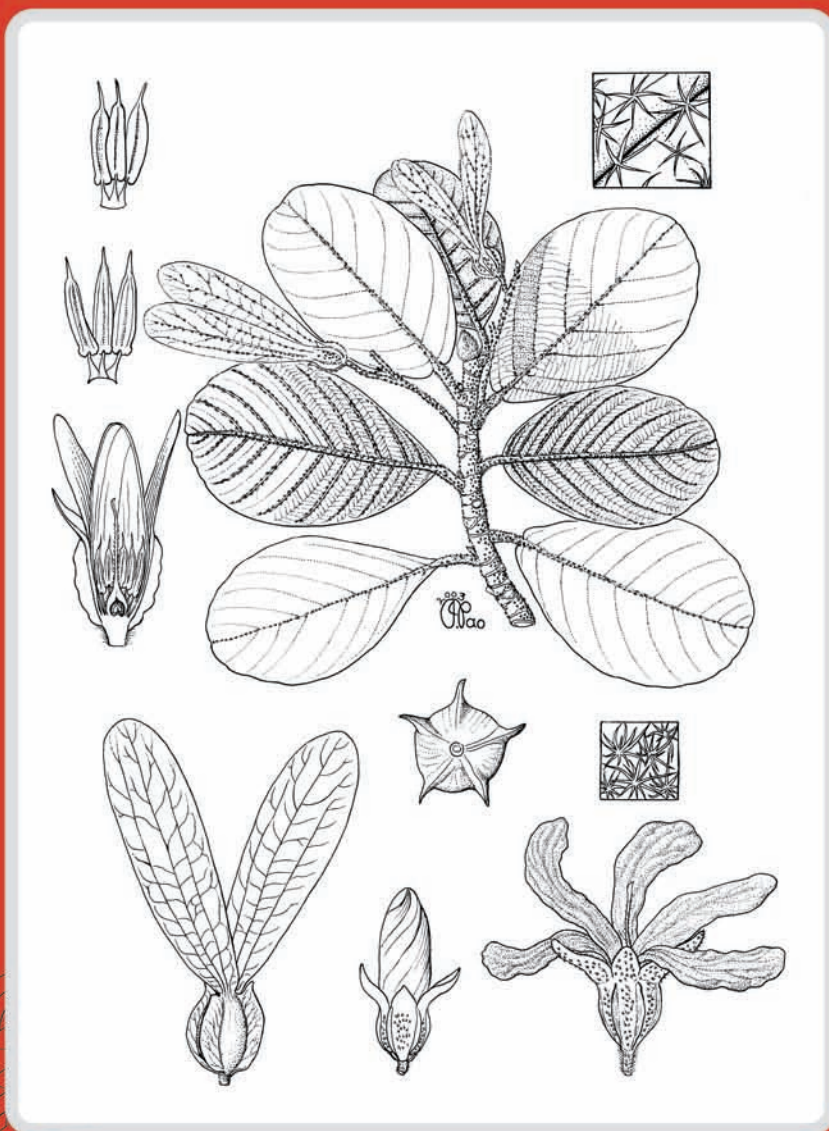


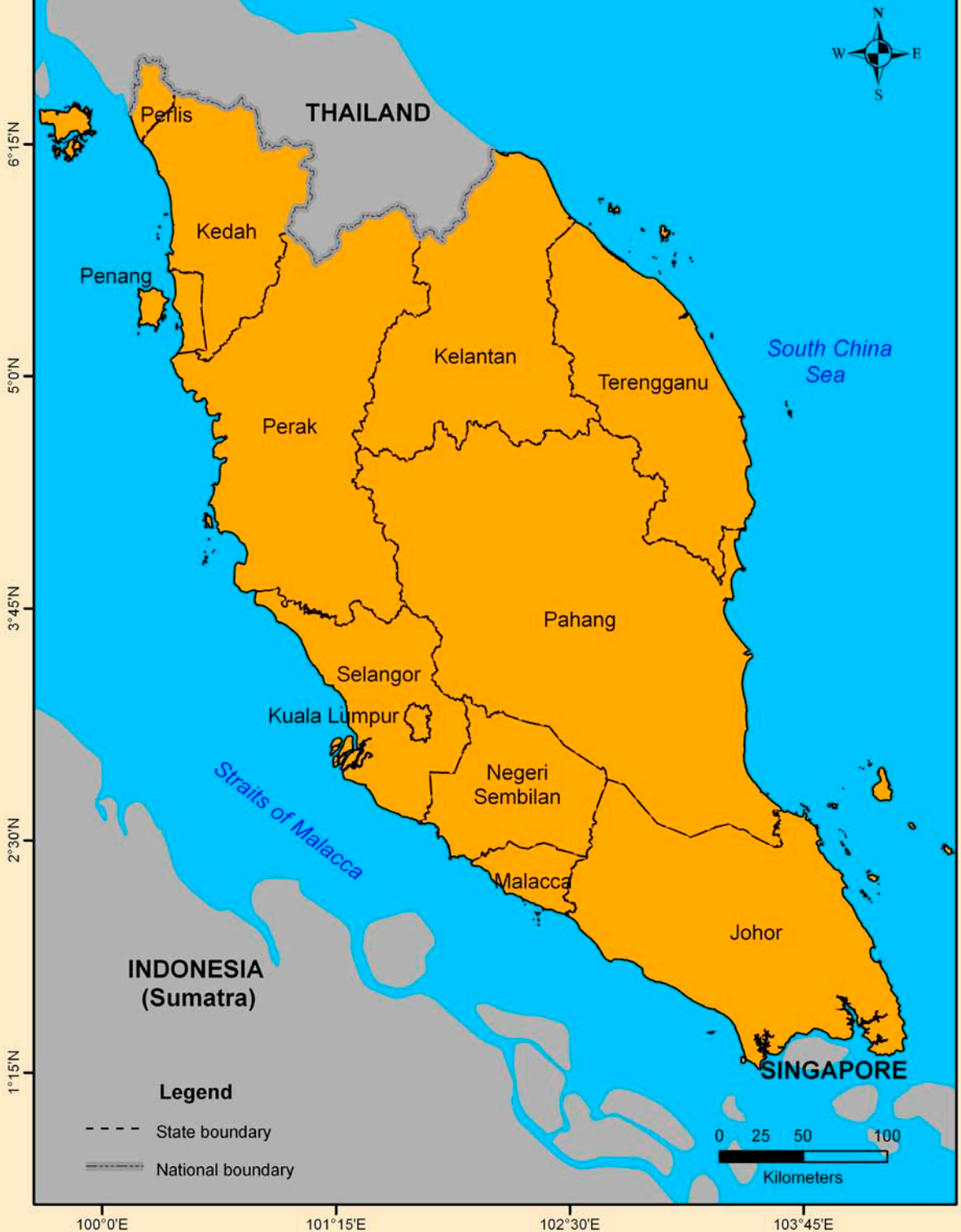
MALAYSIA PLANT RED LIST

PENINSULAR MALAYSIAN DIPTEROCARPACEAE

L.S.L. CHUA, M. SUHAIDA, M. HAMIDAH & L.G. SAW



MAP OF PENINSULAR MALAYSIA



MALAYSIA PLANT RED LIST

PENINSULAR MALAYSIAN DIPTEROCARPACEAE

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**MINISTRY OF SCIENCE, TECHNOLOGY AND INNOVATION
GOVERNMENT OF MALAYSIA**

RESEARCH PAMPHLET NO. 129

MALAYSIA PLANT RED LIST

PENINSULAR MALAYSIAN DIPTEROCARPACEAE

L.S.L. CHUA, M. SUHAIDA, M. HAMIDAH & L.G. SAW



**FOREST RESEARCH
INSTITUTE MALAYSIA**



**MINISTRY OF
NATURAL RESOURCES
AND ENVIRONMENT,
MALAYSIA**

2010

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All enquiries should be forwarded to:

Director-General
Forest Research Institute Malaysia
52109 Kepong
Selangor Darul Ehsan
Malaysia
Tel: 603-6279 7000
Fax: 603-6273 1314
Homepage: <http://www.frim.gov.my/>

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FOREWORD

Although many tree families in Malaysia such as the economically important Dipterocarpaceae are listed in the global IUCN Red List, Malaysia does not have a national Plant Red List. Arising from the need to have a Red List, a project on the conservation monitoring of rare and threatened plants of Peninsular Malaysia was initiated. This project had the objectives of assessing the threat and conservation status of indigenous plant species with the eventual aim of developing a Plant Red List and conducting conservation monitoring of critically threatened plants in the families Dipterocarpaceae, Palmae and Begoniaceae.

The Forest Research Institute Malaysia (FRIM) was in a strategic position to conduct the assessment for indigenous taxa of Peninsular Malaysia as it has the largest historical and current holding of the most fundamental source of information in the peninsula, i.e., specimen-based information. The close cooperation between the major herbaria in the Malaysian region and elsewhere was crucial in enabling this project to conduct the assessment. In addition, the decades of research in plant taxonomy and systematics, forest silviculture, forest management, growth and yield and many other subjects have provided valuable inputs to the assessment process.

The Malaysian National Policy on Biological Diversity, formulated in 1998, sets the national agenda and direction for the country to implement strategies and action plans for the conservation and sustainable utilisation of its biological diversity. Towards this aim, the Malaysian National Strategy for Plant Conservation outlines a systematic approach on ways to further strengthen the strategies and action plans. Target 2 of the National Strategy for Plant Conservation aims to have a preliminary assessment of the conservation status of all known plant species of the nation. It is envisioned that this assessment will accomplish Target 2. The Red List for the Peninsular Malaysian Dipterocarps is the first of a series of publications envisaged for plant assessment in Malaysia. I am confident that this publication marks a major milestone in Malaysia's quest to manage and conserve threatened plant species, and that it will be of use to resource and conservation managers as well as to the forest products industry.



Dato' Dr. Abd. Latif bin Mohmod
Director-General
Forest Research Institute Malaysia

SUMMARY

This Red List covers dipterocarp taxa that are indigenous to Peninsular Malaysia and this includes taxa that are common to the peninsula, Sabah and Sarawak. Peninsular Malaysia has 155 species comprising 165 taxa of which 34 taxa (including an undescribed *Vatica* sp. A) are endemic. Ninety taxa share their range with Sabah and Sarawak while the remaining 41 taxa extend their distribution to Sumatra and the Philippines. *Vatica* sp. A is not evaluated.

Ninety two taxa of dipterocarps (56.1%) occurring in the peninsula have a threatened category nationwide; of these, 22 are endemic to the peninsula. Of the 92 taxa, eleven are not threatened in the peninsula but they are threatened in Sabah and Sarawak. Thirteen taxa are threatened in the peninsula but not threatened in Sabah and Sarawak. Of the fifteen Critically Endangered (CR) taxa, six are endemic to Peninsular Malaysia. They are *Hopea auriculata*, *H. bracteata* var. *penangiana*, *H. subalata*, *Shorea lumutensis*, *Vatica flavida* and *V. yeechongii*. Of the 35 Endangered (EN) and 42 Vulnerable (VU) taxa, 10 and 6 are endemic respectively to Peninsular Malaysia. Examples of CR species which has one or several populations protected include *Dipterocarpus sarawakensis*, *Hopea auriculata*, *Shorea lumutensis*, *S. teysmanniana* and *Vatica yeechongii*. *Shorea kuantanensis* is the only taxon in this family thought to be extinct in the peninsula. Several CR and EN species are under long-term conservation monitoring.

Six taxa have their threatened category upgraded to a higher category in the Malaysian conservation status. They are *Dipterocarpus obtusifolius* var. *subnudus*, *Hopea auriculata*, *H. pachycarpa*, *Parashorea globosa*, *Shorea teysmanniana* and *S. uliginosa*. *Vatica odorata* ssp. *odorata* is upgraded from Lower Risk to Vulnerable. Fifty seven taxa are downgraded to a lower threatened category while fifty eight taxa are downgraded from threatened to not threatened. Two species, i.e., *Dipterocarpus perakensis* and *Shorea farinosa* are downgraded from CR to DD.

Pahang has the most number of threatened taxa (59 taxa; 35.9%) when compared between states in the peninsula. It had also the peninsula's only extinct taxon. This is followed by Johor and Perak with 54 (32.9%) and 53 (32.3%) taxa respectively. Of the three states, Perak is perhaps the most vulnerable as it has the most number of CR taxa. The main threat to all threatened species is land use change.

In the course of the Red List assessment, one new species, *Vatica yeechongii*, and two new records, *Dipterocarpus tempehes* and *Dryobalanops beccarii*, were discovered. Nine species reported as possibly extinct by Symington (2004) have been located in areas adjacent to original sites or elsewhere in the peninsula. These are *Cotylelobium melanoxyton*, *Dipterocarpus sarawakensis*, *D. semivestitus*, *Hopea*

coriacea, *H. pachycarpa*, *H. polyalthioides*, *Shorea inappendiculata*, *Vatica flavida* and *V. havilandii*. Conservation measures are already in place for species such as *Cotylelobium melanoxydon*, *Dipterocarpus sarawakensis*, *D. tempehes*, *Dryobalanops beccarii* and *Vatica yeechongii*. Similar efforts are being taken to conserve the remaining species. The close cooperation forged between FRIM and relevant stakeholders has resulted in the increased awareness of the presence of rare and threatened species in their areas of jurisdiction and the ability to undertake appropriate conservation measures. In addition, FRIM has amassed to date at least 189 species of dipterocarps from the peninsula, Sabah and Sarawak in its *ex situ* collection.

Malaysia is implementing more holistic approaches in the management of her landscapes and environment, in response to the overwhelming challenges of land use changes and natural resource use. This list elucidates the need for a more consolidated effort towards the conservation of threatened plants. Among the critical considerations are the incorporation of the principles of conservation at the planning stages of development plans and measures to be integrated at such stages. Additionally, legal and policy provisions for habitat protection for threatened taxa that are currently not protected in the network of Totally Protected Areas are required, for species that occur in the Permanent Reserved Forests, there is the need for a more comprehensive integration into Sustainable Forest Management practice. Continued support for fundamental research to expand the knowledge base of threatened species is critical. Rescue operations should be conducted where necessary and the commitment and efforts of various stakeholders to support the maintenance of *ex situ* collections are crucial. Networking efforts between stakeholders and engagement with private stakeholders, educational awareness programmes and local involvement through collaborative efforts should be enhanced.

It is cautioned that the Red List should not be interpreted as a means of priority setting for conservation action. It should instead represent the first critical step towards setting national priorities for conservation. In light of the fact that conservation actions require significant financial and logistics input and are dictated by biological needs, the difference between the setting of priorities as a result of the assessment and the implementation of conservation measures must be clearly appreciated and understood.

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INTRODUCTION

The family Dipterocarpaceae comprises 17 genera and 500 species (Ashton, 1982). The family is pantropical, distributed from Colombia and Venezuela to Guyana in South America to Africa and the Indo-Malayan region of Asia. The family achieves its greatest diversity, dominance and majesty in the tropical lowland moist evergreen rain forests of the Indo-Malayan region and southwest Sri Lanka. Members of the family are found in wide-ranging habitat types from the coasts to hills of the tropics at altitudes below 1,800 m.

Within the Indo-Malayan region, Dipterocarpaceae has its centre of diversity in Malesia, a floristic region encompassing Peninsular Thailand, Malaysia, Singapore, Indonesia, the Philippines and the island of New Guinea. Malesia has about 10 genera and 387 species. Peninsular Malaysia has 155 species comprising 165 taxa of which 34 taxa (including an undescribed *Vatica* sp. A) are endemic. Ninety taxa share their range with Sabah and Sarawak while the remaining 41 taxa extend their distribution to Sumatra and the Philippines.

In Malaysia, the dipterocarps are the most abundant constituents among the upper stories of the lowland evergreen rainforest. The family is most dense in the highest size classes in places where it is floristically the richest (Cousens, 1951; Ashton, 1964). At their edaphic optimum, the dipterocarps may comprise more than 80% of emergent individuals and up to 40% of below canopy trees. The occurrence of a species has been shown to be confined primarily by the altitudinal limits of the soils on which they occur rather than by climatic factors (Ashton, 1964; Davies *et al.*, 2005).

Since the early seventies, dipterocarps have provided the bulk of tropical hardwoods traded in the international and domestic markets (Soerianegara & Lemmens, 1993). Overshadowed by this are minor traditional uses. For example, camphor extracted from *Dryobalanops* spp. has been used as medicines while the resin from *Dipterocarpus*, *Hopea* and *Shorea* are used as a base for paints, varnishes as well as medicines. Illipe nuts from several *Shorea* species contain fat similar to cocoa butter. Commonly known as tengkawang fat and considered a delicacy by local communities, tengkawang fat is an excellent substitute for cocoa butter in the manufacture of chocolates (Seibert & Salang, 2001). In the past, the fat was used in the manufacturing of candles and as a lubricating agent in steam machinery and tram cars (Holmes, 1883).

In Peninsular Malaysia, many populations of dipterocarps are on the decline mainly as a result of land use changes and harvesting. These threats have changed in form

and severity with the passage of time. Land use changes were extensive from 1960s' to 1980s', when much of the lowland natural landscapes were converted to plantation agriculture and development. The 70% of the land area under natural forest cover shrank to about 63% by 1972 (Forestry & Forest Industries Development Malaysia (1973), further declining to 49.4% by 1980 (Forest Statistics Peninsular Malaysia 1979–1985). This reduction has now stabilised at 40.7% in 2002 (Anon., 2008). Pristine and semi-pristine lowland forests are now mainly confined to protected areas in National Parks, Wildlife Sanctuaries, State Parks, Permanent Reserved Forests and other areas within the Totally Protected Areas (TPAs) network.

The decline in forest areas and resources resulted in the need to utilise these resources sustainably. The forest is currently looked upon as a source of new wealth in non-timber resources. Although harvesting is considerably less damaging than habitat conversion, this activity presents great challenges to Malaysia because fundamentally, there is very little ecological and population data for the majority of rare dipterocarps. Arising from the compelling need to collate data before the quality of forest areas further deteriorates and the urgent need to save the populations of extremely rare dipterocarp taxa, a project on the conservation monitoring of rare and threatened plants in Peninsular Malaysia was developed. This project has several objectives. They are (1) to provide assessment of the conservation status and threats for selected families and the habitats in which they occur; (2) to develop recommendations, in the form of strategies and action plans, towards improving the current network of *in situ* protected areas as well as enhancing the *ex situ* collection of rare and threatened plant species in the national network of botanic gardens; (3) to provide technical support to improve state and national policies and legislation that support conservation of forest resources and to implement Malaysia's commitments towards international biodiversity-related obligations; and (4) to understand the biology of critically threatened populations through the conduct of long-term monitoring. Dipterocarpaceae, Palmae and Begoniaceae were selected for this phase because of their unique attributes. Dipterocarpaceae was selected by virtue of its immense diversity and abundance and socio-economic importance while Palmae and Begoniaceae are families with a very high degree of local endemism. The project is now in its fourth year.

This Red List covers dipterocarp taxa that are indigenous to Peninsular Malaysia and this includes taxa that are common to the peninsula, Sabah and Sarawak. In total 164 taxa were evaluated; only *Vatica* sp. A was not evaluated. Each taxon is accompanied by its authority, vernacular name(s), geographic distribution, distribution in the region and habitat. Regional status are included in the conservation status. Rationale for the Malaysian category is provided under conservation notes where applicable. The categories published by IUCN (2010), Symington (2004) and Ashton (2004) appear in "Other assessments", accompanied with notes where available. The geographic map(s) is/are attached. Entries for threats and conservation measures are similar for

the different species and have therefore been excluded to avoid repetition. The major threats faced by Dipterocarpaceae in the peninsula are changes in land use patterns and resource harvesting. Measures relevant to the conservation of the populations include both *in situ* and *ex situ* approaches and these approaches are explained under “Existing Conservation Measures”. Taxon images are included where available.

As mentioned above, the taxon datasheet includes the conservation status published in IUCN Red List (2010), Symington (2004) and Ashton (2004). The 2010 IUCN Red List for Dipterocarps was derived from “The World List of Threatened Trees” (Oldfield *et al.*, 1998). This list provided the first global listing of the conservation status of a large number of Malesian dipterocarps and was based on the IUCN Red List Categories and Criteria version 2.3 (1994). Only the categories were used in the publications of ‘Foresters’ Manual of Dipterocarps’ (Symington, 2004, revised by Ashton & Appanah) and ‘Tree Flora of Sabah & Sarawak, Volume 5’ (Ashton, 2004). Reasons for this are elaborated in the respective accounts.

The taxon assessments were evaluated by a review panel comprising dipterocarp specialist Prof. P.S. Ashton and local experts Dr. E. Soepadmo (Coordinator for the Tree Flora of Sabah and Sarawak project, currently based at FRIM) and Dr. Ruth Kiew (Coordinator for the Flora of Peninsular Malaysia project, currently based at FRIM). These assessments will continue to be reviewed as more data become available. The category for most of Peninsular Malaysia’s endemic species now differs from the global IUCN category because much of the data were not made available to the assessor who undertook the global assessment. Updates will be made available through national biodiversity-related websites.

The Impacts of Conservation Monitoring in Peninsular Malaysia

This Red List publication is one of the many outputs of the above-mentioned project. Other significant contributions included the discovery of several new species and new records and the discovery of populations still extant for nine species previously thought to be extinct. A new species, *Vatica yeechongii*, and two new records, *Dipterocarpus tempehes* and *Dryobalanops beccarii*, were discovered several years ago. Preparation is on-going to describe another new species. Several individual trees suspected to be species not previously recorded from Peninsular Malaysia are being closely monitored for flowering and fruiting materials. Symington (2004) reported eleven species as possibly extinct; of these, nine have been successfully located in areas adjacent to original localities or elsewhere in the peninsula. These are *Cotylelobium melanoxyton*, *Hopea coriacea*, *H. pachycarpa*, *H. polyalthioides*, *Dipterocarpus sarawakensis*, *D. semivestitus*, *Shorea inappendiculata*, *Vatica flavida* and *V. havilandii*. In the case of *Dipterocarpus semivestitus*, a population was discovered in a 55-ha swamp forest at

Universiti Teknologi MARA campus at Seri Iskandar (Perak). This forest fragment also contains the very rare and threatened *Vatica flavida*, *Shorea hemsleyana* and *S. macrantha*. Conservation efforts have been initiated by the University. At the national level, the close cooperation forged through this project between FRIM and relevant stakeholders has resulted in the awareness of the presence of rare and threatened species in their areas of jurisdiction and the increased ability to undertake appropriate conservation measures. Many of the critically threatened taxa are currently under long-term monitoring. In addition, FRIM has amassed to date at least 189 species of dipterocarps from the peninsula, Sabah and Sarawak in its *ex situ* collection.

