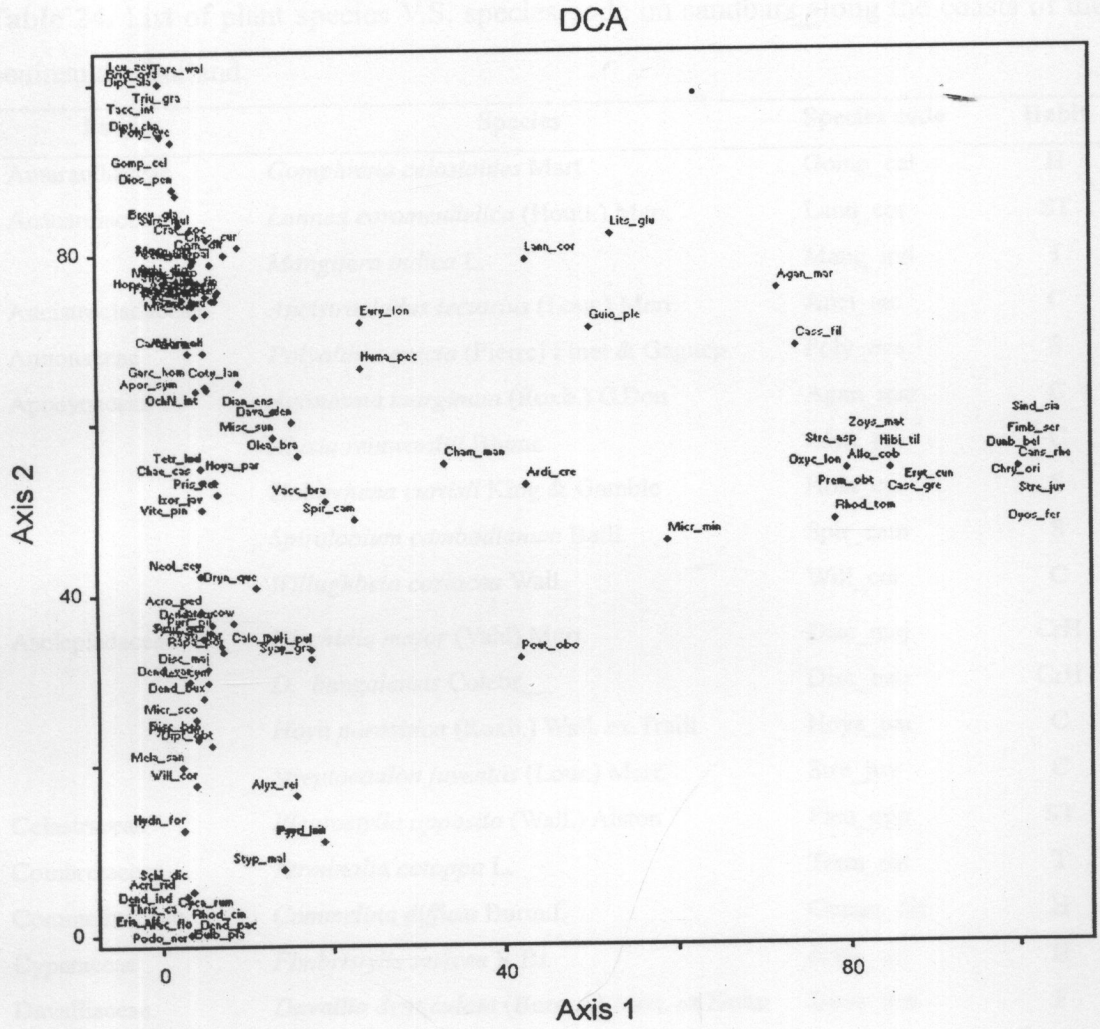


Figure 20. DCA ordination diagram of coastal vegetation for 118 species.
(abbreviation as in Table 24)

The ordination of species by using DCA is shown in Figure 21. Species recorded only at the beach or sand dune are ordinal close to the left end-point of the first axis. Species recorded at the sand dune, e.g., *Fimbristylis sericea*, *Chysopogon orientaris*, *Dunbaria bella* Prain, *Sindora siamensis* *Diospyros ferrea*. Species recorded at the beach, e.g., *Premna obtusifolia, Casearia grewiifolia, Allophylus cobbe* and *Erythroxulum cuneatum* while species recorded only at inland sand dune are close to the right end-point, e.g., *Dipterocarpus alatus*, *D. chataceus*, *Hopea odorata*, *Garcinia Hombroniana, Cotylelobium lanceolatum*, *Vitex pinnata, Acronychia pedunculata*.

Table 24. List of plant species V.S. species code on sandbars along the coasts of the peninsular Thailand.

Family	Species	Species code	Habit
Amaranthaceae	*Gomphrena celosioides* Mart.	Gomp_cel	H
Anacardiaceae	*Lannea coromendelica* (Houtt.) Merr.	Lann_cor	ST
	Mangifera indica L.	Mang_ind	T
Ancistrocladaceae	*Ancistrocladus tectorius* (Lour.) Merr.	Anci_tec	C
Annonaceae	*Polyalthia evecta* (Pierre) Finet & Gagnep.	Poly_eve	S
Apocynaceae	*Aganosma marginata* (Roxb.) G.Don	Agan_mar	C
	Alyxia reinwardtii Blume	Alyx_rei	C
	Holarrhena curtisii King & Gamble	Hola_cur	S
	Spirolobium cambodianum Baill.	Spir_cam	S
	Willughbeia coriacea Wall.	Will_cor	C
Asclepiadaceae	*Dischidia major* (Vahl) Merr.	Disc_maj	CrH
	D. bangalensis Colebr.	Disc_ban	CrH
	Hoya parasitica (Roxb.) Wall. ex Traill	Hoya_par	C
	Streptocaulon juventas (Lour.) Merr.	Stre_juv	C
Celastraceae	*Pleurostylia opposita* (Wall.) Alston	Pleu_opp	ST
Combretaceae	*Terminalia catappa* L.	Term_cat	T
Commelinaceae	*Commelina diffusa* Burm.f.	Comm_dif	H
Cyperaceae	*Fimbristylis sericea* R.Br.	Fimb_ser	H
Davalliaceae	*Davallia denticulata* (Burm.f.) Mett. ex Kuhn	Dava_den	F
	D. heterophylla Sm.	Dava_het	F
	D. pectinata Sm.	Dava_pec	F
Dilleniaceae	*Tetracera indica* (Christm. & Panz.) Merr.	Tetr_ind	C
	T. loureiri (Finet & Gagnep.) Pierre ex Craib	Tetr_lou	C
Dipterocarpaceae	*Cotylelobium lanceolatum* Craib	Coty_lan	T
	Dipterocarpus alatus Roxb. ex G.Don	Dipt_ala	T
	D. chartaceus Symington	Dipt_cha	T
	D. obtusifolius Teijsm. ex Miq.	Dipt_obt	T
	Hopea odorata Roxb.	Hope_odo	T
	Shorea roxburghii G.Don	Shor_rox	T
	Vatica harmandiana Pierre	Vati_har	T
Ebenaceae	*Diospyros areolata* King & Gamble	Dios_are	ST
	D. ferrea (Willd.) Bakh.	Dios_fer	S
Elaeocarpaceae	*Elaeocarpus robustus* Roxb.	Elae_rob	T
Epacridaceae	*Styphelia malayana* (Jack) Spreng	Styp_mal	S