Methods and Information Used in the Assessment

The underlying principles and the categories and criteria used in the taxon assessment are espoused in the IUCN Red List Categories and Criteria version 3.1 (2001). There are nine categories, i.e., Extinct (EX), Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC), Data Deficient (DD) and Not Evaluated (NE). Taxa that are CR, EN and VU are collectively referred to as threatened (Appendix 1). To objectively assign a category for a threatened taxon, five criteria are used, i.e., population reduction, geographic range in the form of extent of occurrence or area of occupancy, small population size and decline, very small or restricted population, and quantitative analysis (Appendix 2). The IUCN Red List Categories and Criteria version 3.1 and its supporting documents are available from the IUCN website (<http://www.iucn.org>).

Baseline information on which a taxon is assessed is contained in the Taxon Data Information Sheet (TDIS) (Chua & Saw, 2006). The TDIS comprises five parts, i.e., Taxon Attributes, Geographic Range and Demographic Details on Population, Red List Category and Criteria Assessment, Current Conservation Measures for the Taxon and Utilisation. This fundamental set of information provides the rationale to support the Red List category given to the taxon concerned. This information is maintained in the form of a database by the Forest Research Institute Malaysia (FRIM). TDIS is available from <http://www.tfbc.frim.gov.my/>.

The taxon's biological information was obtained from published accounts. As part of the assessment, the taxonomy and nomenclature of each taxon were checked by the experts named above and against principal accounts by Ashton (1982), Symington (2004, revised by Ashton & Appanah) and Ashton (2004).

The taxon's geographical information was obtained from geo-referenced herbarium and voucher specimens based at FRIM's Herbarium (KEP), the Herbarium at Sarawak Forest Department (SAR) and the Herbarium of the Forest Research Centre, Sabah

Forest Department (SAN). The databases on Dipterocarpaceae lodged at the Singapore Herbarium (SING) and the Nationaal Herbarium Nederland (L) were also consulted and relevant botanical records included into the master database. This master database also contains voucher specimens made during this project and the project entitled “To determine the optimum size of Virgin Jungle Reserves to enhance the conservation of flora and their attended management prescriptions for each of the ecological forest types”. In the map, localities derived from herbarium and voucher specimens are denoted separately. Localities that appear in published accounts but cannot be presently verified from specimen collection are included in the TDIS but do not appear in the geographical map. All known localities of the taxon were thus used in the generation of its map and this includes localities no longer under forest cover. This geographic map is compromised in its accuracy primarily by the absence of Global Positioning Systems coordinates in historical collections.

Data from permanent sample plots, growth and yield plots and long-term ecological research plots were consulted and included where relevant. This includes data from the 50-hectare plot in Pasoh Forest Reserve, Negeri Sembilan (Manokaran *et al.*, 1992) and 52-hectare plot in Lambir Hills National Park, Sarawak (Lee *et al.*, 2002). The data on the extent of forest cover is obtained from published annual reports and National Forest Inventories (NFIs). Information on areas under total protection is obtained from various institutional reports and related government gazettes. Literature sources for policies and legislation are wide-ranging while trade statistics were consulted for the level of utilisation.

The calculation for the Extent of Occurrence (EOO) follows the IUCN Red List guidelines. In the calculation of Area of Occupancy (AOO), we have used a 2×2 km grid (area of 4 sq km). The values for EOO and AOO were generated using the Conservation Assessment Tools, a software produced by the Royal Botanic Gardens Kew, United Kingdom (Moat, 2007). The forest cover generated by the Third National Forest Inventory and provided here graphically, is used to estimate the percentage area under forest cover. In the map, selected localities are localities that form the boundary of taxon's distribution; localities inside the boundary are not listed but are available upon request.

In conducting the assessment, the status of habitats, current threats and current conservation measures for the majority of taxa were ground-truthed and, where required, checked with the relevant local district offices.

General Considerations

In the selection of the most appropriate IUCN category, the use of the precautionary

principle is emphasised. The precautionary principle states that the lack of full scientific certainty should not be used as a rationale to delay action when there is a threat of serious or irreversible damage. This principle, combined with the ecosystem approach, requires that conservation programmes be developed although scientific knowledge is uncertain or where ecological consequences might be irreversible. However, it is crucial that this principle be applied realistically, despite the limited amount of appropriate data. Predominant application of the precautionary principle is found in, for example, taxa known from only one locality, taxa known only from very old historic collections and taxa confined to favoured collecting sites. For other taxa, sufficient confidence in data accuracy allowed us to apply the most appropriate criterion to the taxon in question.

Malaysia is divided phytogeographically into two regions, i.e., the Malay Peninsula and Borneo. For the purpose of this assessment, Malaysia is regarded as having two regions, i.e., Peninsular Malaysia and Sabah & Sarawak. For a taxon that is common to Peninsular Malaysia, Sabah and Sarawak, it is assessed separately for each region. The higher category is then selected for Malaysia. Both national and regional red list categories are provided here. This process involved the participation of assessors and experts from Sabah and Sarawak.

IUCN Red List Categories and Criteria states that a taxon should be assessed against as many criteria as permitted, however, only the highest category and its corresponding criteria should be listed. In Peninsular Malaysia, there are many endemic taxa known only from Protected Areas (PAs). Although we recognise that the integrity of PAs such as national parks and wildlife sanctuaries are intact, with several PAs protected by decades-old legislation, the attributes of the taxon is still valid under criterion B (geographical range) which automatically entitles it to be placed in a higher threatened category. Although placed in the higher category, we did not ignore or disregard the long-term commitment of the country to continuously protect its PA sites and populations from threats. In cases where a CR category is given, we urge readers to pay particular attention to the conservation notes. We reiterate that there are recent discoveries of new species, new records and populations thought to be extinct. These attest the effectiveness of the conservation safeguards that Malaysia had put in place many decades ago. The mention of conservation efforts is made under conservation notes, where appropriate.

We have attempted to follow the guidelines closely when applying the IUCN categories and criteria to each taxon but the use of certain criterion has proved to be rather difficult. For example, Criterion A provides a maximum time cap of three generations' length or 100 years. Despite the fact that this family has received much research and management attention, there is little historical data that is useful to estimate population reduction taking place even within a single generation time. In addition, dipterocarp

trees have a long life cycle of possibly more than 100 years. In the application of the criteria, a significant use of variables in different unit types was employed.

Readers will note that of the five IUCN criteria available for selection, population decline and geographic range in the form of extent of occurrence or area of occupancy are most frequently used. Geographic range is easily mapped from specimen collection while for population decline, the assessor is permitted to estimate, infer or suspect when actual observation is not available based on the various information contained in forest cover maps, topographic maps, inventory data (Chin *et al.*, 1997; Anon., 2007) etc. Population reduction for long-generation species such as the dipterocarps is suspected from forest cover data over a shorter time frame. Where a taxon is known to be restricted to a specific habitat type, the NFI data were used cautiously during inference.

Ex situ collections are not considered wild populations in this assessment, hence the location of institutions known to maintain *ex situ* collections are not used in the generation of the EOO. Such locations merely appear as points on the map denoted by a unique symbol. An example frequently appearing in this Red List is FRIM, which has a sizable collection of live dipterocarp accessions.

Summary of Assessment

The following summary is furnished for quick reference. A total of 164 taxa comprising 155 species of Peninsular Malaysian Dipterocarpaceae were assessed. *Vatica* sp. A is not evaluated. Table 1 shows the number of taxa, grouped according to genera, under the respective categories. Table 2 lists the threatened taxa. Table 3 shows the number of threatened species occurring in each Malaysian state. It includes an extinct taxon and is ranked according to the number of threatened taxa. The number for Sabah and Sarawak is incomplete as these states have 267 species of which only 90 are common to the regions of Peninsular Malaysia, Sabah and Sarawak.

Shorea kuantanensis is the only taxon in this family thought to be extinct in the peninsula. Ninety two taxa of dipterocarps (56.1%) occurring in the peninsula have a threatened category nationwide; of these, 22 are endemic to the peninsula. Of the 92 taxa, eleven are not threatened in the peninsula but they are threatened in Sabah and Sarawak. These taxa are *Anisoptera costata*, *A. laevis*, *Dipterocarpus kerrii*, *D. sublamellatus*, *Hopea mengarawan*, *H. nutans*, *H. semicuneata*, *Shorea longisperma*, *S. resinosa*, *S. platycarpa* and *Vatica odorata* ssp. *odorata*. These taxa are widespread in the peninsula. Taxa that are threatened in the peninsula but not threatened in Sabah and Sarawak include *Anisoptera marginata*, *Cotylelobium melanoxydon*, *Dipterocarpus acutangulus*, *D. fagineus*, *D. sarawakensis*, *Dryobalanops beccarii*, *Hopea latifolia*,

Shorea atrinervosa, *S. dasyphylla*, *S. exelliptica*, *S. foxworthyi*, *S. gibbosa* and *S. johorensis*.

Of the fifteen CR taxa, six are endemic to Peninsular Malaysia. They are *Hopea auriculata*, *H. bracteata* var. *penangiana*, *H. subalata*, *Shorea lumutensis*, *Vatica flavida* and *V. yeechongii*. Of the 35 EN taxa, 10 are endemic to Peninsular Malaysia; they are *Dipterocarpus rotundifolius*, *Hopea apiculata*, *H. bracteata* var. *perakensis*, *H. polyalthioides*, *Shorea bentongensis*, *S. curtisii* ssp. *grandis*, *S. singkawang* ssp. *scabrosa*, *Vatica lobata*, *V. pallida* and *V. scortechinii*. Of the 42 VU taxa, 6 are endemic to the peninsula and they are *Hopea glaucescens*, *H. johorensis*, *H. pubescens*, *Shorea collina*, *S. ochrophloia* and *Vatica hullettii*.

Examples of CR species that have one or several populations occurring in the protection forests include *Hopea auriculata*, *Shorea lumutensis*, *S. teysmanniana* (in the Virgin Jungle Reserves network) and *Vatica yeechongii* (in the amenity forests network). A Genetic Resource Area was created for *Dipterocarpus sarawakensis*. An *in situ* site of *Hopea subalata* is now in a High Conservation Value Forest (HCVF) while a site of *Shorea peltata* is awaiting similar inclusion.

Examples of EN species that have one or several populations protected include *Cotylelobium melanoxydon* (in the national parks), *Dipterocarpus tempehes* (in the amenity forests), *Dryobalanops beccarii* (in the national parks and Virgin Jungle Reserves) and *Shorea blumutensis* (in the state park). One site of *Cotylelobium melanoxydon* in Peninsular Malaysia is now a HCVF.

Table 1. The number of taxa in Peninsular Malaysia, grouped according to genus, under respective IUCN categories.

Genus	EX	CR	EN	VU	NT	LC	DD	Total
<i>Anisoptera</i>	0	0	1	4	0	1	0	6
<i>Cotylelobium</i>	0	0	1	0	1	0	0	2
<i>Dipterocarpus</i>	0	3	7	10	7	4	1	32
<i>Dryobalanops</i>	0	0	1	0	1	1	0	3
<i>Hopea</i>	0	4	6	11	9	3	0	33
<i>Neobalanocarpus</i>	0	0	0	0	1	0	0	1
<i>Parashorea</i>	0	1	0	0	1	1	0	3
<i>Shorea</i>	1	5	12	12	19	12	1	62
<i>Vatica</i> *	0	2	7	5	7	1	0	22
Total	1	15	35	42	46	23	2	164

* Note: *Vatica* sp. A was not evaluated

Table 2. List of taxa categorised as threatened in Peninsular Malaysia.

Threatened category	Species
Critically Endangered (CR)	<i>Dipterocarpus coriaceus</i>, <i>D. sarawakensis</i>, <i>D. semivestitus</i>; <i>Hopea auriculata</i>, <i>H. bilitonensis</i>, <i>H. bracteata</i> var. <i>penangiana</i>, <i>H. subalata</i>; <i>Parashorea globosa</i>; <i>Shorea hemsleyana</i> ssp. <i>hemsleyana</i>, <i>S. lamellata</i>, <i>S. lumutensis</i>, <i>S. peltata</i>, <i>S. teysmanniana</i>; <i>Vatica flavida</i>, <i>V. yeechongii</i>.
Endangered (EN)	<i>Anisoptera marginata</i>; <i>Cotylelobium melanoxydon</i>; <i>Dipterocarpus acutangulus</i>, <i>D. dyeri</i>, <i>D. obtusifolius</i> var. <i>subnudus</i>, <i>D. rigidus</i>, <i>D. rotundifolius</i>, <i>D. sublamellatus</i>, <i>D. tempehes</i>; <i>Dryobalanops beccarii</i>; <i>Hopea apiculata</i>, <i>H. bracteata</i> var. <i>perakensis</i>, <i>H. coriacea</i>, <i>H. kerangasensis</i>, <i>H. pachycarpa</i>, <i>H. polyalthioides</i>; <i>Shorea atrinervosa</i>, <i>S. bentongensis</i>, <i>S. blumutensis</i>, <i>S. curtisii</i> ssp. <i>grandis</i>, <i>S. dealbata</i>, <i>S. falcifera</i>, <i>S. henryana</i>, <i>S. inappendiculata</i>, <i>S. macrantha</i>, <i>S. platycarpa</i>, <i>S. singkawang</i> ssp. <i>scabrosa</i>, <i>S. uliginosa</i>; <i>Vatica havilandii</i>, <i>V. lobata</i>, <i>V. pallida</i>, <i>V. perakensis</i>, <i>V. ridleyana</i>, <i>V. scortechinii</i>, <i>V. venulosa</i>.
Vulnerable (VU)	<i>Anisoptera costata</i>, <i>A. laevis</i>, <i>A. megistocarpa</i>, <i>A. scaphula</i>; <i>Dipterocarpus caudatus</i> ssp. <i>penangianus</i>, <i>D. chartaceus</i>, <i>D. concavus</i>, <i>D. costatus</i>, <i>D. elongatus</i>, <i>D. eurynchus</i>, <i>D. fagineus</i>, <i>D. hasseltii</i>, <i>D. kerrii</i>, <i>D. palembanicus</i> ssp. <i>palembanicus</i>; <i>Hopea glaucescens</i>, <i>H. helferi</i>, <i>H. johorensis</i>, <i>H. latifolia</i>, <i>H. mengarawan</i>, <i>H. myrtifolia</i>, <i>H. nutans</i>, <i>H. odorata</i>, <i>H. pierrei</i>, <i>H. pubescens</i>, <i>H. semicuneata</i>; <i>Shorea collina</i>, <i>S. dasyphylla</i>, <i>S. exelliptica</i>, <i>S. foxworthyi</i>, <i>S. gibbosa</i>, <i>S. gratissima</i>, <i>S. johorensis</i>, <i>S. longisperma</i>, <i>S. materialis</i>, <i>S. ochrophloia</i>, <i>S. palembanica</i>, <i>S. resinosa</i>; <i>Vatica hullettii</i>, <i>V. maingayi</i>, <i>V. mangachapoi</i> ssp. <i>mangachapoi</i>, <i>V. odorata</i> ssp. <i>odorata</i>, <i>V. stapfiana</i>.

Table 3. The number of threatened taxa, including an extinct taxon, occurring in each Malaysian state, ranked according to the total number of threatened taxa.

State	EX	CR	EN	VU	Total
Pahang	1	1	20	37	59
Johor	0	2	7	35	54
Perak	0	10	15	28	53
Terengganu	0	1	15	31	47
Sarawak*	0	4	19	24	47
Sabah*	0	3	15	22	40
Selangor	0	3	6	25	34
Kedah	0	0	5	23	28
Negeri Sembilan	0	1	3	21	25
Kelantan	0	0	3	21	24
Penang	0	1	1	8	10
Malacca	0	0	1	8	9
Perlis	0	0	2	7	9

* Incomplete, as this analysis deals only with species occurring in Peninsular Malaysia; these states have 267 species of which only 90 are common to both regions.

Compared to other states in Peninsular Malaysia, Pahang has the highest number of threatened taxa (59 taxa; 35.9%). It had also the peninsula's only extinct taxon. This is followed by Johor and Perak with 54 (32.9%) and 53 (32.3%) taxa, respectively. Of the three states, Perak is perhaps the most vulnerable as it has the most number of CR taxa (10) (see Table 2 for CR species). The conservation monitoring however shows that the populations of almost all of Perak's CR taxa are extant but the population sizes are extremely small and hence they are extremely vulnerable to extinction. The same is true for Johor, Pahang and Selangor.

Six taxa have their threatened category upgraded to a higher category in the Malaysian conservation status. *Shorea teysmanniana* is upgraded from EN (IUCN, 2010) to CR while *Shorea uliginosa* is upgraded from VU (IUCN, 2010) to EN. Similarly, *Dipterocarpus obtusifolius* var. *subnudus* is upgraded from LR/lc to EN; *Hopea auriculata* and *Parashorea globosa* are upgraded from EN to CR and *Hopea pachycarpa* is upgraded from VU to EN. Fifty seven taxa are downgraded to a lower threatened category. Two species, i.e., *Dipterocarpus perakensis* and *Shorea farinosa* are downgraded from CR to DD. Fifty eight taxa are downgraded from threatened to not threatened. *Vatica odorata* ssp. *odorata* is upgraded from LR/lc to VU while *Shorea curtisii* ssp. *curtisii* and *S. laevis* are upgraded from LR/lc to NT.

Existing Conservation Measures

With a few exceptions, almost all the conservation measures for dipterocarps take the form of habitat conservation, i.e., via the network of legally established Protected Areas. The protected areas in Peninsular Malaysia comprise National and State Parks, Wildlife Sanctuaries, protected areas within the Permanent Reserved Forests (previously known as Permanent Forest Estates) and Marine Parks. Some of these have been categorised according to the IUCN Management Categories of Protected Areas (IUCN, 1994). Recent initiatives that significantly expand the network of protected areas include the Trans-boundary Biodiversity Conservation Areas of Lanjak Entimau Wildlife Sanctuary (Sarawak) & Betung Kerihun National Park (Kalimantan) and the Pulong Tau National Park (Sarawak) & Kayan Mentarang National Park (Kalimantan). The Heart of Borneo Initiative, an initiative participated by Malaysia, Indonesia and Brunei and covering *ca.* 220,000 km², seeks to re-establish forest connectivity and corridors particularly for protected areas which are fragmented due to forest degradation and land use changes.

Policies and laws have been enacted to protect the country's flora and fauna. Policies that have strong elements of plant conservation include the National Forestry Policy 1978 (revised 1993), the National Policy on Biological Diversity 1998, the National Agriculture Policy 3 (1998–2010) and the National Physical Plan (2005–2020). The National Forestry Policy is underpinned by the National Forestry Act 1984 amended 1993. The Customs (Prohibition of Exports) (Amendment No. 4) Order 1993 has direct relevance to timber trade while the newly enacted International Trade in Endangered Species Act 2008 seeks to provide greater protection to species that are traded in the international market. The National Parks Act 1980 indirectly protects plant populations through habitat protection.

The National Physical Plan (NPP), as provided for in the Town and Country Planning Act 1976, aims to prioritise land and natural resources for sustainable development. It has, as one of its principles, compliance to protect national heritage areas and locations. There are six policies that have direct reference to natural resource and biodiversity assets. The Environmentally Sensitive Areas (ESA) shall be integrated in the planning and management of land use and natural resources. The Central Forest Spine that is established to anchor the ESA includes the mountainous backbone of the peninsula. The NPP also sets out a framework for regional, state and local planning. Through the NPP, Malaysia undertakes to incorporate environmental and conservation considerations into physical planning and governance.

The states of Sarawak and Sabah have their own separate biodiversity legislation and have established regulatory and administrative mechanisms to strengthen efforts at conserving plant resources. For Sabah, the legislation pertaining to biodiversity includes

the Forest Enactment 1968, the Parks Enactment 1984, the Environment Protection Enactment 2002, the Wildlife Conservation Enactment 1997 and the Biodiversity Enactment 2000. Sarawak has the Forest Ordinance 1954 (amended 1994), the National Parks and Nature Reserves Ordinance 1998, the Wildlife Protection Ordinance 1998, the Natural Resources And Environment (Amendment) Ordinance 2005 and Sarawak Biodiversity Regulations 2004.

At the regional and international fora, Malaysia is guided by its obligations to several multi-environmental agreements related to species and habitat conservation, amongst them the Convention of Biological Diversity (specifically the Global Strategy for Plant Conservation), Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the International Tropical Timber Organization (ITTO).

The forests in Malaysia have been systematically managed for timber production since 1901 (Thang, 1986). The shift from the Malayan Uniform System (MUS) to the Selective Management System (SMS) took place to address the changing patterns of forestry and decline of forest resources in the lowland forests of the peninsula. SMS in the peninsula has, over the years, progressively incorporated many elements of Sustainable Forest Management (SFM). Ecologically and environmentally sound forest management and conservation practices were integrated to ensure that forest resources are managed for the sustainable production of its resources including enhancing environmental stability, ecological balance, the safeguarding of water supplies and conservation of biological diversity. In its design, the SMS aspires to achieve, among others, levels of structural diversity approaching that of primary forests. This balance is assisted by the presence of scattered, and in some cases minutely-sized, protection forests such as soil protection forests, water catchment forests, virgin jungle reserves, amenity forests etc. The provision for protected forests in the National Forestry Act 1984 is extensively applied in the Permanent Reserved Forests. The Malaysian Criteria and Indicators (2002) (MC&I (2002)), a market-linked tool to promote and encourage sustainable forest management as well as to provide an assurance to buyers that the timber products they purchase come from sustainably managed forests, also has many elements of SFM. Principal #9 states that management activities in high conservation value forests (HCVF) shall maintain or enhance the attributes that define such forests. From the efforts of the project, several forest areas in Malaysia that were recommended for conservation are now HCVF.

From the *ex situ* aspect, there are currently fresh efforts by the network of Botanic Gardens, research institutions, the academia and stakeholders within Malaysia to upgrade their collection of dipterocarps through the exchange of materials. Rescue operations and recovery plans are being conducted for selected threatened species.

As part of the conservation action plan, research into the taxon's distribution, abundance and biological characteristics, in addition to long-term monitoring, is being conducted for selected CR species. The research findings are continuously channeled, in various forms, to agencies and stakeholders involved in land use and resource planning and management.

The discovery of a new species, several new species records and populations of species thought to be extinct underscores the effectiveness of the collective conservation approaches implemented by Malaysia. It is, however, cautioned here that although the populations remain extant, the viability of a small-sized population and its tolerance towards environmental and genetic stochasticities are not known. Neither are the levels of genetic diversity known.

The Next Steps

To ameliorate the decline in biodiversity and natural resources, it is essential that conservation considerations be incorporated at the early stages of development plans. The Red List of Peninsular Malaysia's Dipterocarps indicates the gaps where more consolidated efforts can be undertaken by Malaysia to conserve threatened species of this keystone family.

The list highlights the state of Perak as being the most vulnerable in terms of the number of critically endangered taxa while Pahang, Johor and Perak have the highest number of threatened taxa. In these states, there is a need to pay more attention when deciding on future areas to be earmarked for land use change.

Many threatened taxa that appear in this Red List have little form of protection in the habitat they occupy. The majority occur outside the network of PAs. Areas that fall outside the current network may need to be prioritised for conservation and be included into the legal and policy framework. For species that occur within the Permanent Reserved Forests, it is envisaged that there shall be a more comprehensive integration of plant conservation into the Sustainable Forest Management practice in Peninsular Malaysia.

As land is finite and its resources more valuable than ever, the selection of new areas to be conserved needs substantial justification. This justification must contain elements of scientific evidence. Research to expand the knowledge base of threatened species, in fundamental subjects such as population biology and autecology, should be pursued. It is crucial to have continued support for such research. The importance of long-term monitoring of threatened taxa, particularly populations of critically endangered taxa, cannot be over-simplified. FRIM is in the process of proposing the establishment of

national guidelines for the conservation of threatened plant species in Malaysia.

In the event the original habitat is at risk of being lost in the near future, rescue operations for tree species will become necessary. The commitment and efforts of various stakeholders to support the maintenance of *ex situ* collection is crucial. From such collections, reintroduction into the natural habitats and rehabilitation of such habitats become feasible.

Other aspects for which Malaysia may want to expand its efforts include the networking between stakeholders. Engagement with private stakeholders is particularly crucial for species that occur on private land. Educational awareness and local involvement can be enhanced further through collaborative efforts with non-governmental organisations and local communities. Collective conservation efforts can be further enhanced in this manner.

These suggested next steps are necessarily small and focus on the needs of threatened dipterocarp species. It is reiterated here that because the dipterocarps play such an important and dominant role in the maintenance of ecological balance, dynamism and diversity of the Malaysian rainforests, their conservation, particularly those which are threatened, merit a more concerted effort.

SPECIES ASSESSMENTS

Anisoptera costata Korth.

Vernacular names: Peninsular Malaysia and Sarawak: mersawa kesat; Sabah: pengiran kesat.

Distribution: Myanmar, Thailand, Indo-China, Indonesia, Peninsular Malaysia, Borneo and the Philippines.

Peninsular Malaysia: Johor, Kedah, Kelantan, Pahang, Perak, Perlis, Selangor and Terengganu.

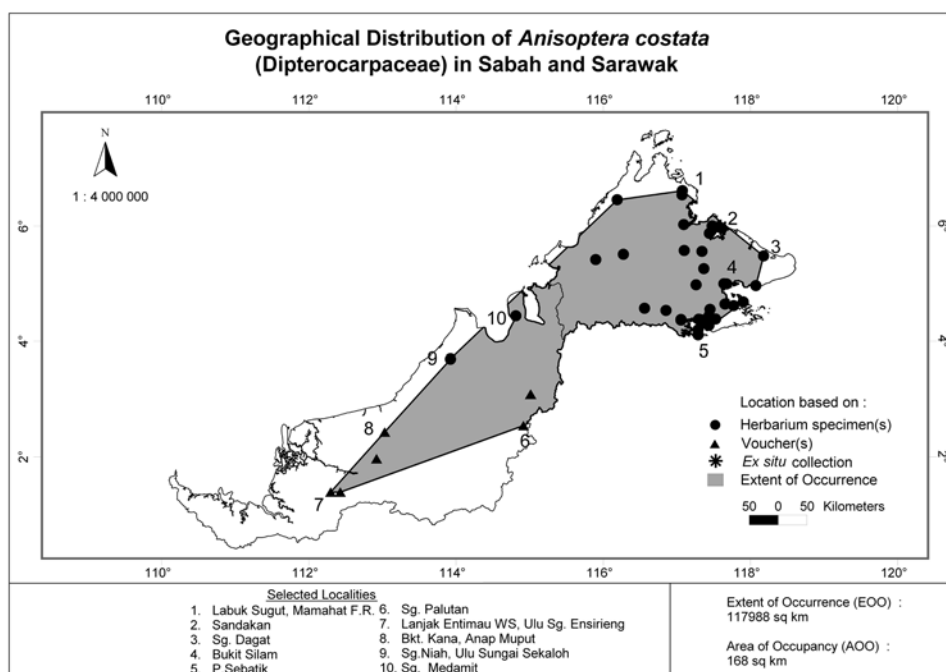
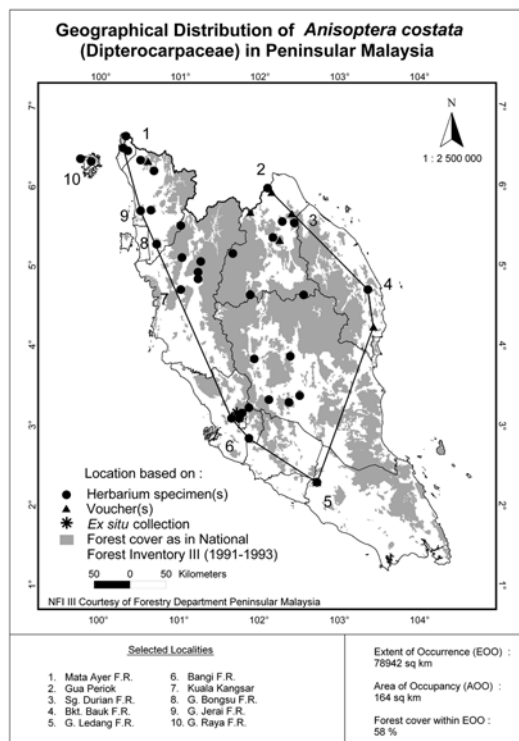
Sabah: Beluran, Keningau, Kinabatangan, Kota Marudu, Lahad Datu, Sandakan, Semporna and Tawau. **Sarawak:** Limbang, Marudi, Miri, Song and Tatau.

Habitat: Lowland to hill forests at altitudes to 700 m.

Conservation status: VU B1ab(iii) for Malaysia; NT for Peninsular Malaysia; VU B1ab(iii) for Sabah and Sarawak.

Conservation notes: Several populations occur in the Protected Areas network.

Other assessments: EN A1cd+2cd (IUCN, 2010); EN, threats from forest conversion (Symington, 2004); VU, uncommon (Ashton, 2004).



Anisoptera curtisii Dyer ex King

Vernacular name: Peninsular Malaysia: mersawa kuning.

Distribution: Peninsular Thailand, Peninsular Malaysia, Singapore and Sumatra.

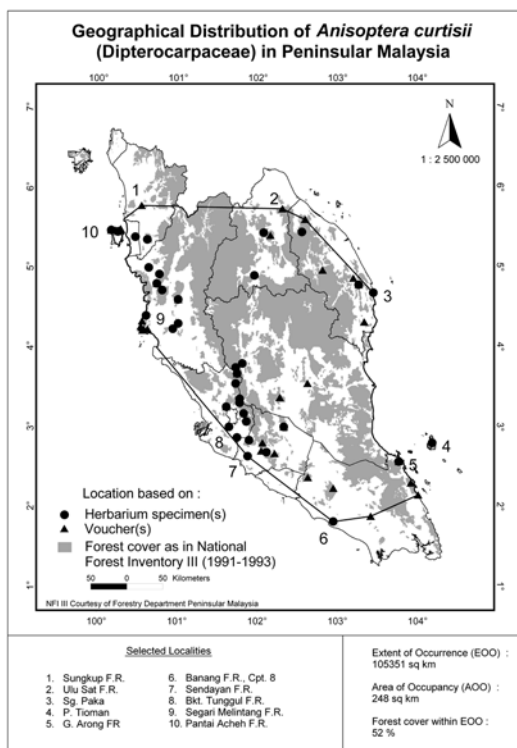
Peninsular Malaysia: Johor, Kedah, Kelantan, Negeri Sembilan, Pahang, Penang, Perak, Selangor and Terengganu.

Habitat: Lowland to hill forests up to 650 m altitude.

Conservation status: LC for Malaysia.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 119,000 adult stems (above 30 cm dbh) in the Permanent Reserved Forests.

Other assessments: CR A1cd+2cd (IUCN, 2010); EN, threats from logging (Symington, 2004).

*Anisoptera laevis* Ridl.

Vernacular names: Peninsular Malaysia and Sarawak: mersawa durian; Sabah: pengiran durian.

Distribution: Sumatra, Peninsular Malaysia, Singapore and Borneo (Sabah, Sarawak and Brunei).

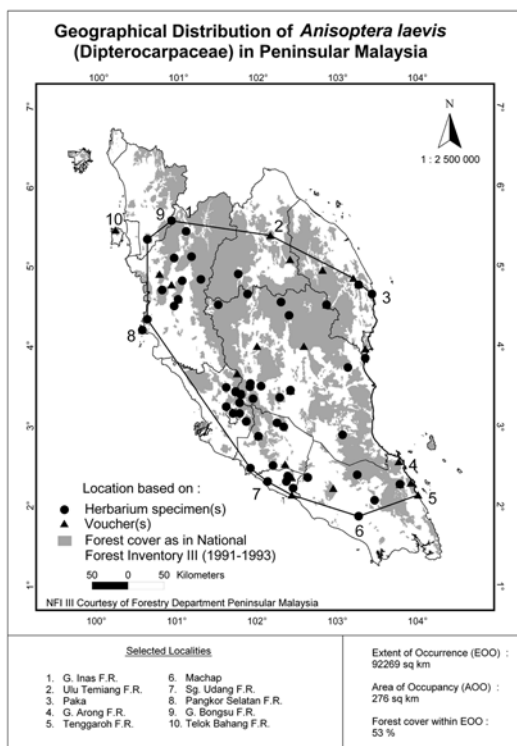
Peninsular Malaysia: Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Penang, Perak, Selangor and Terengganu. **Sabah:** Beaufort, Beluran, Lahad Datu, Ranau, Sipitang and Tenom. **Sarawak:** Bau, Belaga, Kapit, Lawas, Limbang, Lubok Antu and Tatau.

Habitat: Lowland to hill forests up to 900 m altitude.

Conservation status: VUB2b(iii)+c(ii) for Malaysia; LC for Peninsular Malaysia; VU B2b(iii)+c(ii) for Sabah and Sarawak.

Conservation notes: Several populations are present in the network of Totally Protected Areas and in large forested Forest Reserves. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 143,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: EN A1cd+2cd (IUCN, 2010); VU, threats from habitat conversion and logging (Symington, 2004); VU (Ashton, 2004).



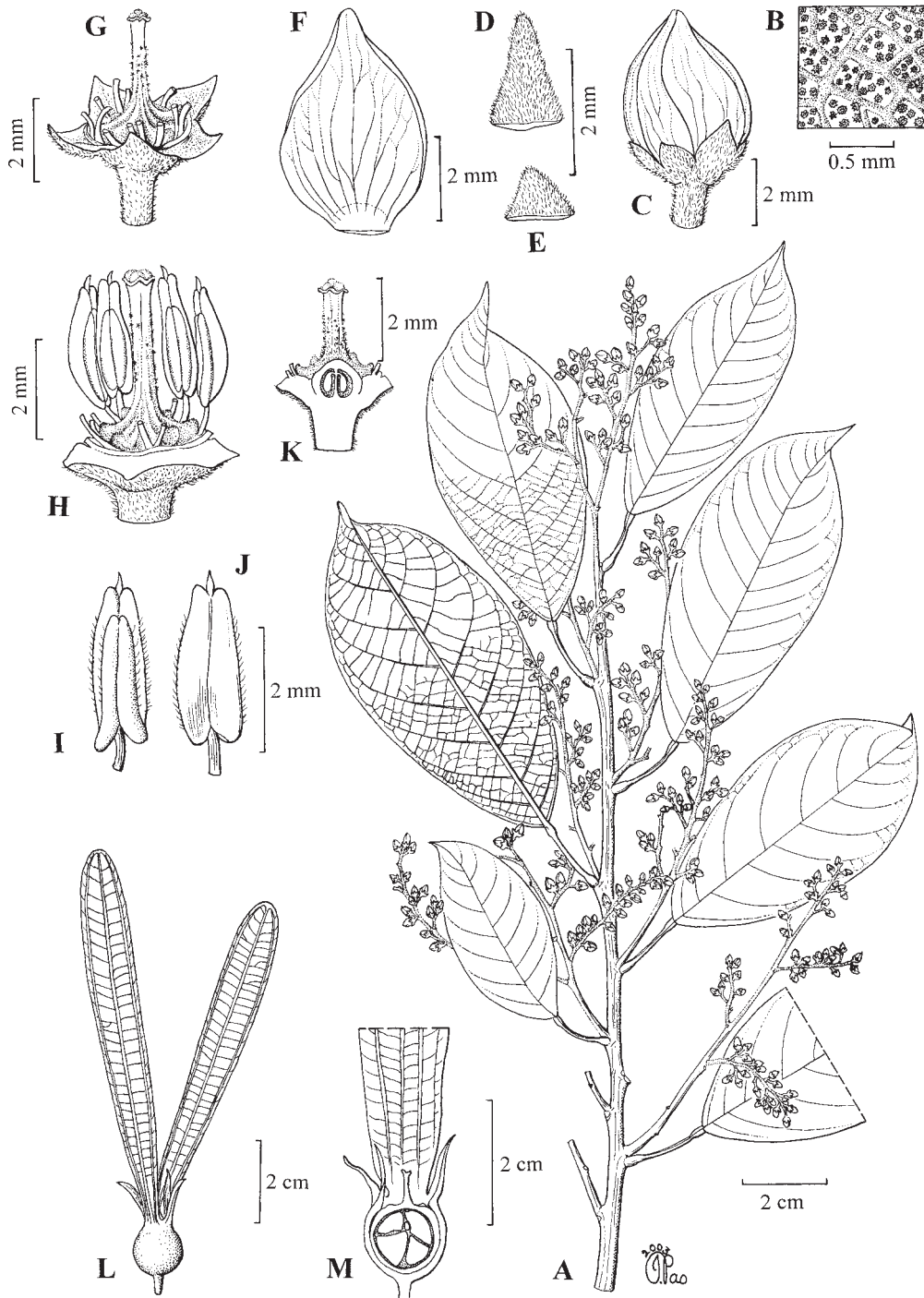
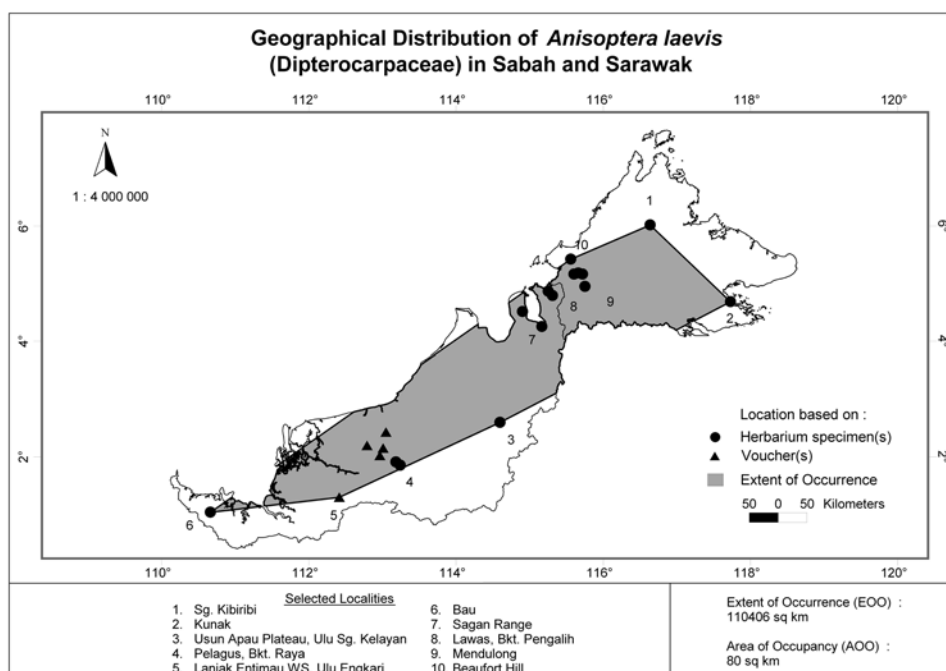


Fig. 1. *Anisoptera laevis*. A, flowering leafy twig; B, detail of venation and indumentum on lower leaf surface; C, flower bud; D, abaxial view of larger sepal; E, abaxial view of smaller sepal; F, adaxial view of petal; G, flower bud with petals and stamens removed; H, flower bud with sepals and petals removed; I, adaxial view of stamen; J, abaxial view of stamen; K, longitudinal section of gynoecium; L, fruit; M, longitudinal section of fruit. (A–K from SAN 15083, L–M from Ridley 6886) (Reproduced with permission from the Tree Flora of Sabah and Sarawak project).



Anisoptera marginata Korth.

Vernacular names: Peninsular Malaysia and Sarawak: mersawa paya; Sabah: pengiran kerangas.

Distribution: Sumatra, Peninsular Malaysia and Borneo.

Peninsular Malaysia: Pahang, Perak and Selangor.

Sabah: Beaufort, Beluran, Sandakan and Tawau.

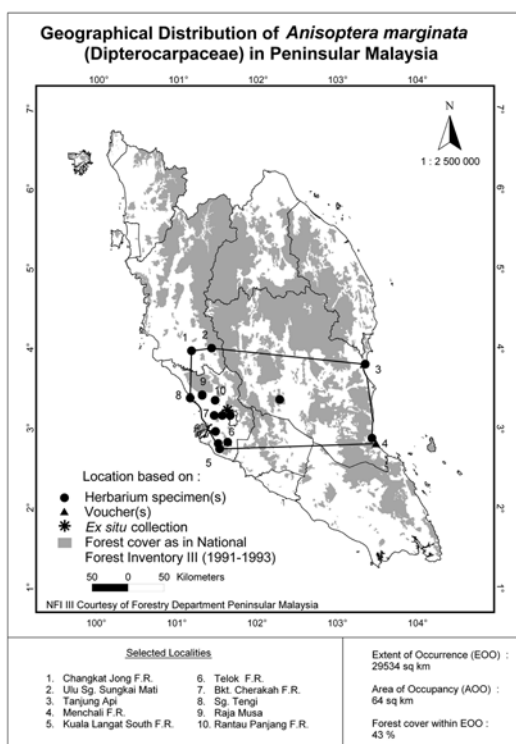
Sarawak: Belaga, Betong, Bintulu, Kapit, Kuching, Lawas, Lundu, Marudi, Mukah, Sibul, Sri Aman and Tatau.

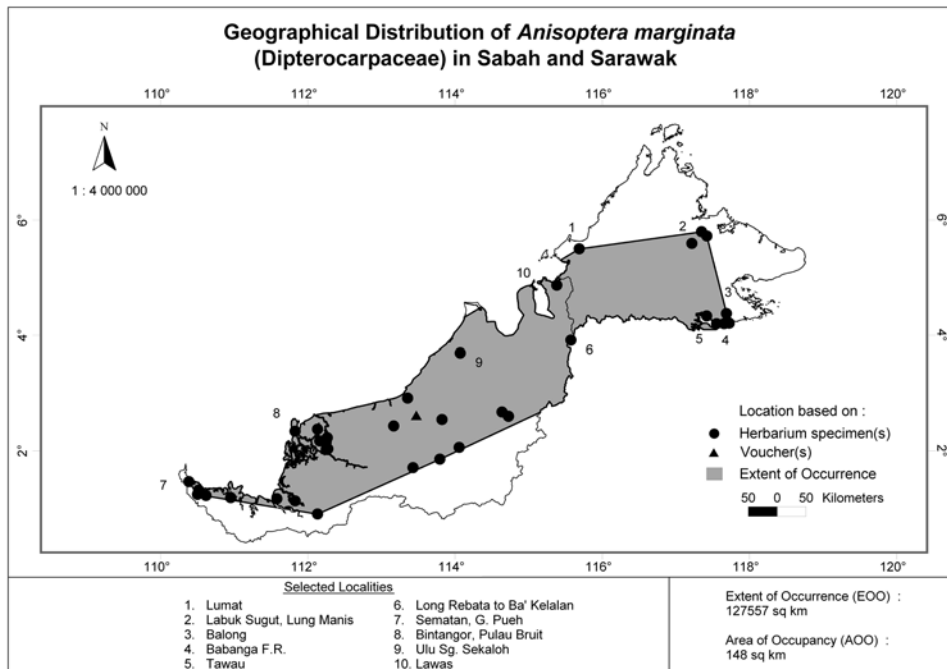
Habitat: The species occurs in or near coastal peat swamp forests, poorly drained heath (kerangas) forest and on ultrabasic rocks at altitudes to 850 m.

Conservation status: EN B2b(iii)+c(ii), C1 for Malaysia; EN B2b(iii)+c(ii), C1 for Peninsular Malaysia; NT for Sabah and Sarawak.

Conservation notes: The population at Kuala Langat South FR is in a Virgin Jungle Reserve.

Other assessments: EN A1cd+2cd (IUCN, 2010); CR by habitat conversion (Symington, 2004); VU, possibly EN (Ashton, 2004).





Anisoptera megistocarpa Sloaten

Vernacular name: Peninsular Malaysia: mersawa merah.

Distribution: Peninsular Thailand, Peninsular Malaysia, Singapore and Sumatra.