Table 24. (continued)

Family	Species	Species code	Habit
Ericaceae	*Vaccinium bracteatum Thunb.*	Vacc_bra	S
Erythroxylaceae	*Erythroxylum cuneatum* (Miq.) Kurz	Eryt_cun	S
Euphrobiaceae	*Breynia racemosa* (Blume) Mull.Arg.	Brey_rac	S
	Chaetocarpus castanocarpus (Roxb.) *Thwaites*	Chae_cas	ST
	Suregada multiflorum (A.Jass.) Bail.	Sure_mul	S
Flacourtiaceae	*Casearia grewiifolia* Vent.	Case_gre	ST
Gentianaceae	*Fagraea fragrans* Roxb.	Fagr_fra	T
Guttifereae	*Calophyllum pulcherrimum* Wall.	Calo_pul	T
	C. cochinchinense (Lour.) Blume	Crat_coc	ST
	Garcinia cowa Roxb. ex DC.	Garc_cow	ST
	G. hombroniana Pierre	Garc_hom	T
Hemerocallidaceae	*Dianella ensifolia* (L.) DC.	Dian_ens	H
Labiatae	*Premna obtusifolia* R.Br.	Prem_obt	C
	Vitex pinnata L.	Vite_pin	T
Lauraceae	*Cassytha filiformis* L.	Cass_fil	C
	Neolitsea zeylanica (Nees) Merr.	Neol_zey	ST
	Litsea glutinosa (Lour.) C.B.Rob	Lits_glu	ST
Leguminosae-Caesalpinioideae	*Sindora siamensis* Teijsm. & Miq.	Sind_sia	S
Leguminosae-Papilionoideae	*Abrus precatorius* L.	Abru_pre	C
	Derris indica Bennet	Derr_ind	ST
	Dunbaria bella Prain	Dunb_bel	C
Malvaceae	*Hibiscus tiliaceus* L.	Hibi_til	ST
Melastomataceae	*Melastoma malabathricum* L.	Mela_mal	S
	M. sanguineum Sims	Mela_san	S
	M. ovatum Sm.	Meme_ova	S
	M. scutellatum Naudin	Meme_scu	S
Moraceae	*Streblus asper* Lour.	Stre_asp	ST
Myrsinaceae	*Ardisia crenata* Sims	Ardi_cre	S
	Rapanea porteriana (A.DC.) Mez	Rapa_por	ST
Myrtaceae	*Rhodamnia cinerea* Jack	Rhod_cin	S
	R. tomentosa (Aiton) Hassk.	Rhod_tom	S
	Syzygium grande (Wight) Walp.	Syz_gran	T

Table 24. (continued)

Family	Species	Species code	Habit
	S. gratum (Wight) S.N.Mitra	Syz_grat	ST
Ochidaceae	*Acriopsis ridleyi* Hook.f.	Acri_rid	O
	Arachnis flosaeris (L.) Rchb.f.	Arac_flo	O
	Bulbophyllum planibulbe (Ridl.) Ridl.	Bulb_pla	O
	Cymbidium finlaysonianum Lindl.	Cymb_fin	O
	Dendrobium crumenatum Sw.	Dend_cru	O
	D. indivisum (Blume) Miq.	Dend_ind	O
Ochidaceae	*D. pachyphyllum* (Kuntze) Bakh.f.	Dend_pac	O
	Doritis pulcherrima Lindl.	Dori_pul	TerO
	Eria affinis Griff.	Eria_aff	O
	Eulophia andamanensis Rchb.f.	Eulo_and	O
	Thrixspermum calceolus (Lindl.) Rchb.f.	Thri_cal	O
	Vanilla aphylla Blume	Vani_aph	O
Ochnaceae	*Ochna integerrima* (Lour.) Merr.	Ochn_int	S
Oleaceae	*Olea brachiata* (Lour.) Merr.	Olea_bra	ST
Opiliaceae	*Champereia manillana* (Blume) Merr.	Cham_man	S
	Cansjera rheedei J.F.Gmel.	Cans_rhe	C
Pittosporaceae	*Pittosporum ferrugineum* W.T.Aiton	Pitt_fer	ST
Poaceae	*Chrysopogon orientalis* A.Camus	Chry_orie	G
	Zoysia matrella (L.) Merr.	Zoys_mat	G
Podocarpaceae	*Podocarpus neriifolius* D.Don.	Podo_ner	T
Polypodiaceae	*Drynaria quercifolia* (L.) Sm.	Dryn_que	F
	Microsorum scolopendria (Burm.f.) Copel.	Micr_sco	F
	Pyrrosia longifolia (Burm.f.) Morton.	Pyrr_lon	F
	Pyrrosia adnascens (G.Forst.) Ching	Pyrr_adn	F
	P. piloselloides (L.) M.G.Price	Pyrr_pil	F
Rhizophoraceae	*Carallia brachiata* (Lour.) Merr.	Cara_bra	ST
Rubiaceae	*Catunaregam tomentosa* (Blume ex DC.) Tirveng.	Catu_tom	S
	Chassalia curviflora (Wall.) Thwaites	Chas_cur	S
	Hydnophytum formicarum Jack	Hydn_for	H
	Ixora javanica (Blume) DC.	Ixor_jav	S
	Morinda elliptica Ridl.	Mori_ell	S
	Oxyceros longiflora (Lam.) T.Yamaz.	Oxyc_lon	S
	Prismatomeris tetrandra (Roxb.) K.Schum.	Pris_tet	S
	Psychotria sarmentosa Blume	Psyc_sar	C

Table 24. (continued)