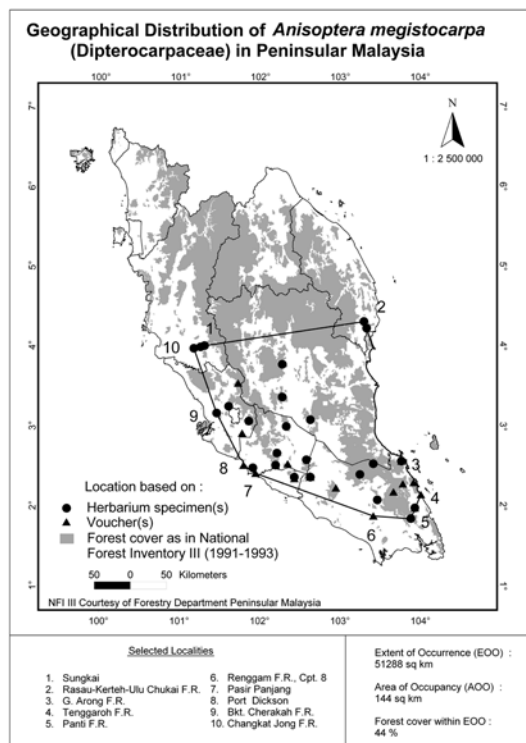
Peninsular Malaysia: Johor, Malacca, Negeri Sembilan, Pahang, Perak, Selangor and Terengganu.

Habitat: Lowland forests.

Conservation status: VU B2b(iii)+c(ii) for Malaysia.

Conservation notes: Several populations occur in the network of Totally Protected Areas and in research plots of Forest Reserves.

Other assessments: CR A1cd+2cd (IUCN, 2010); EN, threats from habitat conversion (Symington, 2004); VU, possibly EN (Ashton, 2004).



Anisoptera scaphula (Roxb.) Kurz

Vernacular name: Peninsular Malaysia: mersawa gajah.

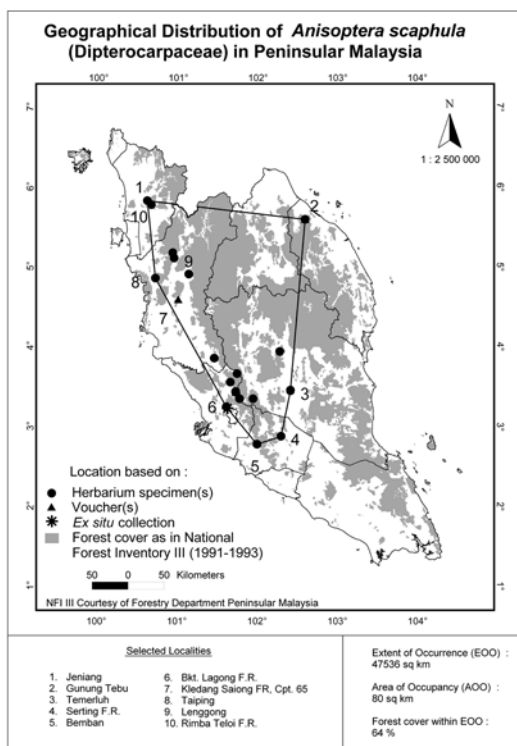
Distribution: Bangladesh, Myanmar, Indo-China, Peninsular Thailand and Peninsular Malaysia.

Peninsular Malaysia: Kedah, Kelantan, Negeri Sembilan, Pahang, Perak, Selangor and Terengganu.

Habitat: Lowland forests.

Conservation status: VU B2b(iii)+c(iv) for Malaysia.

Other assessments: CR A1cd+2cd (IUCN, 2010); EN, threats from agriculture (Symington, 2004).

*Cotylelobium lanceolatum* Craib

Plates 1C–D

Vernacular names: Peninsular Malaysia: resak bukit; Sabah: resak kelabu; Sarawak: resak batu.

Distribution: Peninsular Thailand, Peninsular Malaysia, Anambas Islands and Borneo.

Peninsular Malaysia: Johor, Pahang and Terengganu. **Sabah:** Sandakan, Sipitang and Tawau.

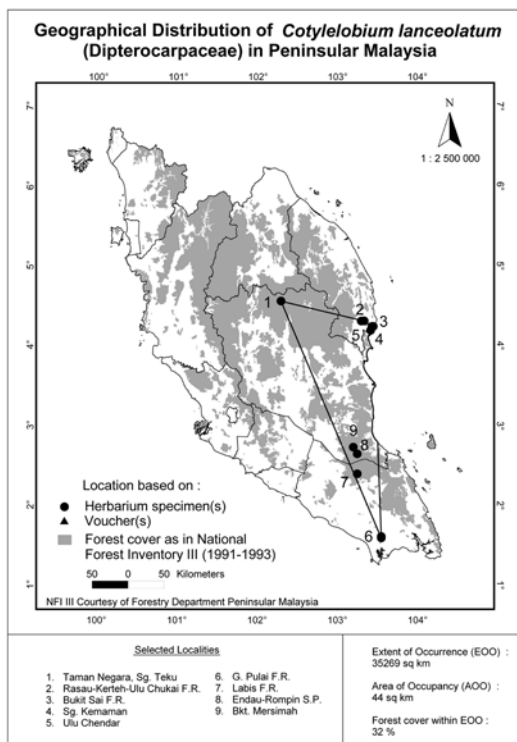
Sarawak: Bau, Kuching, Bintulu, Lawas, Limbang, Marudi, Mukah, Miri, Serian and Tatau.

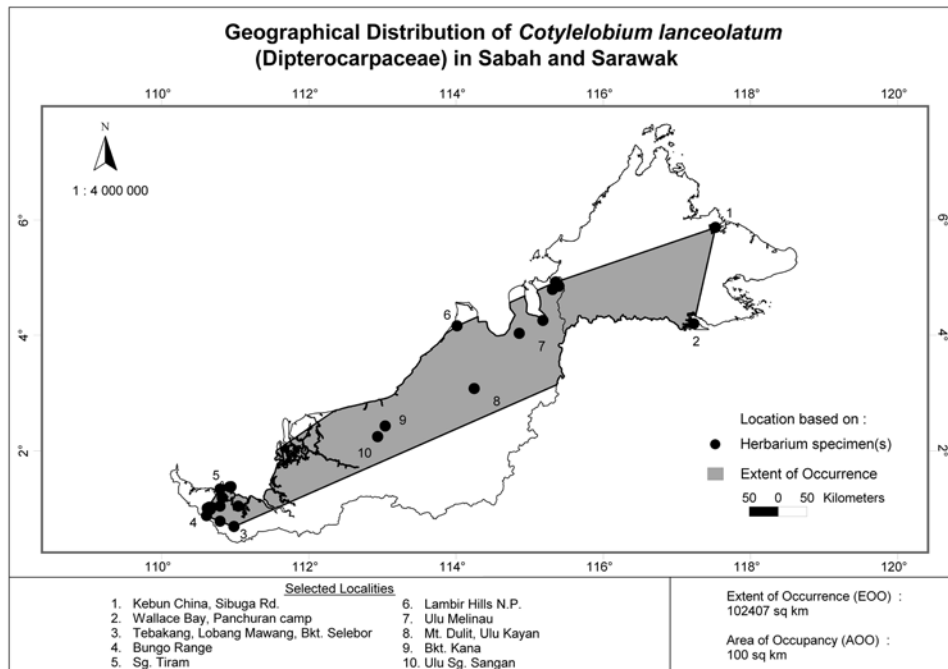
Habitat: Lowland to montane oak forests up to 1,500 m altitude, in kerangas (heath) forest, on raised beach terraces, sandstone plateau and limestones.

Conservation status: NT for Malaysia.

Conservation notes: Several populations occur in the network of Totally Protected Areas.

Other assessments: VU A1cd, B1+2c (IUCN, 2010); CR (Symington, 2004).





Cotylelobium melanoxydon (Hook.f.) Pierre

Fig. 2, Plates 2A–B

Vernacular names: Peninsular Malaysia: resak; Sabah: resak tempurung; Sarawak: resak hitam.

Distribution: Sumatra, Peninsular Malaysia and Borneo.

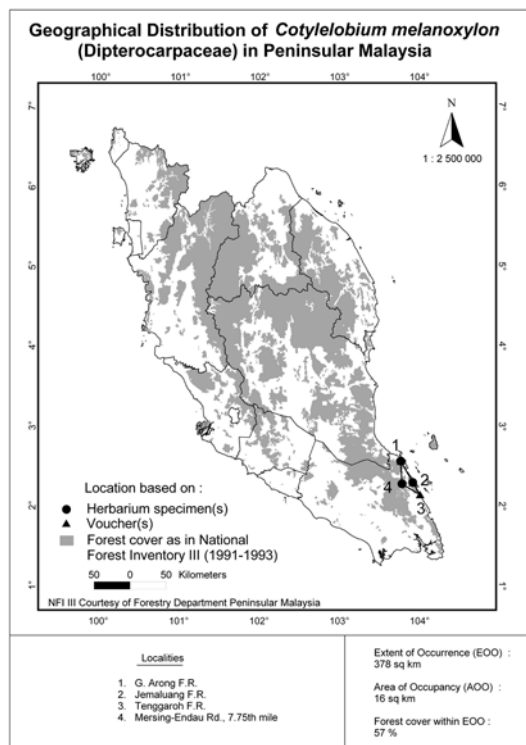
Peninsular Malaysia: Johor. **Sabah:** Beaufort, Beluran, Kota Kinabalu, Kudat, Penampang, Sandakan, Sipitang and Tawau. **Sarawak:** Bau, Bintulu, Kuching, Lundu, Marudi, Miri and Tatau.

Habitat: Lowland to hill forests at altitudes below 400 m and in kerangas (heath) on podsols and usually not far from the coast.

Conservation status: EN B2ab(iii) for Malaysia; EN B2ab(iii) for Peninsular Malaysia; LC for Sabah and Sarawak.

Conservation notes: In Sabah and Sarawak, several populations occur in the network of Totally Protected Areas. In Lambir Hills, Sarawak, at least 1,009 trees above 1 cm diameter were recorded from a 52-ha research plot in 1991 with 91.1% having diameters less than 5 cm. In Peninsular Malaysia, at least 154 trees had been located in the Gunung Arong FR (c. 16,000 ha), 45 trees in Jemaluang FR (c. 8,000 ha) and 30 trees in Tenggaroh FR (c. 7,000 ha). Populations in Compartment 14, Gunung Arong FR are now in High Conservation Value Forest.

Other assessments: EN A1cd+2cd (IUCN, 2010); possibly EX (Symington, 2004); VU (Ashton, 2004).



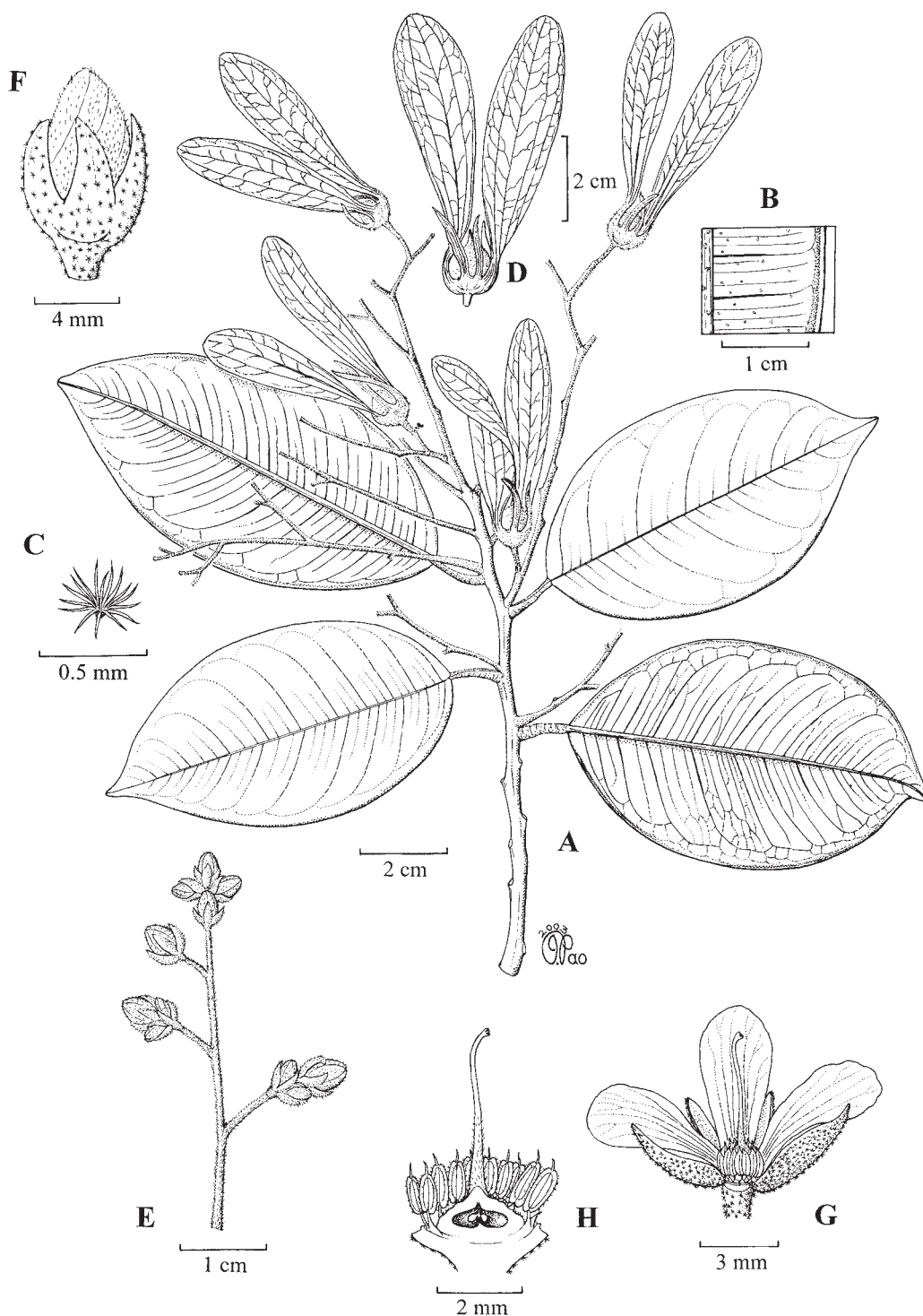
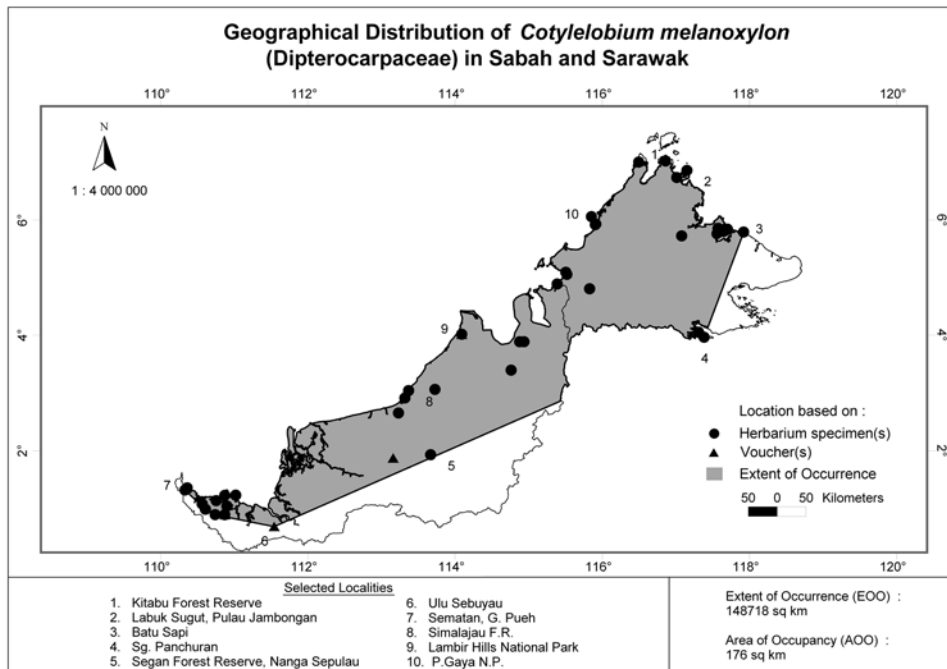


Fig. 2. *Cotylelobium melanoxydon*. A, fruiting leafy twig; B, detail venation on lower leaf surface; C, side view of tufted hairs; D, mature fruit; E, part of inflorescence bearing flower buds; F, flower bud; G, open flower with one sepal and two petals removed; H, longitudinal section of gynoecium and adaxial view of stamens (A–C from *SAN 56120*, D from *S 15886*, E from *SAN 57677*, F–H from *SAN 37642*) (Reproduced with permission from the Tree Flora of Sabah and Sarawak project).



Dipterocarpus acutangulus Vesque

Plates 2C–D

Vernacular names: Sabah: keruing merkah; Sarawak: keruing beludu.

Distribution: Peninsular Malaysia and Borneo.

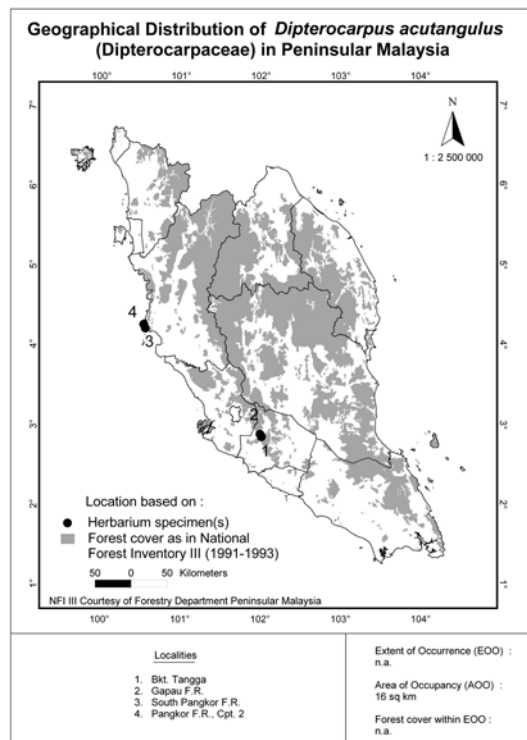
Peninsular Malaysia: Negeri Sembilan and Perak.

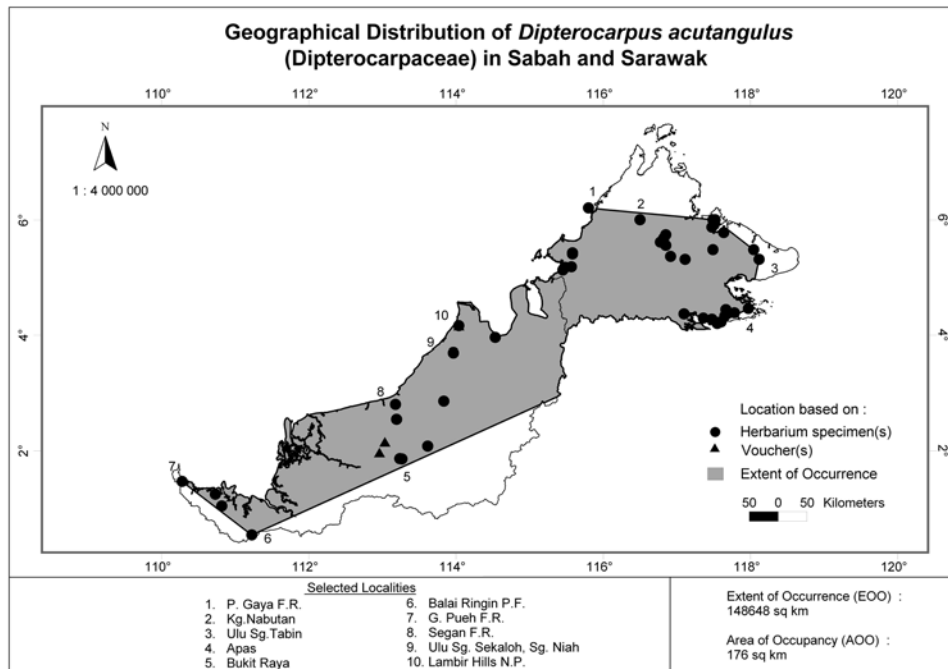
Sabah: Beaufort, Beluran, Kinabatangan, Kota Kinabalu, Lahad Datu, Ranau, Sandakan, Semporna, Sipitang and Tawau. **Sarawak:** Bintulu, Kapit, Kuching, Lawas, Lundu, Miri, Serian, Simunjan and Tatau.

Habitat: Lowland to hill forests up to 1,000 m altitude, also scattered on inland shale and sandstone ridges.

Conservation status: EN B2ab(iii) for Malaysia; EN B2ab(iii) for Peninsular Malaysia; LC for Sabah and Sarawak.

Other assessments: CR, threats from logging (Symington, 2004); VU (Ashton, 2004).





Dipterocarpus baudi Korth.

Vernacular name: Peninsular Malaysia: keruing bulu.

Distribution: Myanmar, Indo-China, Thailand, Peninsular Malaysia and Sumatra.

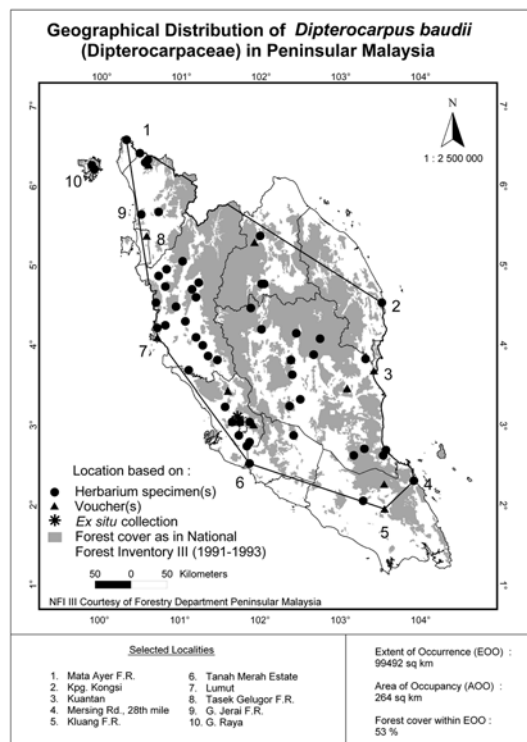
Peninsular Malaysia: Johor, Kedah, Kelantan, Negeri Sembilan, Pahang, Penang, Perak, Perlis, Selangor and Terengganu.

Habitat: Lowland forests.

Conservation status: LC for Malaysia.

Conservation notes: Several populations occur in the network of Totally Protected Areas. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 354,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: CR A1cd+2cd (IUCN, 2010); CR, threats from land conversion (Symington, 2004).



***Dipterocarpus caudatus* Foxw. ssp. *penangianus* (Foxw.) P.S.Ashton** Plates 3A–C

Vernacular name: Peninsular Malaysia and Sarawak: keruing gasing.

Distribution: Sumatra, Peninsular Malaysia, Singapore and Borneo (Sabah, Sarawak and Brunei).

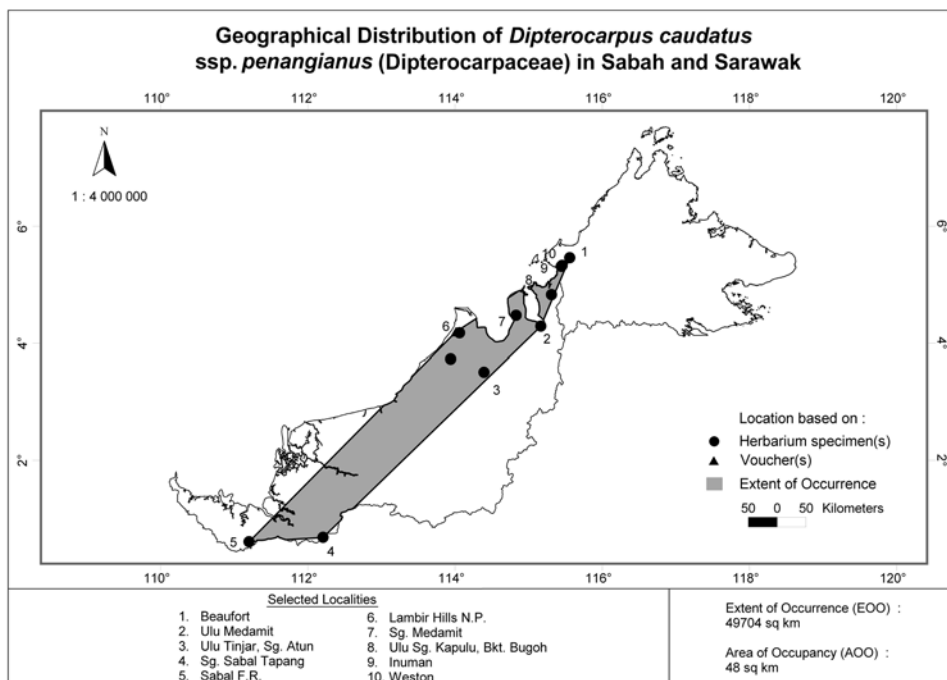
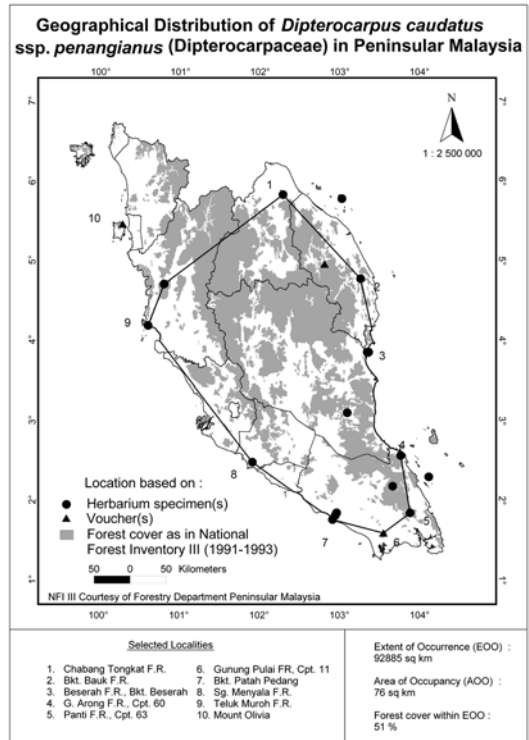
Peninsular Malaysia: Johor, Kelantan, Negeri Sembilan, Pahang, Penang, Perak and Terengganu.

Sabah: Beaufort. **Sarawak:** Lawas, Limbang, Marudi, Miri, Samarahan and Simunjan.

Habitat: Lowland to hill forests at altitudes below 400 m often near the coast.

Conservation status: VU B2b(iii)+c(ii) for Malaysia.

Other assessments: EN A1cd+2cd, B1+2c (IUCN, 2010); potentially EN, threats from logging and land conversion (Symington, 2004); EN, threats from land conversion (Ashton, 2004).



Dipterocarpus chartaceus Symington

Vernacular name: Peninsular Malaysia: keruing kertas.

Distribution: Peninsular Thailand and Peninsular Malaysia.

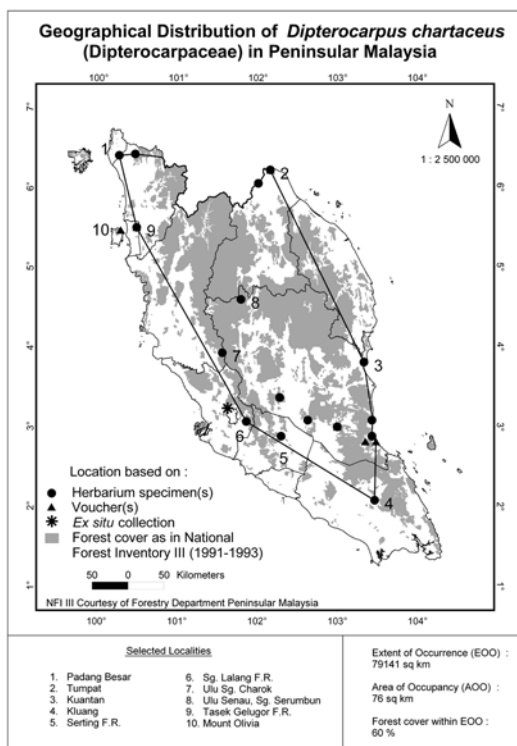
Peninsular Malaysia: Johor, Kedah, Kelantan, Negeri Sembilan, Pahang, Penang, Perak, Perlis and Selangor.

Habitat: Lowland dipterocarp forests and in coastal localities.

Conservation status: VU A4c for Malaysia.

Conservation notes: Although widespread, none of the populations are known to occur in the protected areas. Many of the Forest Reserves where it occurs are fragmented. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 30,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: CR A1cd+2cd, B1+2c (IUCN, 2010); CR (Symington, 2004).



Dipterocarpus concavus Foxw.

Vernacular name: Peninsular Malaysia: keruing senduk.

Distribution: Peninsular Malaysia and Sumatra.

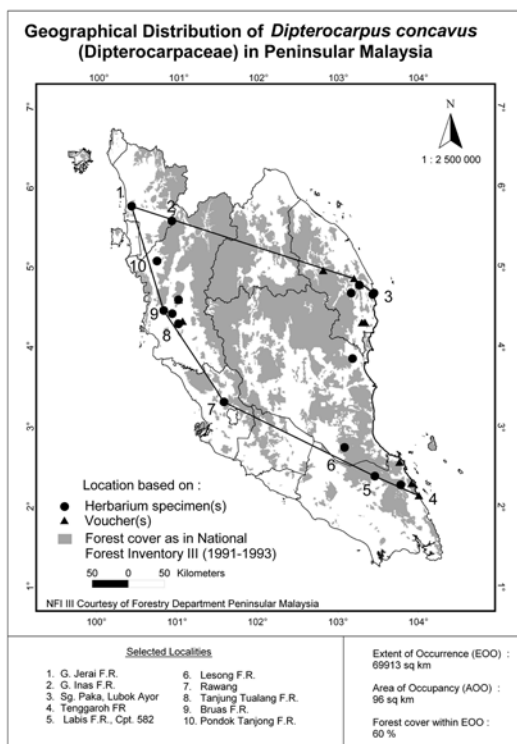
Peninsular Malaysia: Johor, Kedah, Pahang, Perak, Selangor and Terengganu.

Habitat: Lowland forests.

Conservation status: VU B2b(iii)+c(ii) for Malaysia.

Conservation notes: Several of the Forest Reserves have been degazetted. Some of the remaining Forest Reserves have large tracts of natural forests but others are small fragments. There are no populations known in the protected areas. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 54,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: CR A1cd+2cd, B1+2c (IUCN, 2010); CR, threats from land conversion and logging (Symington, 2004).



Dipterocarpus coriaceus Slooten

Vernacular name: Peninsular Malaysia and Sarawak: keruing paya.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sarawak and Kalimantan).

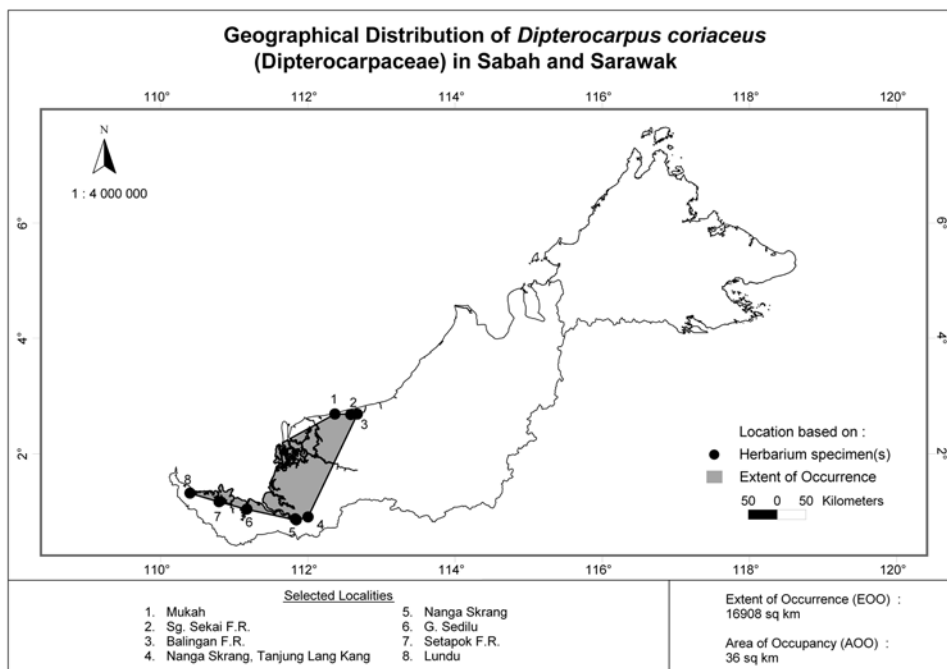
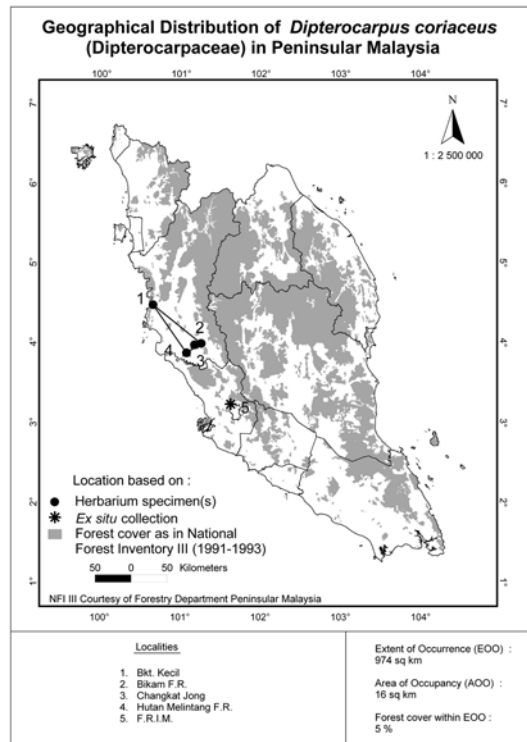
Peninsular Malaysia: Perak. **Sarawak:** Kuching, Lundu, Mukah, Samarahan, Sibü and Sri Aman.

Habitat: Lowland forests along inner margins of peat swamp forests.

Conservation status: CR A4c for Malaysia.

Conservation notes: No population is known to occur in the network of Protected Areas.

Other assessments: CR A1cd+2cd, B1+2c (IUCN, 2010); may not be EX (Symington, 2004); CR (Ashton, 2004).



Dipterocarpus cornutus Dyer

Vernacular name: Peninsular Malaysia: keruing gombang.

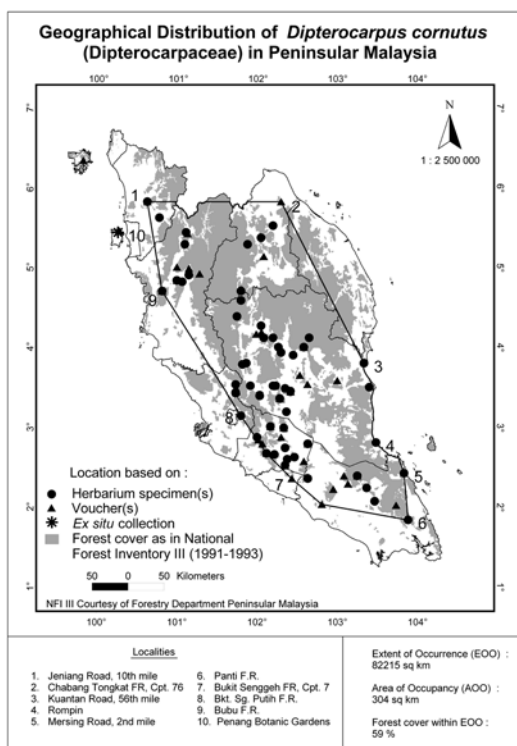
Distribution: Sumatra, Peninsular Thailand, Peninsular Malaysia, Singapore and Borneo (Kalimantan).

Peninsular Malaysia: Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Penang, Perak and Selangor.

Habitat: Lowland to hill forests, on well-drained, flat or undulating land or hills.

Conservation status: LC for Malaysia.

Other assessments: CR A1cd+2cd (IUCN, 2010); NT, threats from land conversion (Symington, 2004).

*Dipterocarpus costatus* Gaertn.f.

Vernacular name: Peninsular Malaysia: keruing bukit.

Distribution: Andaman, Bangladesh, Myanmar, Thailand, Indo-China and Peninsular Malaysia.

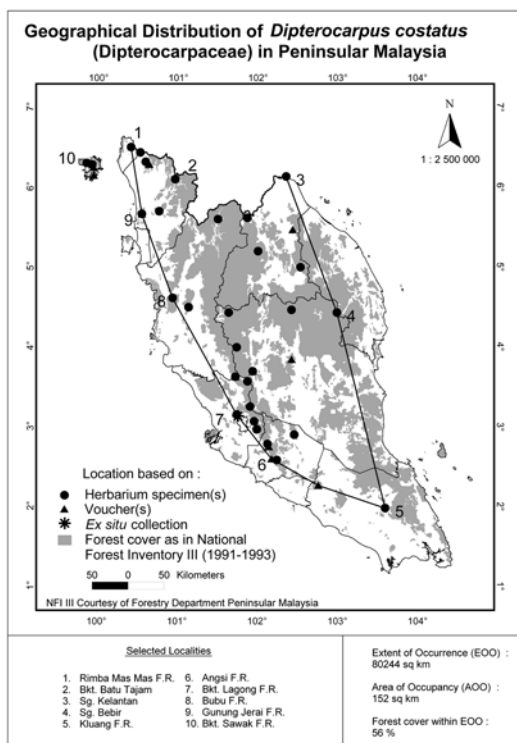
Peninsular Malaysia: Johor, Kedah, Kelantan, Negeri Sembilan, Pahang, Perak, Perlis, Selangor and Terengganu.

Habitat: Lowland to hill forests at altitudes of 600–1,100 m. In the seasonal forest of the northern states, it occurs almost at sea level.

Conservation status: VU A4c for Malaysia.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 5,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: EN A1cd+2cd (IUCN, 2010); VU (Symington, 2004).



Dipterocarpus costulatus Slooten

Vernacular name: Peninsular Malaysia, Sabah and Sarawak: keruing kipas.

Distribution: Sumatra, Peninsular Thailand, Peninsular Malaysia, Singapore and Borneo (Sabah, Sarawak and Kalimantan).

Peninsular Malaysia: Johor, Kelantan, Negeri Sembilan, Pahang, Perak, Selangor and Terengganu.

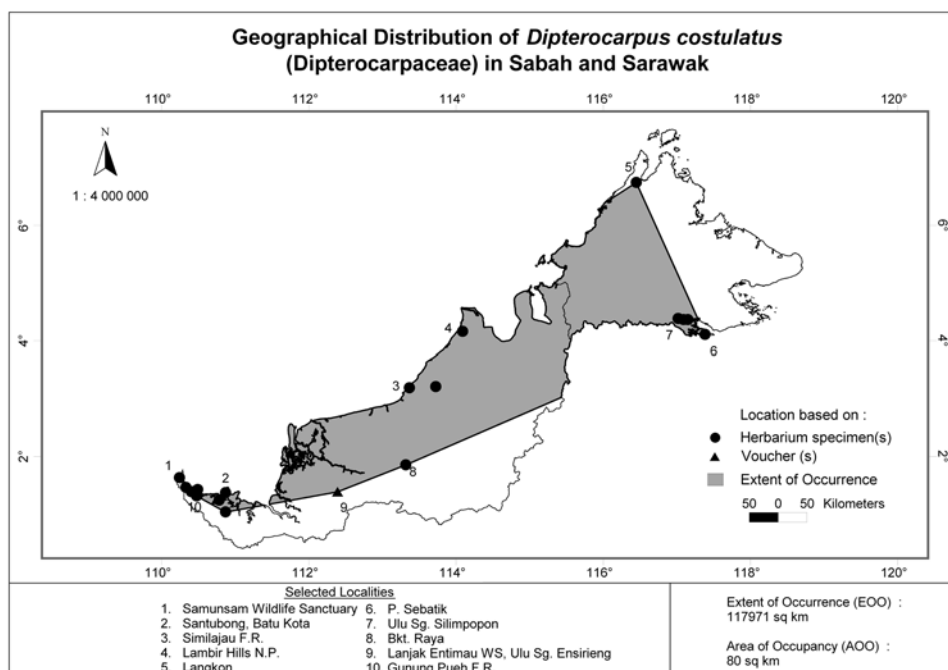
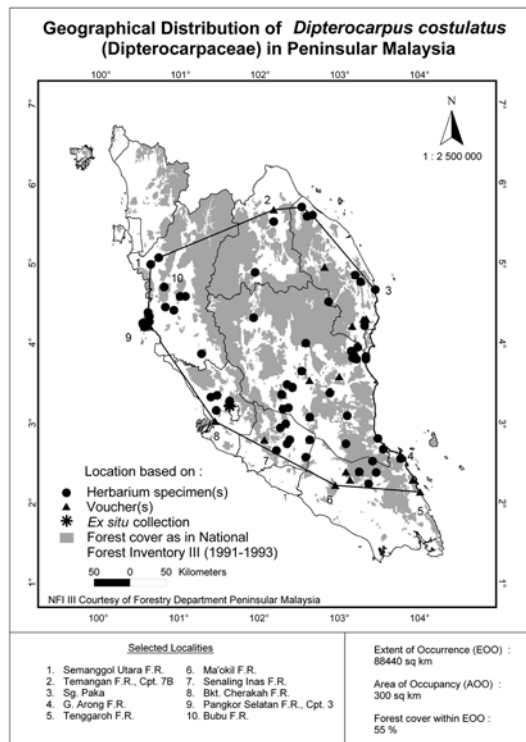
Sabah: Kota Marudu and Tawau. **Sarawak:** Bintulu, Lundu, Kuching, Kapit, Miri and Song.

Habitat: Lowland to hill forests to 600 m altitude. In Sabah and Sarawak found in occasionally flooded alluvium, kerangas forests, on sandy soils and shallow peat at altitudes below 200 m.

Conservation status: NT for Malaysia; LC for Peninsular Malaysia; NT for Sabah and Sarawak.

Conservation notes: It occurs in the network of Totally Protected Areas in Peninsular Malaysia and Sarawak. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 395,000 adult stems above 30 cm dbh in the Permanent Reserved Forests. In Pasoh FR, Negeri Sembilan, at least 626 trees above 1 cm diameter were recorded from a 50-ha research plot in 1985. 85.9% of this had diameters less than 5 cm.

Other assessments: CRA1cd+2cd, B1+2c (IUCN, 2010); EN, threats from land conversion (Symington, 2004); highly VU, threats from forest conversion (Ashton, 2004).



Dipterocarpus crinitus Dyer

Vernacular name: Peninsular Malaysia, Sabah and Sarawak: keruing mempelas.

Distribution: Sumatra, Peninsular Thailand, Peninsular Malaysia, Singapore and Borneo.

Peninsular Malaysia: Johor, Kelantan, Malacca, Negeri Sembilan, Pahang, Perak, Selangor and Terengganu. **Sabah:** Beaufort, Sipitang and Tawau.