Family	Species	Species code	Habit
	Psydrax nitida (Craib) K.M.Wong	Psyd_nit	S
	Tarenna wallichii (Hook.f.) Ridl.	Tare_wal	S
Rutaceae	*Acronychia pedunculata* (L.) Miq.	Acro_ped	ST
	Atalantia monophylla (DC.) Correa	Atal_man	ST
	Micromelum minutum (G.Forst.) Wight & Arn.	Micr_min	ST
Sapindaceae	*Allophylus cobbe* (L.) Raeusch	Allo_cob	S
	Guioa pleuropteris (Blume) Radlk.	Guio_ple	ST
	Mischocarpus sundaicus Blume	Misc_sun	ST
Sapotaceae	*Pouteria obovata* (R.Br.) Baehni	Pout_obo	ST
Schizaeaceae	*Schizaea dichotoma* (L.) Sm.	Schi_dic	F
	S. digitata (L.) Sw.	Schi_lon	F
Simaroubaceae	*Eurycoma longifolia* Jack	Eury_lon	S
Stemonaceae	*Stemona tuberosa* Lour.	Stem_tub	C
Taccaceae	*Tacca integrifolia* Ker Gawl.	Tacc_int	H
Theaceae	*Schima wallichii* (DC.) Korth.	Schi_wal	ST
Tiliaceae	*Microcos tomentosa* Sm.	Micr_tom	ST
Viscaceae	*Viscum articulatum* Burm.f.	Visc_art	Pa

Habit: C= Climber, CrS= Creeping Shrub, F= Fern, G= Grass, H= Herb, HC= Herbaceous Climber, O= Orchid, Pa= Parasite, S= Shrub, ST= Shrubby Tree, T= Tree, TerO= Terestrial Orchid

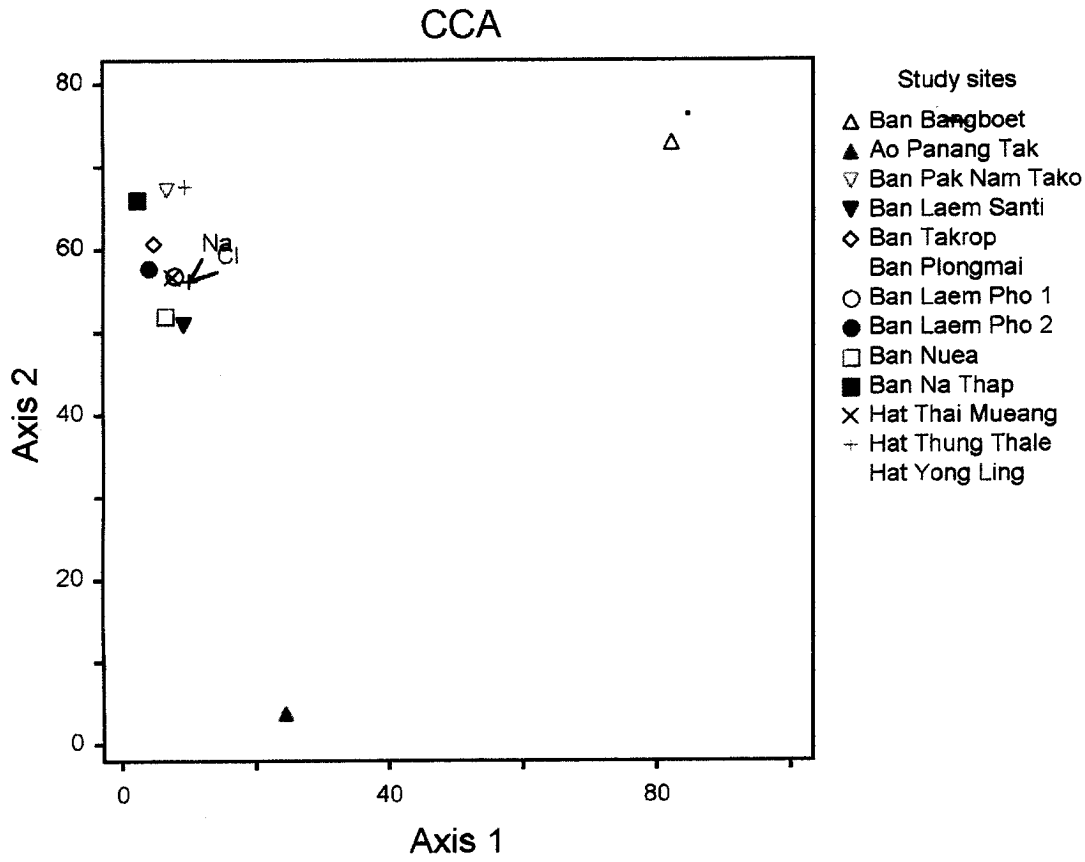


Figure 21. CCA ordination diagram of coastal vegetation for 124 species.

The ordination of species by using CCA is shown in Figure 21. The CCA eigenvalues for the first two ordination axes were 0.64 and 0.47 (Table 25), which explains 40.7 % in the vegetation data. The CCA Axis 1 was correlated with Na and Cl contents.

Table 25. Summary statistics for DCA ordination and comparisons with result from CCA.

	Axis 1	**Axis 2**	**Axis 3**
DCA			
Eigenvalues	0.66	0.27	0.11
CCA			
Eigenvalues	0.64	0.47	0.39
Cumulative % explained	23.4	40.7	54.9
Pearson correlation	0.998	0.981	0.984

DISCUSSIONS

The plant succession V.S. the coastal sandbars

Unlike the wind-blown particle sand dune, the origin of the coastal sandbars was different. The sedimentation from the coastal sea current and the geological uplift of the continent in the past had created such sandbars, both the off shored and the coastal. So, the coastal sandbar landform is quite stable. Any natural change of the coastal sandbars would happen in a large scale of time. The evidences of plant succession in this landform are hardly seen due to the rather stable physical factors. On the other hand, the different zones of vegetation along the transect line from the sea shore are quite distinct due to the different physical factors in each zone.

1.1 Coastal sand dune landform

While "the Coastal sand dune landform" at Ban Bangboet, Chumphon is the landform that due to the wind (medium-sand and fine-sand blown from the beach, creating different sizes of dunes) is called "the Eolian Landform" (The National Research Council of Thailand (NRCT), Ministry of Science Technology and Environment, 1995). Unlike the former ones, the shapes of this dune type are dynamic. As the shape could change due to the wind direction and its speed, it is rather difficult for the woodland vegetation to develop on such unstable landform. Therefore, grassland and scrub vegetation dominate on such dunes.

A note on plant succession process on the wind-blown particle sand dune at Ban Bangboet.