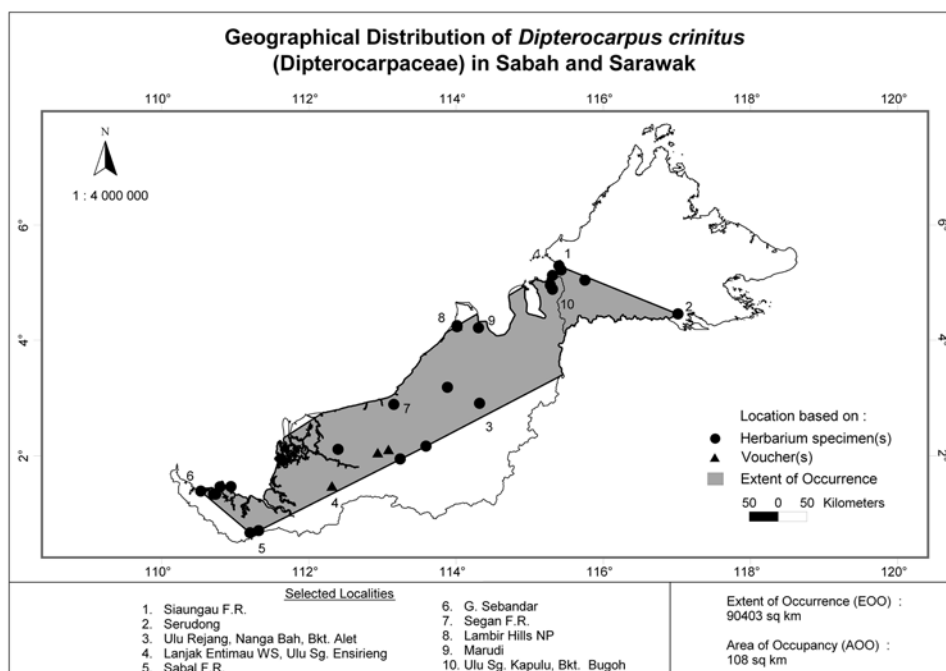
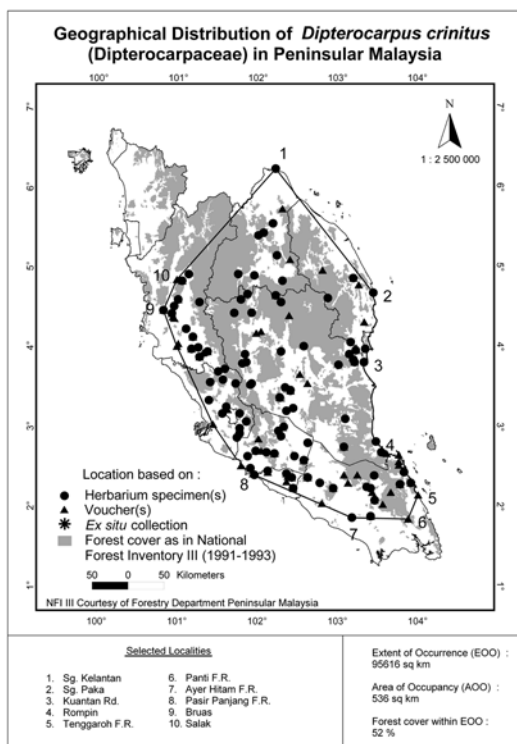
Sarawak: Bintulu, Kapit, Kuching, Lawas, Lundu, Marudi, Miri, Simunjan, Song and Tatau.

Habitat: Lowland and hill forests to 900 m altitude.

Conservation status: NT for Malaysia; LC for Peninsular Malaysia; NT for Sabah and Sarawak.

Conservation notes: It is well-represented in the Totally Protected Areas network. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 404,000 adult stems above 30 cm dbh in the Permanent Reserved Forests. Individuals are well distributed in two long-term research plots.

Other assessments: EN A1cd+2cd (IUCN, 2010); VU, threats from land conversion and logging (Symington, 2004); VU (Ashton, 2004).



Dipterocarpus dyeri Pierre

Vernacular name: Peninsular Malaysia: keruing etoi.

Distribution: Myanmar, Indo-China, Thailand and Peninsular Malaysia.

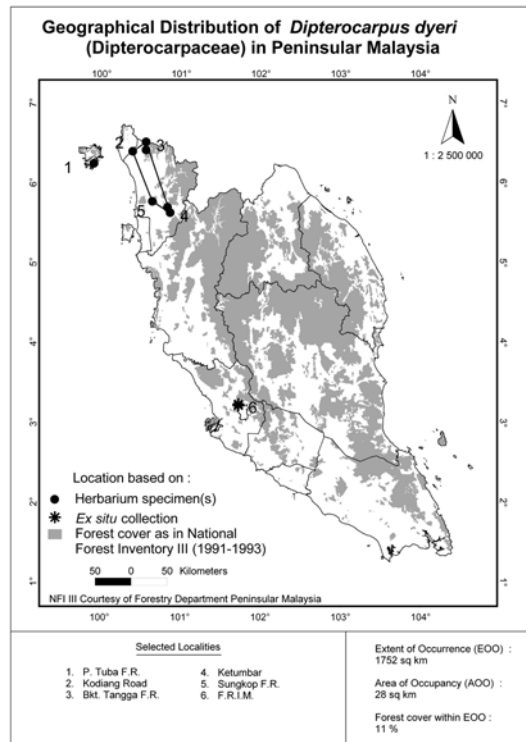
Peninsular Malaysia: Kedah.

Habitat: Seasonally dry tropical rain forests and regenerated logged-over forests.

Conservation status: EN B2b(iii)+c(ii) for Malaysia.

Conservation notes: The species may occur in the Protected Areas network.

Other assessments: CR A1cd+2cd, B1+2c (IUCN, 2010); CR (Symington, 2004).



Dipterocarpus elongatus Korth.

Vernacular name: Peninsular Malaysia and Sarawak: keruing latek.

Distribution: Sumatra, Peninsular Malaysia, Anambas Archipelago and Borneo.

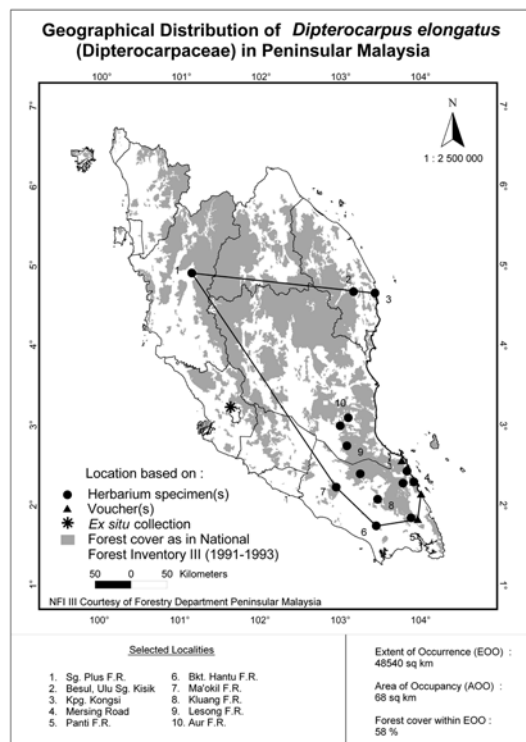
Peninsular Malaysia: Johor, Pahang, Perak and Terengganu. **Sabah:** Kinabatangan. **Sarawak:** Bintulu, Lawas, Miri and Tatau.

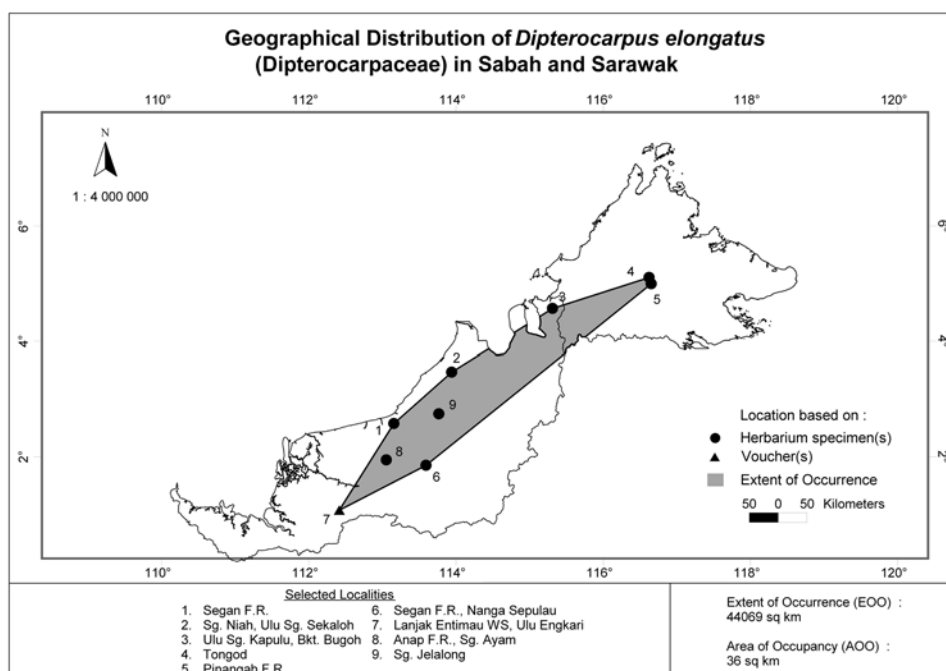
Habitat: Lowland forests sometimes on swampy ground and in floodplains at altitudes below 300 m.

Conservation status: VU A4c, B2ab(iii) for Malaysia; VU A4c for Peninsular Malaysia; VU B2ab(iii) for Sabah and Sarawak.

Conservation notes: It has not been found in the network of protected areas in Peninsular Malaysia. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 36,000 adult stems (above 30 cm dbh) in the Permanent Reserved Forests.

Other assessments: CR A1cd+2cd, B1+2c (IUCN, 2010); CR, threats from land conversion (Symington, 2004); CR (Ashton, 2004).





Dipterocarpus eurynchus Miq.

Vernacular name: Peninsular Malaysia and Sarawak: keruing baran.

Distribution: Sumatra, Peninsular Malaysia, Borneo (Sarawak and Brunei) and the Philippines.

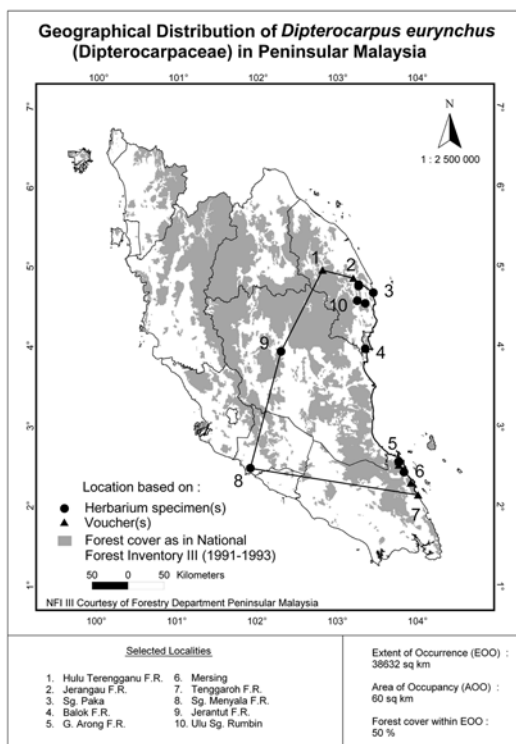
Peninsular Malaysia: Johor, Negeri Sembilan, Pahang and Terengganu; **Sarawak:** Kapit, Limbang, Miri, Song and Tatau.

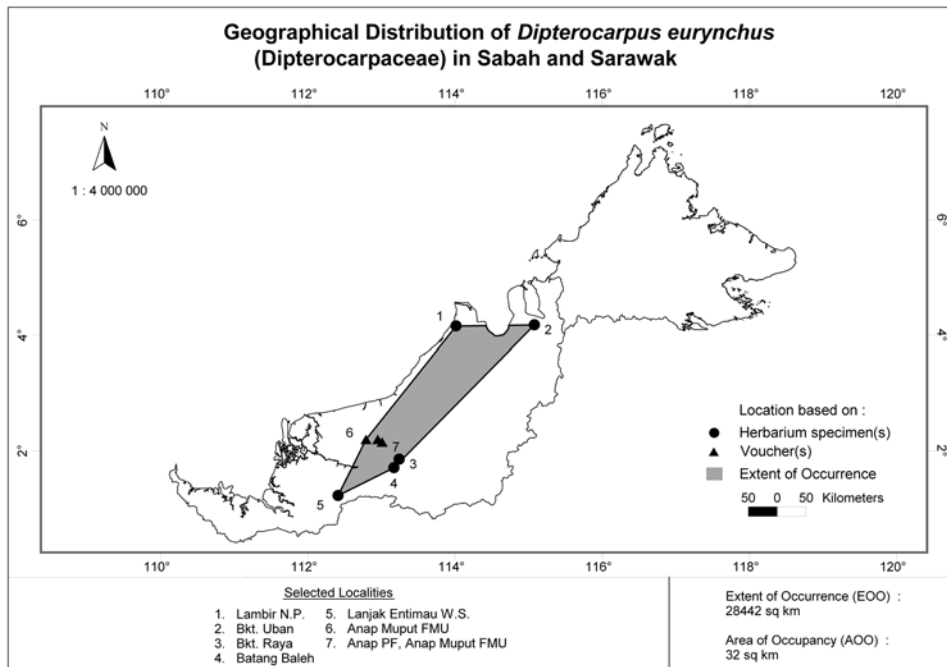
Habitat: Lowland to hill forests up to 1,000 m altitude.

Conservation status: VU A4c, B2ab(iii) for Malaysia; VU A4c for Peninsular Malaysia; VU B2ab(iii) for Sarawak.

Conservation notes: No populations are known to occur in the network of protected areas in Peninsular Malaysia.

Other assessments: CR A1cd+2cd, B1+2c (IUCN, 2010); CR, threats from land conversion and logging (Symington, 2004); VU (Ashton, 2004).





Dipterocarpus fagineus Vesque

Vernacular name: Peninsular Malaysia and Sarawak: keruing pipit.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sarawak).

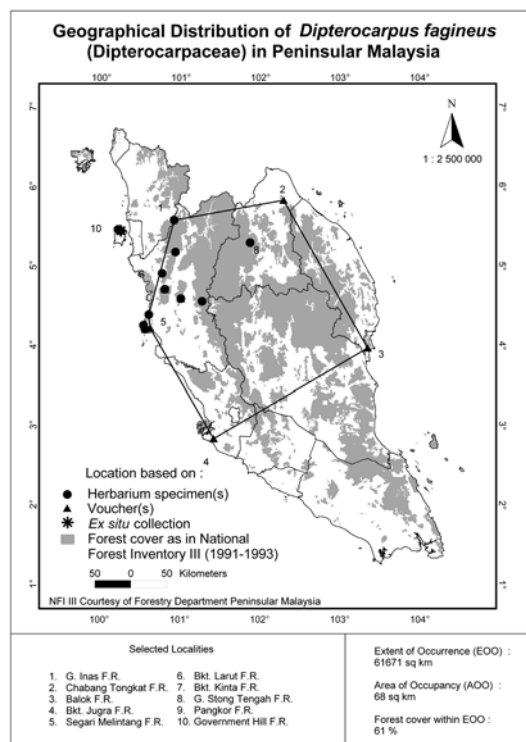
Peninsular Malaysia: Kedah, Kelantan, Pahang, Penang, Perak and Selangor. **Sarawak:** Belaga, Kapit, Marudi and Simunjan.

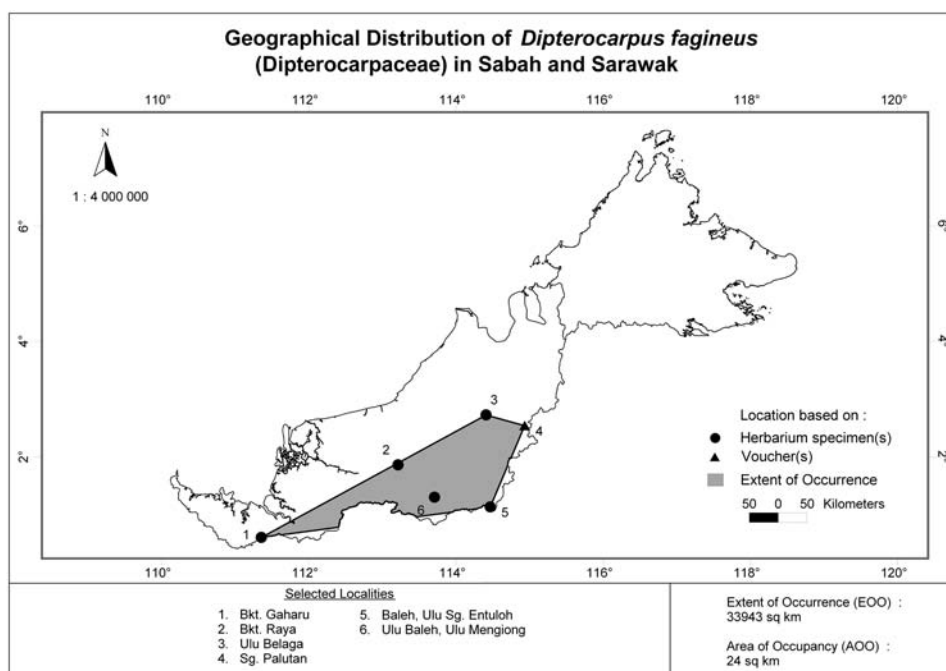
Habitat: Hill and coastal hill forests between 200 to 1,000 m altitude.

Conservation status: VU B2b(iii)+c(i) for Malaysia; VU B2b(iii)+c(i) for Peninsular Malaysia; DD for Sarawak.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 32,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: CR A1cd+2cd (IUCN, 2010); VU, threats from land conversion and logging (Symington, 2004).





Dipterocarpus gracilis Blume

Plates 4A–B

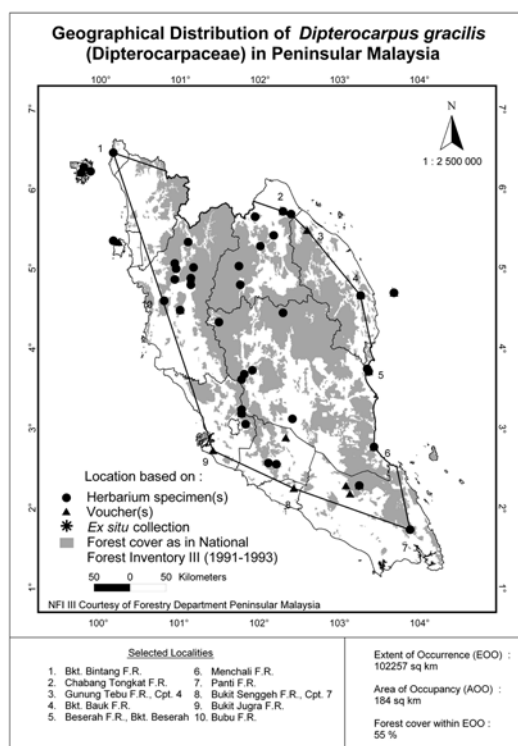
Vernacular name: Peninsular Malaysia, Sabah and Sarawak: keruing kesat.

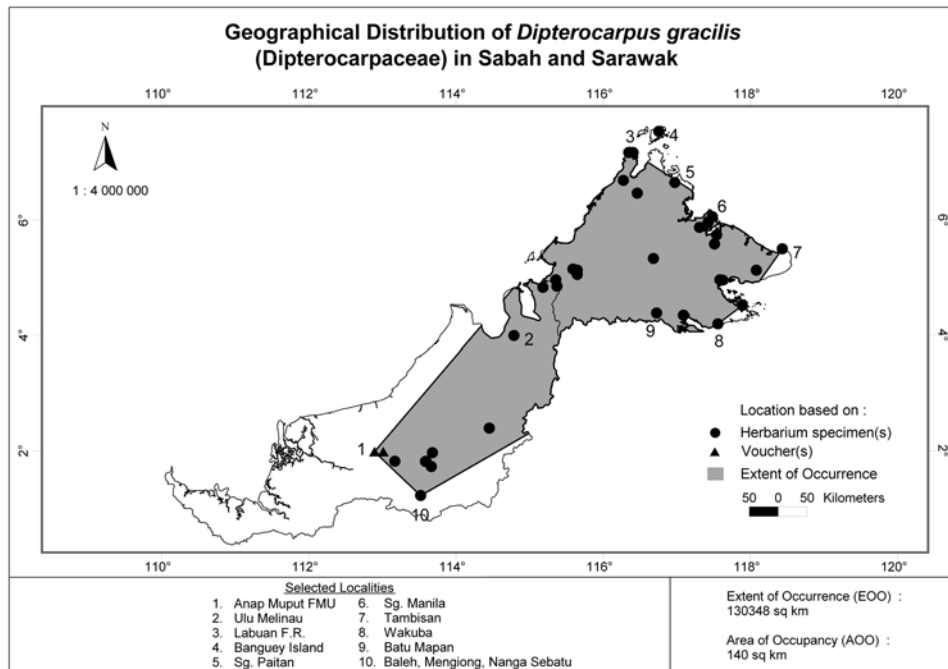
Distribution: Andaman, Bangladesh, Myanmar, Thailand, Peninsular Malaysia, Sumatra, Java, Borneo and the Philippines.

Peninsular Malaysia: Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Penang, Perak, Perlis, Selangor and Terengganu. **Sabah:** Beaufort, Keningau, Kinabatangan, Kota Marudu, Kudat, Lahad Datu, Sandakan, Semporna, Sipitang, Tawau and Tenom. **Sarawak:** Belaga, Kapit, Lawas, Limbang and Marudi.

Habitat: The species occurs over a wide altitudinal range in valleys, hill slopes and ridges from lowland to hill forests up to 800 m altitude, also found in seasonally dry tropical rain forests.

Conservation status: NT for Malaysia; LC for Peninsular Malaysia; NT for Sabah and Sarawak. Other assessments: CR A1cd+2cd (IUCN, 2010); EN, threats from logging and land conversion (Symington, 2004); probably EN (Ashton, 2004).





Dipterocarpus grandiflorus (Blanco) Blanco

Vernacular name: Peninsular Malaysia and Sabah: keruing belimbing.

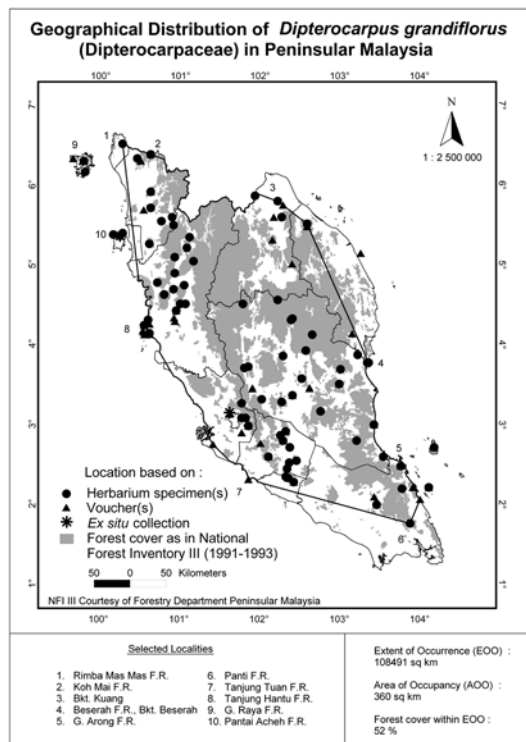
Distribution: Andamans, Myanmar, Thailand, Vietnam, Sumatra, Peninsular Malaysia, Borneo (Sabah) and the Philippines.

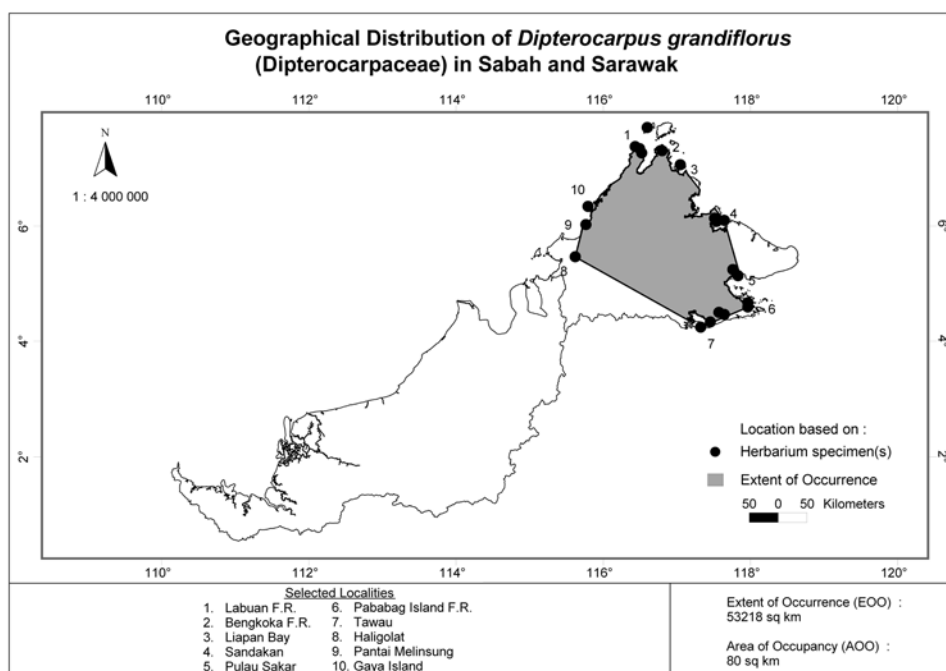
Peninsular Malaysia: Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Penang, Perak, Perlis, Selangor and Terengganu. **Sabah:** Beaufort, Kota Kinabalu, Kudat, Lahad Datu, Papar, Sandakan, Semporna and Tawau.

Habitat: Lowland to hill forests between 50–650 m altitude with a preference for ridges in hilly areas.

Conservation status: NT for Malaysia; LC for Peninsular Malaysia; NT for Sabah.

Conservation notes: In Sabah, the species is widespread and occurs in many protected Forest Reserves. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 1.4 million adult stems above 30 cm dbh in the Permanent Reserved Forests. Other assessments: CR A1cd+2cd (IUCN, 2010); VU, threats from logging and land conversion (Symington, 2004); VU (Ashton, 2004).





Dipterocarpus hasseltii Blume

Vernacular names: Peninsular Malaysia: keruing ropol; Sabah: keruing kerukup kecil.

Distribution: Peninsular Thailand, Peninsular Malaysia, Sumatra, Java, Nusa Tenggara, Borneo (Sabah and Kalimantan) and the Philippines.

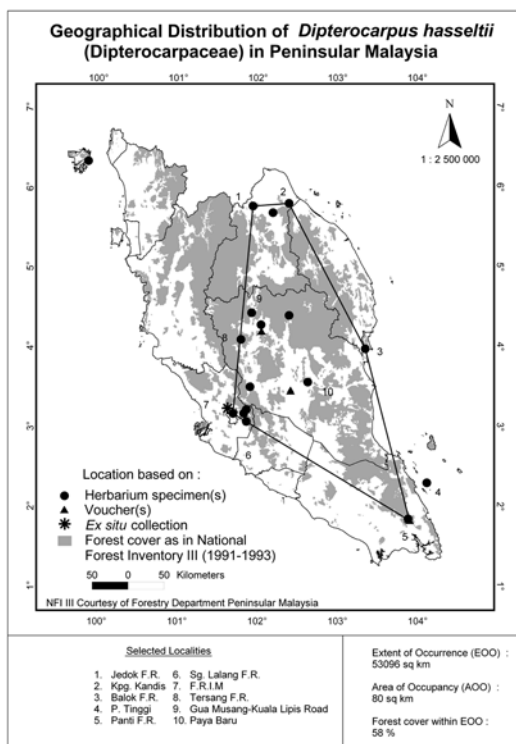
Peninsular Malaysia: Johor, Kedah, Kelantan, Pahang and Selangor. **Sabah:** Kinabatangan, Lahad Datu, Sandakan, Semporna and Tawau.

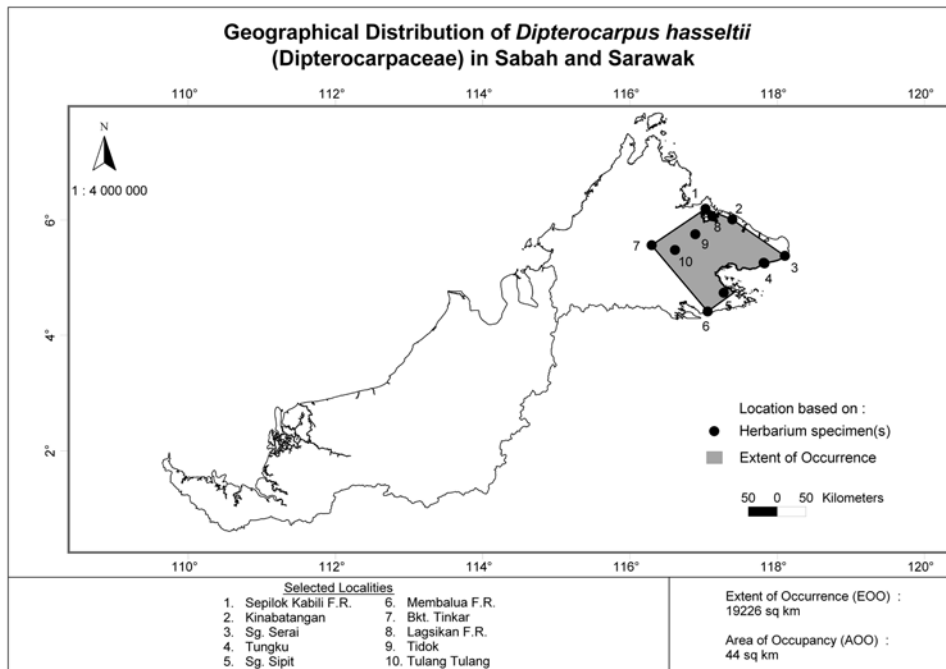
Habitat: Lowland to hill forests in the vicinity of streams, on lower slopes of hills and moist valleys up to elevation over 600 m.

Conservation status: VU B2b(iii)+c(iii) for Malaysia.

Conservation notes: It occurs in Taman Negara National Park, Peninsular Malaysia and Sepilok Kabili FR, Sabah.

Other assessments: CR A1cd+2cd (IUCN, 2010); at risk from land conversion (Symington, 2004); CR, threats from forest conversion (Ashton, 2004).





Dipterocarpus kerrii King

Vernacular name: Peninsular Malaysia and Sabah: keruing gondol.

Distribution: Andamans, Myanmar, Thailand, Sumatra, Peninsular Malaysia, Borneo (Sabah) and the Philippines.

Peninsular Malaysia: Johor, Kedah, Malacca, Negeri Sembilan, Pahang, Perak and Selangor.

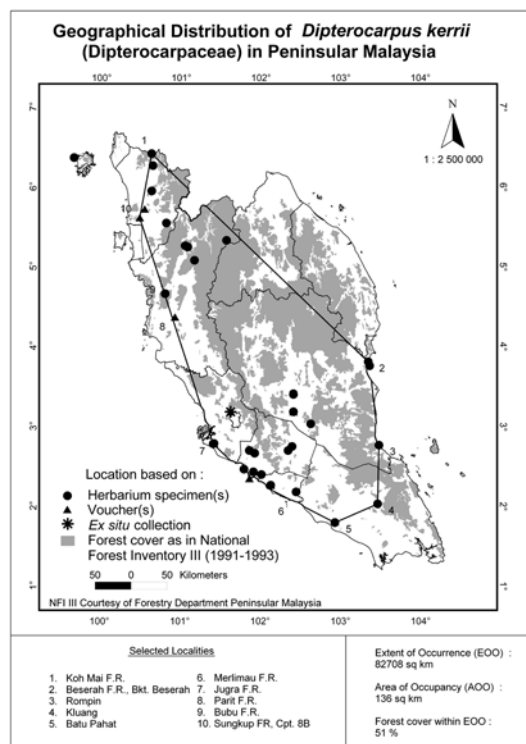
Sabah: Beaufort, Beluran, Kinabatangan, Sandakan and Tawau.

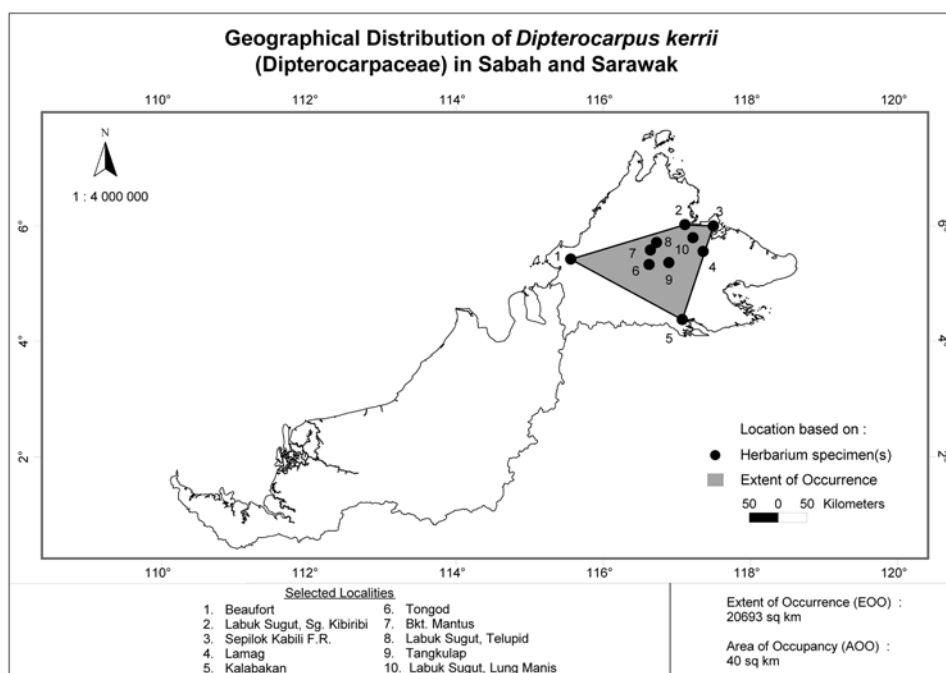
Habitat: Lowland forests including seasonally dry tropical rain forests, locally common near coasts and on flat land and hills to 400 m altitude.

Conservation status: VUB2b(iii)+c(ii) for Malaysia; NT for Peninsular Malaysia; VU B2b(iii)+c(ii) for Sabah.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 224,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: CR A1cd+2cd, B1+2c (IUCN, 2010); CR, threats from forest conversion (Symington, 2004); highly VU, possibly EN (Ashton, 2004).





Dipterocarpus kunstleri King

Plates 4C–D

Vernacular names: Peninsular Malaysia: keruing gombang merah; Sabah: keruing rapak; Sarawak: keruing kuntum putih.

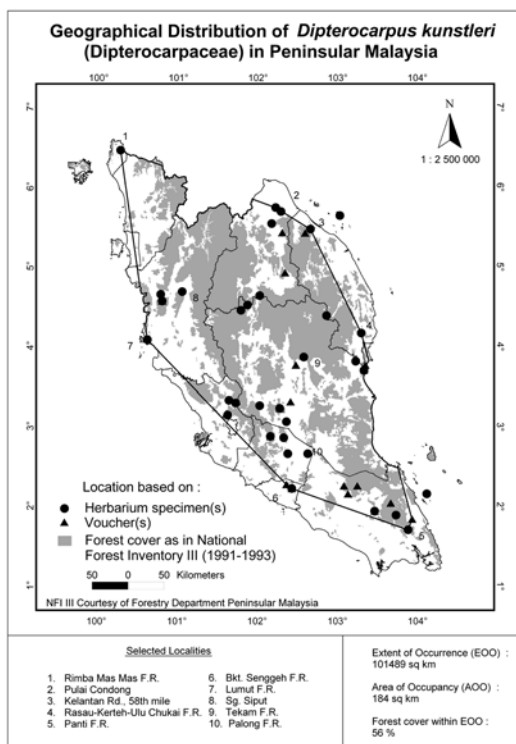
Distribution: Sumatra, Peninsular Malaysia, Borneo and the Philippines.

Peninsular Malaysia: Johor, Kelantan, Malacca, Negeri Sembilan, Pahang, Perak, Perlis, Selangor and Terengganu. **Sabah:** Kinabatangan, Kota Marudu, Lahad Datu, Lamag, Nabawan, Papar, Ranau, Sandakan, Sipitang and Tawau. **Sarawak:** Kapit, Lundu, Lubok Antu, Marudi and Miri.

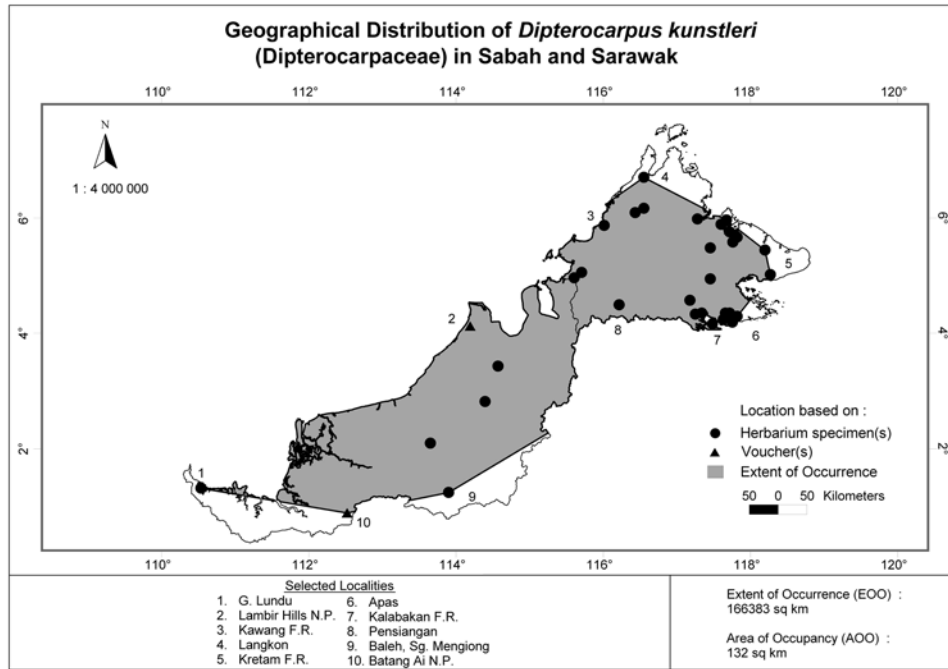
Habitat: Lowland forests below 400 m altitude.

Conservation status: NT for Malaysia; LC for Peninsular Malaysia; NT for Sabah and Sarawak.

Conservation notes: It occurs in the network of Totally Protected Areas. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 567,000 stems above 30 cm dbh in the Permanent Reserved Forests. At least 75 trees above 1 cm diameter were recorded from Pasoh 50-ha plot in 1985; 74.6% had diameters less than 5 cm. In 1991, at least 87 trees above 1 cm diameter were recorded from Lambir Hills 52-ha plot with 72.4% having diameters less than 5 cm.



Other assessments: CR A1cd+2cd (IUCN, 2010); EN, threats from land conversion (Symington, 2004); highly VU (Ashton, 2004).



Dipterocarpus lowii Hook.f.

Fig. 3, Plates 5A–B

Vernacular name: Peninsular Malaysia, Sabah and Sarawak: keruing sol.

Distribution: Sumatra, Peninsular Malaysia and Borneo.

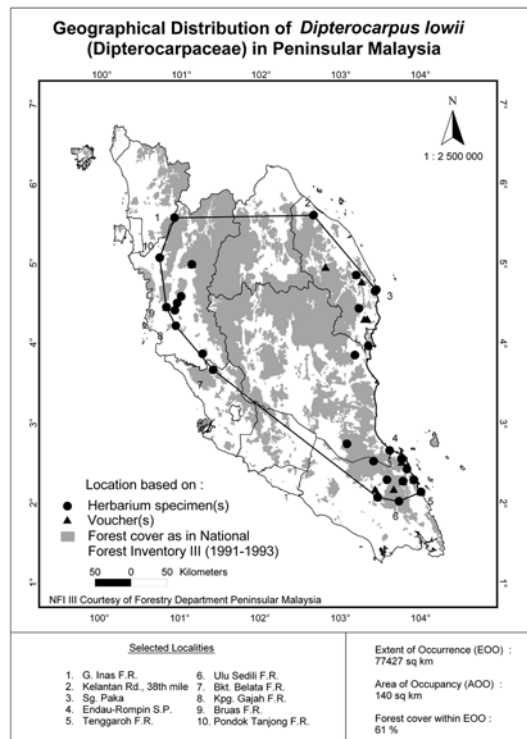
Peninsular Malaysia: Johor, Kedah, Pahang, Perak, Selangor and Terengganu. **Sabah:** Beaufort, Beluran, Lahad Datu, Sipitang and Tawau. **Sarawak:** Bintulu, Kuching, Lawas, Limbang, Lundu and Tatau.

Habitat: Lowland forests on undulating land and ridges up to 450 m altitude.

Conservation status: NT for Malaysia; LC for Peninsular Malaysia; NT for Sabah and Sarawak.

Conservation notes: The species occurs within the network of Totally Protected Areas. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 309,000 stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: CR A1cd+2cd, B1+2c (IUCN, 2010); CR, threats from land conversion (Symington, 2004); VU (Ashton, 2004).



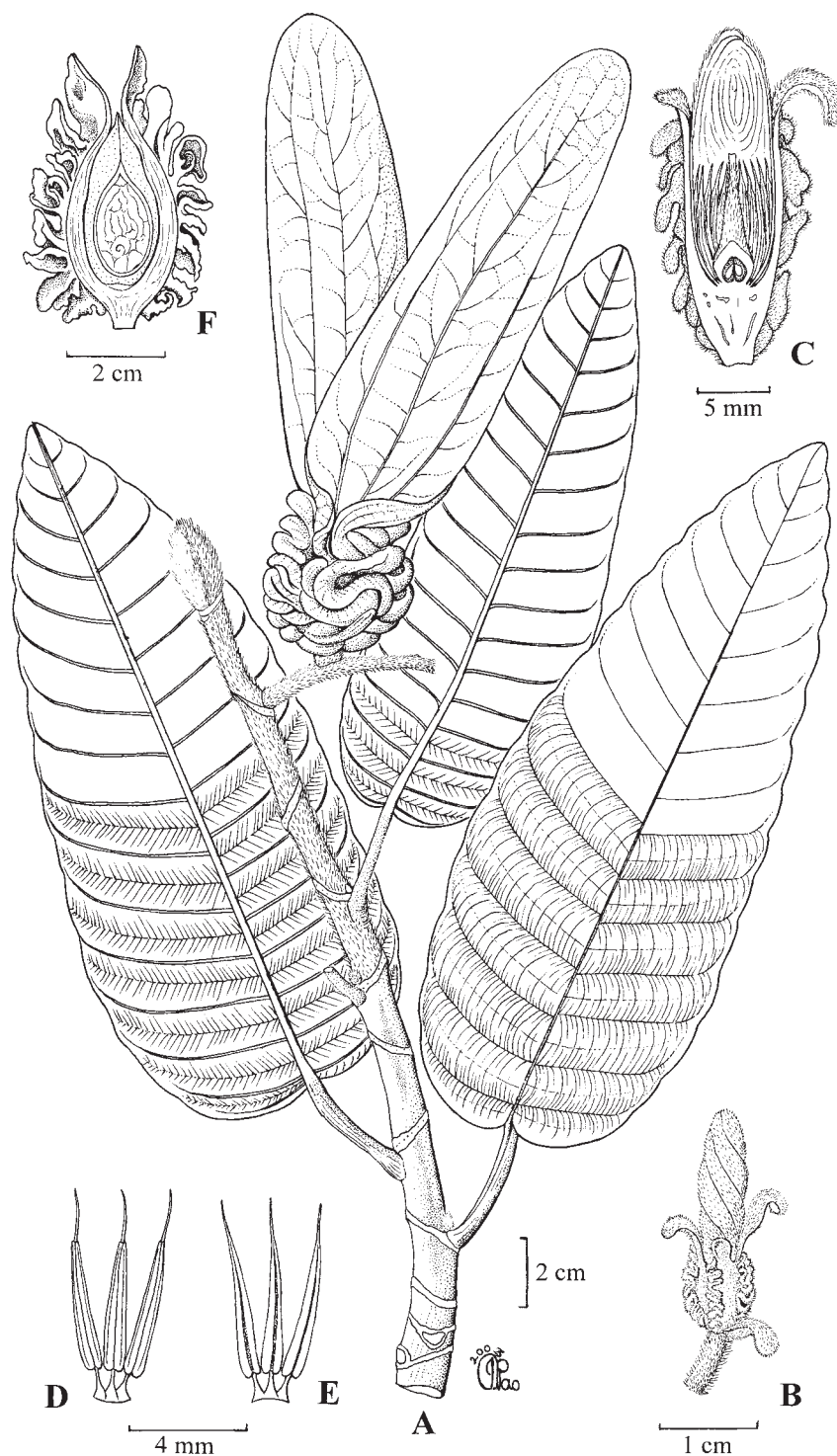
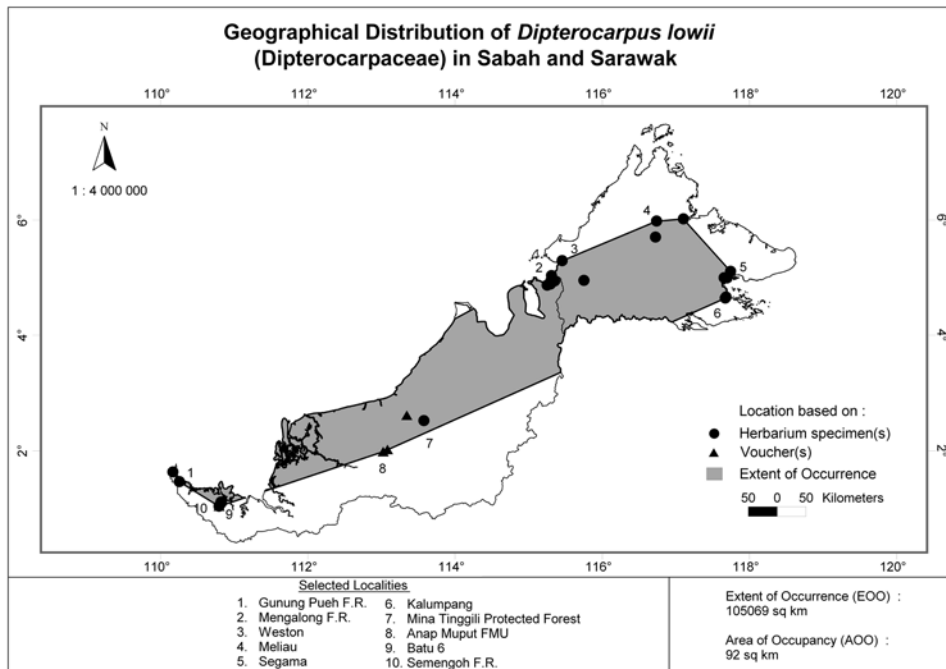


Fig. 3. *Dipterocarpus lowii*. A, fruiting leafy twig; B, flower bud; C, longitudinal section of flower bud; D, adaxial view of stamens; E, abaxial view of stamens; F, longitudinal section of fruit (A from SAN 40611, B–E from S 10068, F from S 1826) (Reproduced with permission from the Tree Flora of Sabah and Sarawak project).