The different successional stages of vegetation on the sand dune at Ban Bangboet, Pathio district, Chumphon might be ranked according to different types of plant communities as well as the plant species composition (Plate 42), i.e.,

Stage 1: Primary colonization (Plate 42, A-B)

Primary colonization might happen at the edge of the dune next to the tidal zone on the bare sand surface. The succession process might begin with the

seeds of common coastal grass/sedges, e.g., *Chrysopogon orientalis and Fimbristylis sericea*. Unlike the coastal sandbars, which were formed by the sea current in the past, the sand surface of the coastal sand dune would be rather unstable at this stage and could change topographically due to varying wind speed and direction from the open sea. Therefore, the development of such stage of plant succession to the next one would depend very much on the wind direction as well as its speed.

Stage 2: Embryo dune (Plate 42, C-D)

The dune that developed from the bare sand surface had certain period of time for sand accumulation on a certain place and hence, also enough time for more plant species migration into the new forming "embryo" dune, likewise. In this embryo dune, some other additional herbaceous species to the primary colonization could be found, e.g., *Dunbaria bella*. However, the embryo dune is also unstable. It could be changed according to the wind as well. If so, the plant community might not be able to develop to the next stage due to the change of the dune itself.

Stage 3: Semi-fixed dune (Plate 42, E-F)

When the embryo dune is stable enough to have more sand accumulation, it would, then, become a semi-fixed dune. This stage of dune development is also stable enough to let more woody plant species develop. They are mostly common coastal bushes, e.g., *Pandanus odoratisimus* and *Rhodomyrtus tomentosa*. In any case, the semi-fixed dune is subjected to change due to the wind from open sea.

Stage 4: Fixed dune (Plate 42, G-H)

The fixed dune is stable enough to allow the development of more species of woody plants. Scrubs as well as shrubby trees, e.g., *Calophyllum pulcherrimum*, *Connarus semidecandrus* and *Syzygium gratum* could be found in the plant community which had developed in such areas. In some selected places, small trees could be also found due to the fact that the fixed dune changes very slowly. However, the diversity of the plant community on the fixed dune could not be compared with those of plant communities on the coastal sandbars. It may due to the

fact that thought the fixed dune landform might change slowly, it is still subjected to change. So, there would not be enough time for more litter layer as well as important plant nutrients to be accumulated so as to accommodate more plant diversity.

2. The ground water

The water reaction (pH) of ground water is slightly acid to neutral, ranges from 5.4 to 7.1 (collected in the wet period). The electrical conductivity (EC) of soil is low according to Landon (1991) and ranges from 7-88. The EC values at Ban Bangboet, Ban Nuea and Ao Panang Tak are highest among all sites studied (88, 73 and 56 μS/cm). This might be due to the effect from the nearby sea water.

There is no correlation of EC values of the groundwater and water extracts of the topsoil. The rooting pattern of species together with the distance from soil surface to the groundwater and the sensitivity of species will determine if groundwater can be utilized by the vegetation. Therefore, it is to be noticed here that the rapid recovery of terrestrial coastal vegetation from the influence of sea water of the Tsunami 2004 in selected sites on the Andaman coast e.g. Hat Thai Mueang site etc. might due to the dilution, as an effect of high precipitation in particular.

3. The Soil

According to all soil properties investigated from all study sites, it could be clearly interpreted as "Arenosols", according to the world reference base for soil resources (2006), which comprised sandy soil, including both soil developed in residual sand. Corresponding soils in other classification systems include "Psamments" of the US Soil Taxonomy. (Food and Agriculture organization of the United Nations (FAO), 2006b.)

3.1 The soil profile

At Ban Bangboet, where the sand dunes were established by the wind, soil profiles exhibit only an a A and a C horizon. Soils consist of sand particles.

The only complete profile, down to groundwater level, had been found out at Ban Pak Nam Tako. It consists of four horizons i.e. A1, AE, E and Bh. This area is an old beach deposit, situated on the inland sandbar (1,600 m from the sea). It could

be classified as an albic Arenosol.

The other study sites have almost the same pattern, consisting of three horizons i.e. A1, A2 and C. Especially the sites at Ban Takrop to Ban Nuea are called "Chiya sandbar". They are in Chiya district, Surat Thani province. The soils may also be podzolised and therefore be classified as Hyperalbic Arenosols (or 'Giant Podzol'), as the spodic horizon could not be reached in the shallow soil profile, a final classification is impossible at this stage.

In most cases an organic layer, mostly comprised of fresh fallen and slightly altered litter layer (L) and a partly decomposed and densely rooted F layer, is developed. The thickness of the A horizon varies from less than 10 to 35 cm.

3.2 The mineralogy

Minerals supply base cations (Ca^{++}, Mg^{++}, Na^{+}, K^{+}) by weathering processes. Quartz is the main mineral found at all study sites (because of sand is mainly composed of quartz). There are no traces of K- Feldspar found in 5 sites, i.e., Ban Bangboet, Ban Pak Nam Tako, Ban Nathap, Hat Thai Mueang, and Hat Thung Thale. That implies that those soils have low nutrient contents (as quartz is hard and weathering slowly) (Donahue *et al.*,1983). Traces of K-feldspar were found in the soils of Ban Laem pho 1, Ban Laem Pho 2, Ban Nuea 1 and Hat Yong Ling. Ao Panang Tak, Ban Takrop, Ban Plongmai and Ban Nuea 2 and 3. Intermediate amounts of K-felspar and traces of plagioclase could be detected in one site at Ban Laem Santi. Soils containing feldspars are more fertile, as K-feldspar and plagioclase could release nutrients by weathering, especially the potassium (K) which is one of the essential elements for plant (as K-feldspar would provide important nutrient and clay in the weathered products) (Donahue *et al.*, 1983).

3.3 The soil physical properties

3.3.1 Particle size distribution (Soil texture)

The composition and sizes of particles have direct impacts to the soil properties in terms of water holding capacity, aeration and soil strength. Considering the sand dune sites of Ban Bangboet 1 and Ban Bangboet 2, the particle sizes vary from the medium sand (mS) to very small particles (Sum<20μm). It is to be noticed

that higher contents of small particles could be detected Ban Bangboet 2 compared to Ban Bangboet 1. It might be owing to the fact that there is vegetation cover at the site of Ban Bangnoet 2, leading to higher interception of dust particels. More litter from the vegetation may in addition accelerate the weathering process. On the other hand, the particle sizes detected from the sandbar landform vary from the coarse sand (>2mm) to a small size (Sum<20μ). Therefore it is rather difficult at this stage to relate the sizes of the particle detected to the vegetation covered.

3.4 The soil chemical properties

3.4.1 Soil reaction (pH)

Soil reaction (pH) of all study sites is "very slightly acid" according to Landon (1991), ranges from 6.5-6.8 on A1 and A2 horizon and tends to be slightly lower in the C and Bh horizon, were it ranges from 6.3-6.6. High pH values are untypical for podzolized soils, on the other hand the almost pure quartz will be more or less inert.

The pH value of all study sites is suitable for the vegetation. The best suitable pH value for most plants is 5.5 on organic soils and 6.5 for the mineral soil (Donahue *et al.*, 1983).

3.4.2 Cation exchange capacity (CEC) and Base saturation (BS)

Exchangeable cations are generally important for both higher plants and microorganism as it is the "bank account of nutrients". The capacity is the number of exchange places, the base saturation is the number of places occupied by the important nutrients K, Ca and Mg (and Na, but Na is not limiting plant growth). High exchange capacity and high base saturation means good nutrient supply. However, most of the exchange capacity in the soil of all study sites will be related to humus, as there are almost no clay minerals. Cation exchange capacity (CEC) at all study sites is low and ranges from 2.0-36.3 $mmol_c/kg$ (Land Classification Division and FAO Project Staff, 1973). The base saturation (BS) in all study sites is also low and ranges from 1.1-31.3% (Land Classification Division and FAO Project Staff, 1973). The low exchange capacity and low base saturation mean that there is low nutrient supply as well.

3.4.3 Electrical conductivity (EC)

The electrical conductivity (EC) measurement is used as an indication of total quantities of soluble salts in soils. The EC of all study sites is very low and ranges from 3.5-71.9 µS/cm. So soils are not saline (the EC of saline soils is >200 µS/cm) (Land Classification and FAO Project Staff, 1973) despite that there is an influence from salt spray from the nearby sea in all sites studied.

3.4.4 Total N vs. C/N Ratio

The contents are extremely low and partly close to detection limits. Both N content and C/N ratio tell something about potential N supply. Close C/N ratio mean better availability than wide C/N ratio. The C/N ratios > 40 to 50 are unrealistic and caused by the fact that analyses close to detection limit are not very accurate. Carbon (C) and Nitrogen contents (N) decrease rapidly from the surface soil (A horizon) to the subsurface soil (A2 and C horizon). There are higher carbon contents in the subsurface soil (E and Bh horizon) at Ban Pak Nam Tako because of the accumulation of organic matter at the boundary zone to the groundwater. Low N contents and rather wide C/N ratios in almost all sites in the present study imply that there is rather low available N in such soil for plant species in general. The same is probably true for phosphorus (not analyzed).

Notes on the Soil properties vs. the terrestrial coastal vegetation on sandbars/ sand dune.

Concerning all aspects of the soil properties, it is to be noticed here that such Albic Arenosols soil might not play an important role in nutrient supply for plant species of the coastal vegetation on sandbars/ dunes either in terms of mineralogy as it cannot release enough nutrients by weathering nor in terms of exchange capacity (CEC) and base saturation (BS) which are extremely low. The low N (and probably P) content and the rather wide C/N ratio will also limit nutrient supply. Therefore it is to state here that the terrestrial coastal vegetation on the sandbars/ dune relies on a closed nutrient cycle. The nutrient supply for plant species in such vegetation depends much on the humus/litter of the vegetation itself. Many myrmecophytes which have particular source of nutrient besides soil could be seen in such vegetation i.e. *Dischidia major* and *Hydnophytum formicarum*. These plants

have special morphological adaptation as shelters for ants e.g. modified leaf and stem. And the ants would provide litter/humus for plants in return (Figure 22). Any kind of disturbances on such vegetation and humus/litter, e.g., burning of the areas for many kinds of land use; wrong land preparing for the reforestation; overcutting, etc. which could destroy or decrease the humus accumulation on the soil surface might have great impacts to the vegetation directly. In addition, some microorganism in humus/litter or plant roots, e.g., micorrhyza, nitrogen fixing bacteria, etc. may play important roles in providing essential nutrients for plants. However, further studies concerning these issues in future are, therefore, needed.

Figure 22. Myrmecophyte at Ban Nathap Chana district, Songkhla province: *Dischidia major* (Vahl) Merr.

4. The relationship between the vegetation and the soil properties. DCA analysis

Considering DCA ordination (Figure 20, 21), sites tended to cluster into three groups along the first axis (eigenvalue = 0.66). When the habitats, locations as well as plant species have been taken into account, they arrange in accordance with those parameters as sand dune vegetation, sand beach vegetation and inland sandbars

vegetation. In additions, the ordination diagram displayed graphically that the species composition of the beach vegetation at Ao Panang Tak site is related to the vegetation at the inland sandbars sites, i.e., Ban Pak Nam Tako, Ban Laem santi, Ban Takrop, Bna Plong Mai, Ban Laem Pho 1, Ban Laem Pho 2, Ban Nuea, Ban Nathap, Hat Thung Thale, Hat Thai Mueang. The vegetation of the inland sandbars had separated toward the negative end of Axis 1, while those within the sand dune vegetation had separated out at the other end and all of the variation in the DCA ordination could be explained by the first Axis.

This might imply that the species composition of the sand dune is rather different from those on the sandbars sites (Figure 21). Moreover, Panang Tak site had separated from others as well in spite of its location on a given coastal bar. It may due to the fact that this site is located on the coastal plane next to the tidal zone on a gulf which has different conditions from the other sites on the inland sandbars (e.g., gulf/bay is a close area, not subjected directly to the wind direction as other sites on the sandbars that are parallel to the coast which subjected directly to the wind direction from the open sea). It is possible that the landforms may have some impacts to these conditions of separation in term of vegetation between these three habitats however more additional evidence is still needed.

CCA analysis

Considering CCA analysis (Figure 22), the pattern of ordination is consistent with DCA results (Figure 20, 21). The samples which are coordinated on the first axis with respect to Na and Cl content, which might due to the impact of the salt spray from the open sea. The diagram tended to cluster into the three groups along the first axis (eigenvalue = 0.64), i.e., sand dune vegetation (Ban Bangboet), beach vegetation (Ao Panang Tak) and inland vegetation (others). These distribution patterns of sites were correlated well with some given chemical properties of soil, i.e., Na and Cl, while it is not correlated with the physical factor (particle sizes). This might suggest that NaCl of the salt spray through the wind from the open sea may have some impact on the distribution of plant species which are the compositions of given vegetation on sand bars/ dune along the coasts or vise versa. The vegetation itself may also perform as a filter of the salt spray from one zone to another, beginning from the

grassland one, shrub- and woodland ones. It is, however, hesitated at this stage to draw a conclusion on the impact of the salt spray on the vegetation as it is also possible that the different zones of vegetation along the transect line from the tidal zone may not be a consequence of the different amount of the salt spray, however, the vegetation itself may limit the amount of salt spray from the open sea through this transect from the tidal zone. So in such case, the landform might have some impact on the species composition and structure of the vegetation. In any case, it could imply at this stage that any change of the vegetation might cause a higher amount of the salt spray to the inland areas that should have some impact on the plant species composition in a given type of vegetation along the coasts as well.

Plate 42. A-H: Plant succession stages on the coastal wind-bowled particle sand dune at Ban Bangboet, Pathio district, Chumphon Province: A-B: Primary colonization (stage 1); C-D: embryo dune (stage 2); E-F: semi fixed dune (stage 3); G-H: fix dune (stage 4).

CHAPTER 6
SUMMARY

The terrestrial vegetation on sandy habitats along the coasts in peninsular Thailand on both sides is interesting in terms of plant diversity resource as well as other ecological and environmental aspects. However, the deforestation for many purposes, e.g., agriculture, land development, tourism, etc. as well as many reforestation programs without basic data of plant communities of its kind have been terminated most of this vegetation. The natural vegetation left as separated patches along the coasts are, therefore, important as they are not only containing elements which have been dominated the sandy terrestrial coastal areas in the past, but these remnant patches perform as natural bridges of gene-flow between natural populations of plant species occurring in such vegetation.

The present study had documented all the natural vegetation on sandy habitats along the coasts in peninsular Thailand on both sides which left as remnant patches by describing them in terms of species composition as well as their profiles and analyzing all this patches through Braun-Blanquet method (Zürich-Montpellier School). Twenty–eight categories had been analyzed which could be divided into three main categories:

A. Coastal Grassland vegetation

Cyperus stoloniferus community

Vigno-ipomoetum pedis-caprae (*Canavalia rosea-Ipomoea pes-caprae* community)

Ischaimum mutricum community

Hdroyphyllex maritima community

Glehnio-Spinificetum littorei (*Spinifex littoreus* community)

Fimbristylis sericea community

Dunbaria bella community

B. Coastal Scrub Vegetation

Thareio-Viticetum routundifoliae (*Vitex rotundifolia* community)

Scaevola taccada community

Rhodomyrtus tomentosa community

Pandanus odoratisimus community

Calophyllum pulcherimum community

Sindora siamensis community

Diospyros ferrea community

Polyalthia evacta community

Syzygium gratum community

Vaccinium brateatum-olea brachiata sub-community

Styphelia malayana-Rhodamnia cinerea sub-community

Micromelum minutum-Allophyllus cobbe community

C. Coastal Woodland Vegetation (Coastal forest Vegetation)

Psychotria sarmentosa-Dipterocarpus obtusifolius community

Symplocos cochinchinensis-Lannea coromandelica community

Polyalthia evecta sub-community

Typical sub-community

Memecylon scutellatum sub-community

Davallia denticulata–Vatica harmandiana community

Rhodamnia cinerea–Syzygium gratum community

Typical sub-community

Styphelia malayana sub-community

Soil analyses had shown that it falls into arenosol category. Moreover some other chemical property analyses, especially exchange capacity (CEC), base saturation (BS) and C/N ratio, had suggested that the terrestrial coastal vegetation on the sandbars/ dune is not depending on such soil. It is to be suggested that the available essential nutrients for plant species in such vegetation might depend much on the humus/litter of the vegetation.

The DCA analyses of some selected parameters and the sites where these remnant patches of vegetation occurred had shown that the sites had separated into three groups according to the land forms, i.e., the sand dune at Ban Bangboet which occurred due to the wind (the Eolian Landform); the gulf sandy beach of Ao Panang Tak; other inland sandbars sites. It is possible that the landforms may have some impacts to these conditions of separation in term of vegetation between these three habitats however more additional evident is still needed.

The CCA analyses had suggested that these distribution patterns of sites were correlated well with some given chemical properties of soil, i.e., Na and Cl, while it is not correlated with the physical factor (particle sizes). This might suggest that NaCl of the salt spray through the wind from the open sea may have some impact on the distribution of plant species which are the compositions of given vegetation on sand bars/ dune along the coasts or vise versa. More evident is, therefore, needed.

CONSERVATION RECOMMENDATION

All the remnant patches of coastal forest vegetation of the peninsula are substantially threatened in the near future because most of them are not protected by law. Various human activities, including transformation of natural habitats according to agriculture purposes (especially rubber and oil palm plantations), monoculture forest plantation using alien species (e.g., *Eucalyptus* spp., *Acacia* spp. and even *Casuarina* spp.), tourism infrastructure, as well as many reforestation programs without basic data of plant communities of its kind have been terminated most of this vegetation because the available essential nutrients for plant species in such vegetation might depend much on the humus/litter of the vegetation itself. Any kind of disturbances which could destroy or decrease the humus accumulation on the soil surface might have great impacts to the vegetation directly.

Unless all remnant patches of such vegetation are identified and marked as reserved spots/areas, the natural coastal terrestrial vegetation on the sandbars/dunes/beaches along the coasts of the peninsular Thailand will completely disappear in the near future.

REFERENCES

Austrian Standards Institute. 2008. *ÖNORM (Austrtan Standards) L1080, L1082, L1086.* Available Source: www.on-norm.at. (accessed on March 15th, 2008).

Brady, N. C. 1974. *The Nature and Properties of Soils, 8th ed.* Macmillan Publishing Co., Inc., USA.

Braun-Blanquet, J. 1964. *Pflanzensoziologie, Grundzüge der Vegetationskunde.* 3 Aufl., Springer Verlag, Wien-New York.

Bridson, D. and Forman, L. 1999. *The Herbarium Handbook, 3rd ed.* The Board of Trustees of The Royal Botanic Gardens, Kew, UK.

Carter, D.B. and Mather, J.R. 1966. Climatic classification for environmental biology. *Laboratory of Climatology Publications* 19(4): 305-395.

Chamchumroon, V. 2001. Botanical expedition of beach forest in Koh Lok, Koh Lanta National Park, Changwat Krabi. *Journal of Thai Forestry Research* 3(1): 1-7.

Congdon, G. 1982. The Vegetation of the Tarutao National Park. *The Natural History Bulletin of the Siam Society* 30(2): 135-198.

Doanhue, R. L., Miller, R. W. and Shickluna J. C. 1983. *Soils: An Introduction to Soils and Plant Growth.* Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

Food and Agriculture organization of the United Nations (FAO). 2006a. Guidelines for Soil Description. 4 th ed. FAO, Rome,97 p.

Food and Agriculture organization of the United Nations (FAO). 2006b. *World reference base for soil resources.* 103 World Soil Resources Reports.

Forest Soil Co-ordinating Centre, Research Institute for Nature and Forest. 2006. *Manual on methods and criteria for harmonized sampling, assessment, monitoring and analysis of the effects of air pollution on forests, part IIIa: Sampling and Analysis of Soil.* Available Source: http://www.inbo.be/docupload/2922.pdf (accessed on August 30th, 2010).

Good, R. 1974. *The Geography of the Flowering Plants, 4th ed.* John William Clowes & Sons, London.

Hayasaka, D. and Fujiwara, K. 2005. Species composition and environmental factors, including human impacts, on coastal sand-dunes and maritime strand-forests in Southern Thailand. *Tropics* 14(3): 245-254.

Haslett, S. K. 2000. *Coastal Systems: Routledge Introductions to Environmental Series.* Routledge, London and New York.

Jongman, R. H. G., ter Braak, C. J. F., van Tongeren, O. F. R. 1997. *Data Analysis in Community and Landscape Ecology.* Pudoc, Wageningen.

Kent, M. and Coker, P. 1994. Vegetation Description and Analysis: A Practical Approach. John Wiley & Sons Ltd., Chichester, England.

Kottek, M., Grieser, J., Beck, C., Rudolf, B. and Rubel , F. 2006. World map of the Köppen-Geiger climate classification. Meteorologische Zeitschrift 15: 259-263.

Land Classification Division and FAO Project Staff. 1973. *Soil Interpretation Handbook for Thailand.* Department of Land Department, Ministry of Agriculture and Cooperatives, Bangkok.

Landon, J. R. 1991. *Booker Tropical Soil Manual: A Handbook for Soil Survey and Agricultural Land Evaluation in the Tropics and Subtropics.* Longman Group (FE) Limited, Hong Kong.

Laongpol, C., Suzuki, K., Katzensteiner, K. and Sridith, S. 2009. Plant community structure of the coastal vegetation of Peninsular Thailand. *Thai Forest Bulletin (Botany)* Special Issue: 106-133.

Laongpol, C., Suzuki, K. and Sridith, S. 2005. Floristic composition of the terrestrial coastal vegetation in Narathiwat, Peninsular Thailand. *Thai Forest Bulletin (Botany)* 33: 44-70.

Laoengsiriwong, N.2007. Water Analysis Method for Coastal Aquacuture, Ministry of Agriculture and Cooperatives.

Maxwell, J.F. 1974. Vascular flora of the Sattahip area. *Thai Forest Bulletin (Botany)* 8: 49-87.

McCune, B. and Mefford, M. J. 2006. *PC-ORD Multivariate Analysis of Ecological Data, Version 5.19.* MjM Software, Gleneden Beach, Oregon, U.S.A.

Miyawaki, A. and Suzuki, K. 1980. Process of phytosociological studies and vegetation mapping. *Bulletin of the Institute of Environmental Science and Technology, Yokohama National University* 6(1): 65-76.

Nakamura, T. and Suzuki, K. 1984. Studies on the plant communities of the Yap islands. *Journal of Phytogeography and Taxonomy* 32(1): 19-30.

Nakamura, T. and Suzuki, K. 1986. Studies on the plant communities of the Palau islands. *Journal of Phytogeography and Taxonomy* 34(1): 40-54.

Ohba, T., Miyawaki, A. and Tüxen, R. 1993. Pflanzengesellshaften der Japanischen Dünen-Kusten. *Vegetatio* 26: 1-143.

Pongsaputra, P. 1991. *Illustrated Landforms of Thailand.* Darnsutha Press, Bangkok.

Santisuk, T. 1999. *Mu Koh Samae-san, Forest and Flora.* The Royal Project of Plant Genetics Conservation (under the royal patronage of H.R.H. Princess Maha Chakri), Bangkok.

Smitinand, T. 1977. A preliminary study of the vegetation of Surin islands. *The Natural History Bulletin of the Siam Society* 26: 227-246.

Sridith, K. 2002. The remnant of vegetation on coastal sandbars in Songkhla province, Peninsular Thailand. *Thai Forest Bulletin (Botany)* 30: 49-58.

Sridith, K. and Laongpol, C. 2003. The preliminary study on some natural plant communities of the sandbars along eastern coast of Peninsular Thailand. *The Songklanakarin Journal of Science and Technology* 25(1): 103-113.

Steenis, C. G. J. van. 1950. Chapter 3: The delimitation of Malaysia and its main plant geographical divisions, pp. LXX-LXXV. In: Steenis, C. G. J. van, ed. *Flora Malesiana. Series I, Vol. 1.* Noordhoff-Kolff N.V., Djakarta, The Netherlands.

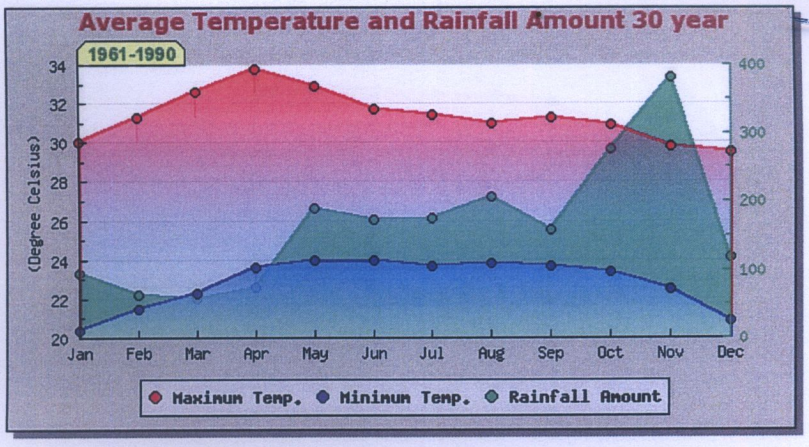
Suzuki, K., Laongpol, C. and Sridith, K. 2005. Phytosociological studies on vegetation of coastal dunes at Narathiwat, Thailand. *Tropics* 14(3): 229-244.

The National Research Council of Thailand (NRCT), Ministry of Science Technology and Environment. 1995. *Landforms of Thailand from Space.* Darnsutha Press, Bangkok.

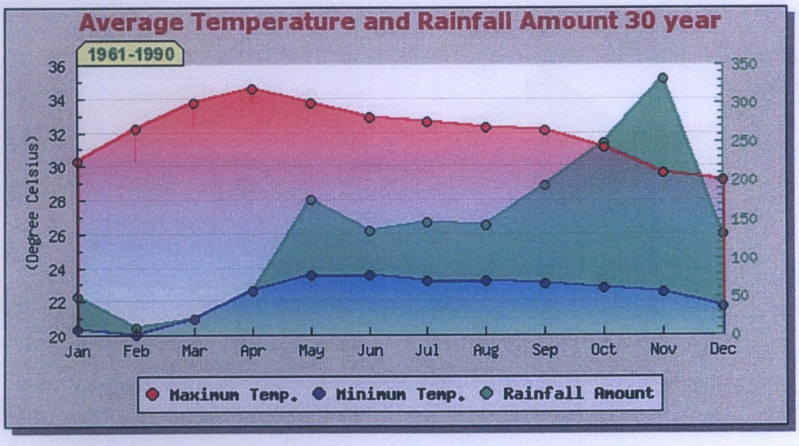
Thunthawanich, R. 2001. *Vegetation and Environmental Gradients across the Beach Forest in Sirinath National Park, Changwat Phuket.* M.S. Thesis, Kasetsart University.

Whitmore, T.C. 1985. *Tropical Rain Forest of the Far East (revised ed.).* Clarendon Press, Oxford.

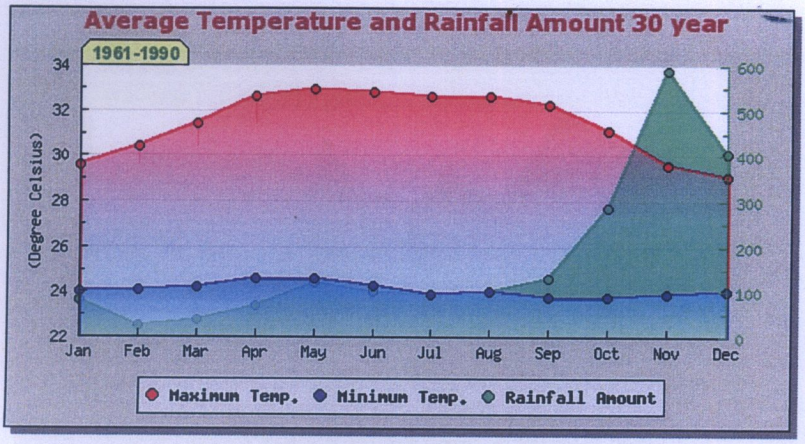
APPENDICES



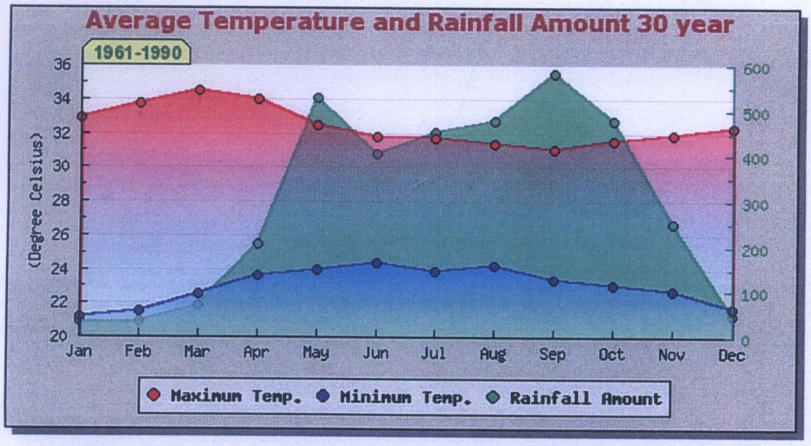
APPENDIX 1. Average Temperature and Rainfall Amount 30 year (1961 – 1990) in Chumphon province.



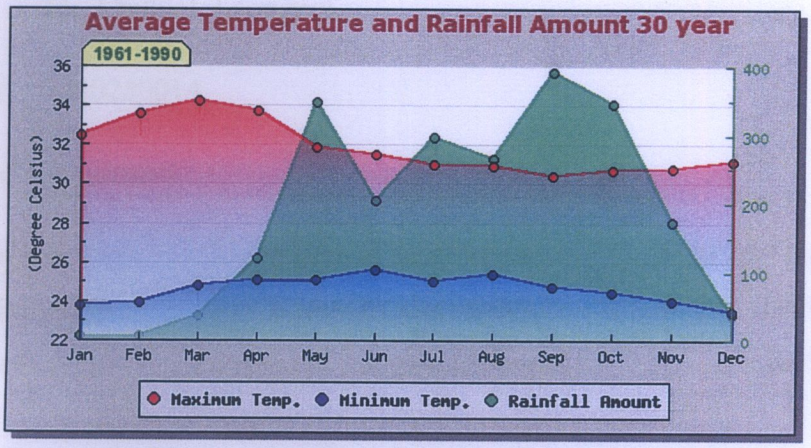
APPENDIX 2. Average Temperature and Rainfall Amount 30 year (1961 – 1990) in Surat Thani province.



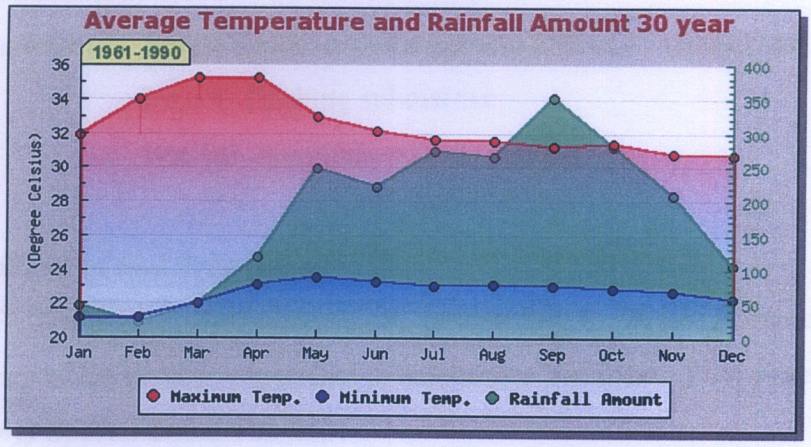
APPENDIX 3. Average Temperature and Rainfall Amount 30 year (1961 – 1990) in Songkhla province.



APPENDIX 4. Average Temperature and Rainfall Amount 30 year (1961 – 1990) in Phangnga province.



APPENDIX 5. Average Temperature and Rainfall Amount 30 year (1961 – 1990) in Krabi province.



APPENDIX 6. Average Temperature and Rainfall Amount 30 year (1961 – 1990) in Trang province.

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