Dipterocarpus oblongifolius Blume

Plates 5C–E

Vernacular names: Peninsular Malaysia and Sabah: keruing neram; Sarawak: ensurai.

Distribution: Peninsular Thailand, Peninsular Malaysia and Borneo.

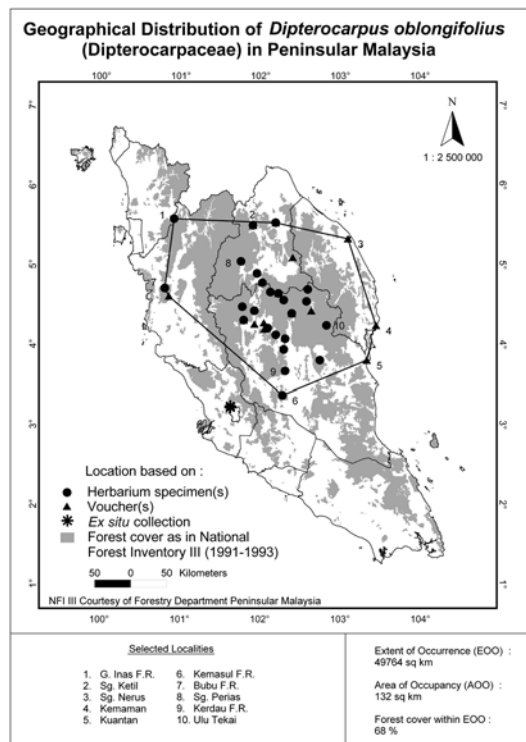
Peninsular Malaysia: Kedah, Kelantan, Pahang, Perak and Terengganu. **Sabah:** Beaufort, Beluran, Keningau, Kinabatangan, Penampang, Ranau, Sandakan, Sipitang, Tawau and Tenom. **Sarawak:** Belaga, Betong, Bintulu, Kapit, Limbang, Marudi, Miri, Song, Sri Aman and Tatau.

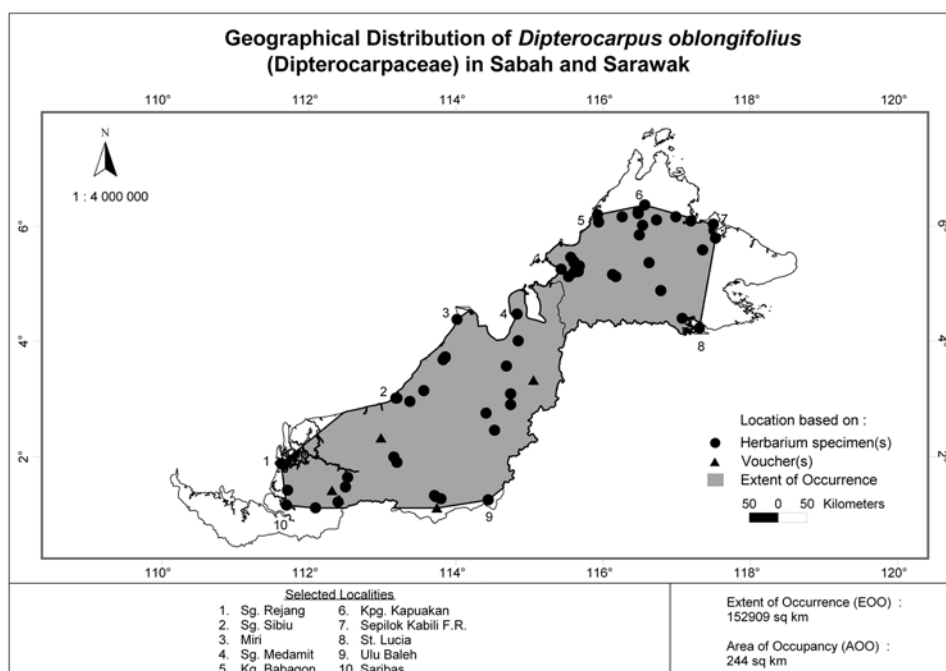
Habitat: Lowland forest along banks of rivers beyond the tidal reaches at altitudes to 400 m.

Conservation status: LC for Malaysia.

Conservation notes: The species occurs in the network of Totally Protected Areas. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 45,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: LR/lc (IUCN, 2010); VU, threats from habitat fragmentation (Symington, 2004); not VU (Ashton, 2004).





***Dipterocarpus obtusifolius* Teysmann ex Miq. var. *subnudus* Ryan et Kerr**

Vernacular name: Peninsular Malaysia: keruing beludu.

Distribution: Myanmar, Thailand, Indo-China and Peninsular Malaysia.

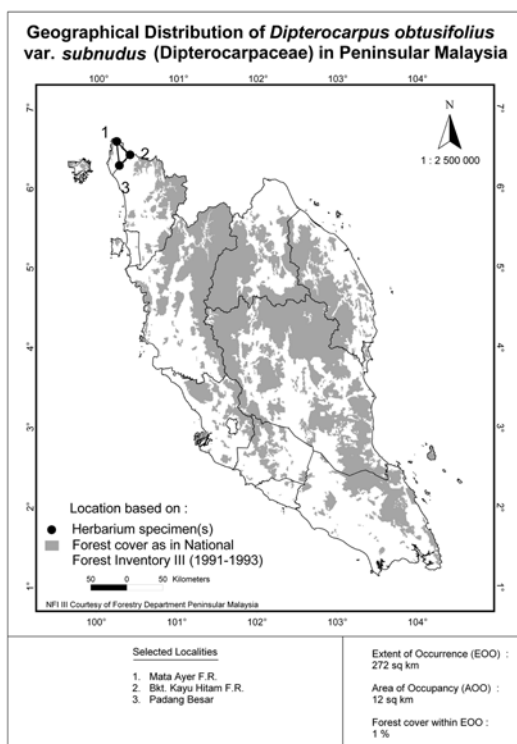
Peninsular Malaysia: Kedah and Perlis.

Habitat: Seasonally dry tropical rain forests in *Schima*-bamboo forests.

Conservation status: EN B2ab(iii) for Malaysia.

Conservation notes: The population in Mata Ayer FR is in a Virgin Jungle Reserve.

Other assessments: LR/lc (IUCN, 2010); may now be EX (Symington, 2004).



Dipterocarpus palembanicus Slooten ssp. *palembanicus*

Vernacular name: Peninsular Malaysia: keruing ternek.

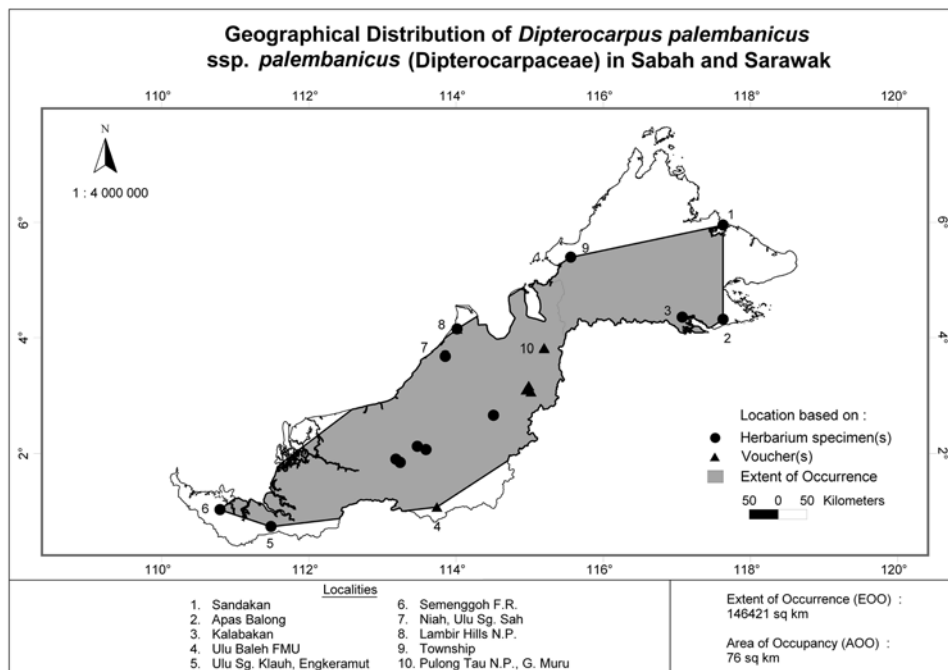
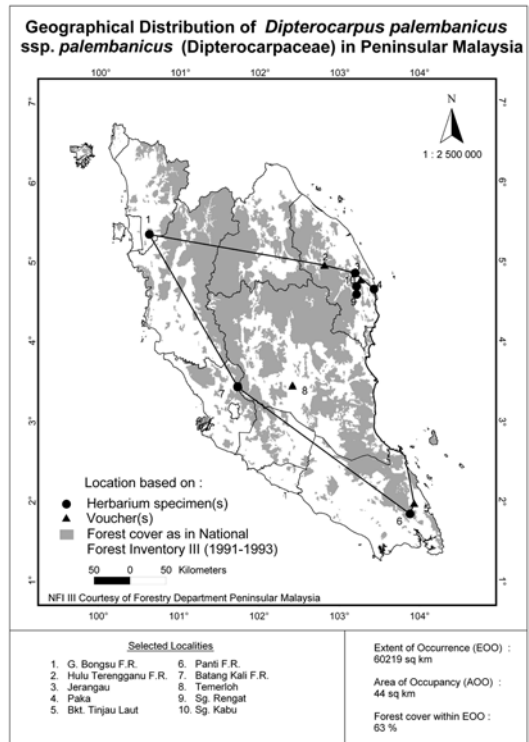
Distribution: Sumatra, Peninsular Thailand, Peninsular Malaysia, Singapore and Borneo (Sarawak).

Peninsular Malaysia: Johor, Kedah, Pahang, Selangor and Terengganu. **Sabah:** Beaufort, Sandakan and Tawau. **Sarawak:** Bintulu, Kuching, Kapit, Marudi, Miri and Sri Aman.

Habitat: Lowland to hill forests, often in the vicinity of streams and along ridges to 600 m altitude.

Conservation status: VU A4c, B2b(iii)+c(ii) for Malaysia; VU A4c for Peninsular Malaysia; VU B2b(iii)+c(ii) for Sabah and Sarawak.

Conservation notes: The species is reported absent from Sabah (Ashton, 2004); there are however collections from Beaufort, Sandakan and Tawau. In Sarawak, it is represented in the Totally Protected Areas network. Information on the habitat status for certain localities in Peninsular Malaysia is required. Other assessments: CR, threats from land conversion (Symington, 2004); VU (Ashton, 2004).



Dipterocarpus perakensis P.S.Ashton

Plate 6A

Distribution: Peninsular Malaysia.

Peninsular Malaysia: Penang and Perak.

Habitat: Coastal hill dipterocarp forests.

Conservation status: DD for Malaysia.

Conservation notes: There are difficulties in locating mature trees during searches and this is due to the lack of distinctive vegetative character, rarity and scattered distribution. The species is not selectively logged because of its restricted distribution. However the close vegetative resemblance to *Dipterocarpus fagineus* may result in trees being wrongly identified and hence become targets for harvesting. No populations are known to occur in the network of Protected Areas.

Other assessments: CR A1cd+2cd, B1+2c, C1, D (IUCN, 2010); CR, threats from land conversion (Symington, 2004).

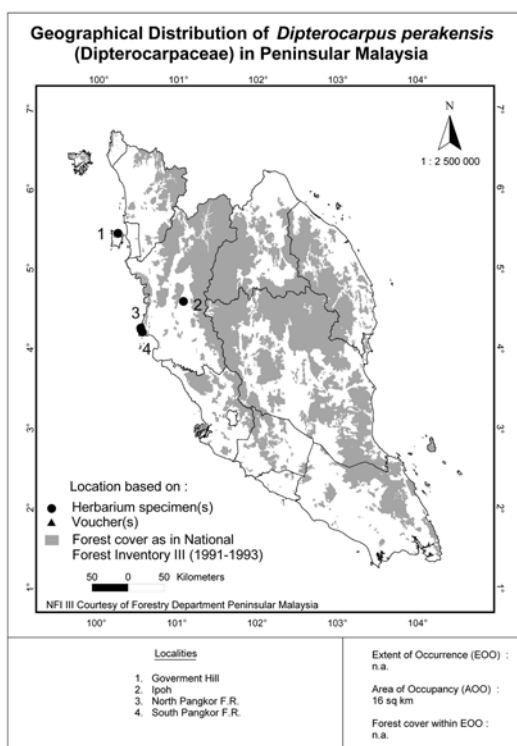
*Dipterocarpus retusus* Blume

Plate 6B

Vernacular name: Peninsular Malaysia: keruing gunung.

Distribution: Assam, Myanmar, Thailand, Peninsular Malaysia, Sumatra, Java and Lesser Sunda Islands.

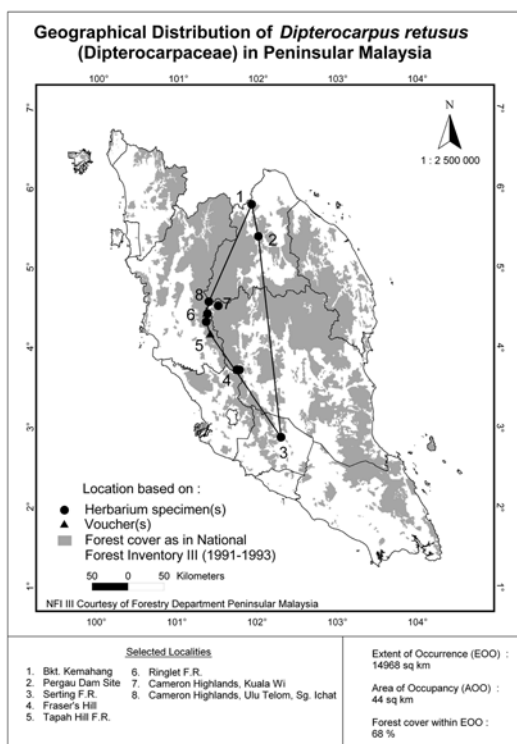
Peninsular Malaysia: Kelantan, Negeri Sembilan, Pahang and Perak.

Habitat: Upper hill to montane oak forests between 800 to 1,300 m altitude.

Conservation status: LC for Malaysia.

Conservation notes: All forests above 1,000 m altitude are categorised under the Land Capability Classification System.

Other assessments: VU A1cd+2cd, B1+2c (IUCN, 2010); VU, threats from highland development (Symington, 2004).



Dipterocarpus rigidus Ridl.

Vernacular names: Peninsular Malaysia: keruing cogan; Sarawak: keruing utap.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sarawak and Kalimantan).

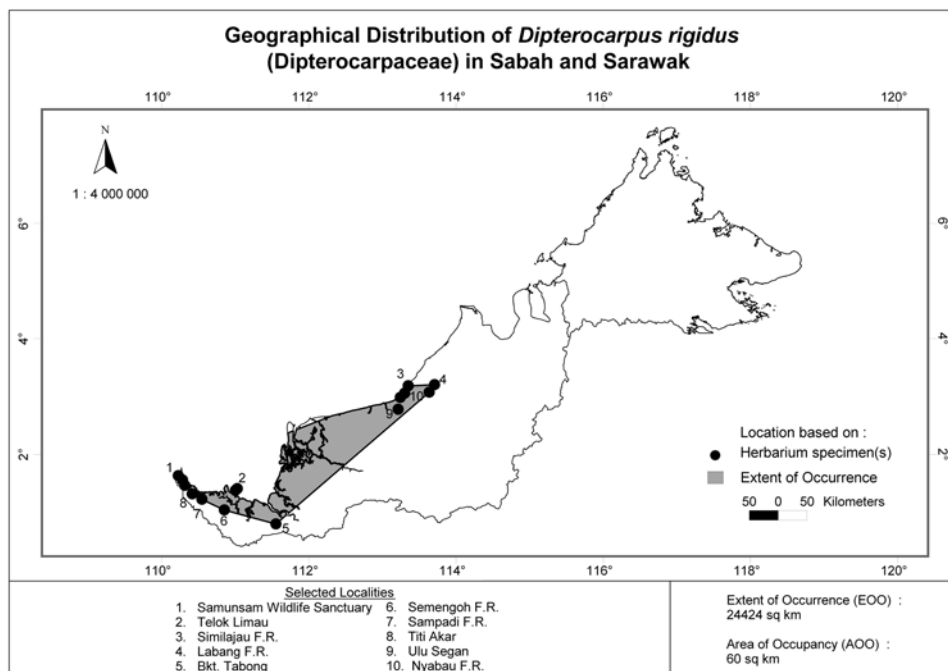
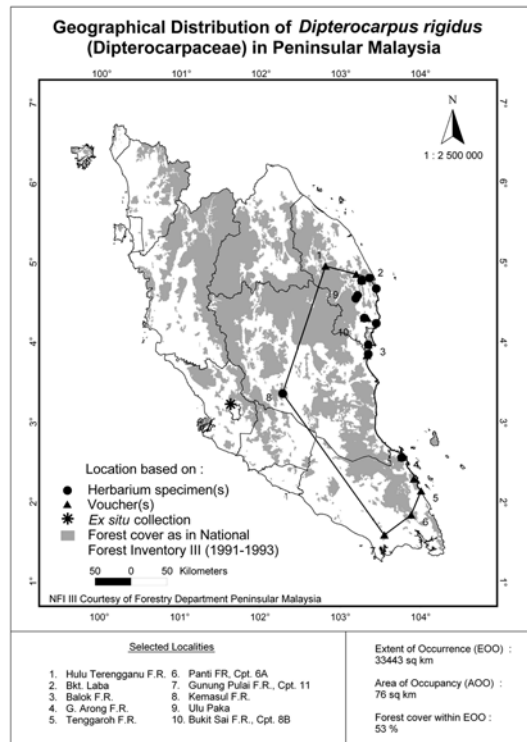
Peninsular Malaysia: Johor, Pahang and Terengganu. **Sarawak:** Bintulu, Kuching, Lundu and Sri Aman.

Habitat: Lowland to hill forests and on low hills not far from coasts.

Conservation status: EN B2b(iii)+c(ii) for Malaysia; EN B2b(iii)+c(ii) for Peninsular Malaysia; VU B2b(iii)+c(ii) for Sarawak.

Conservation notes: Populations in Sarawak are found in the network of Totally Protected Areas. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 11,000 adult stems (above 30 cm dbh) in the Permanent Reserved Forests.

Other assessments: CR A1cd+2cd, B1+2c (IUCN, 2010); EN, threats from logging and land conversion (Symington, 2004); EN, threats from forest conversion (Ashton, 2004).



Dipterocarpus rotundifolius Foxw.

Plates 6C–F

Vernacular name: Peninsular Malaysia: keruing mengkai.

Distribution: Peninsular Malaysia.

Peninsular Malaysia: Johor, Pahang and Perak.

Habitat: Coastal hill forests.

Conservation status: EN B2ab(iii) for Malaysia.

Conservation notes: Although its extent of occurrence is greater than 20,000 sq. km., the area of occupancy is much smaller as the species is restricted to the coastal hill forests. In Peninsular Malaysia, the extent of this habitat type is small. The population in Sg. Bantang, Labis FR lies in an amenity forest.

Other assessments: CR A1cd+2cd, B1+2c (IUCN, 2010); CR, threats from land conversion and logging (Symington, 2004).

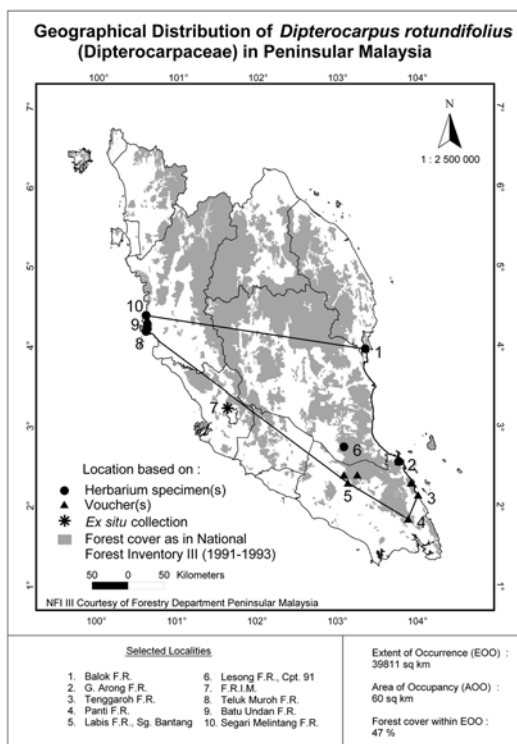
*Dipterocarpus sarawakensis* F.G. Browne ex Slooten

Fig. 4, Plates 7A–E

Vernacular name: Sarawak: keruing layang.

Distribution: Peninsular Malaysia and Borneo (Sarawak, Brunei and Kalimantan).

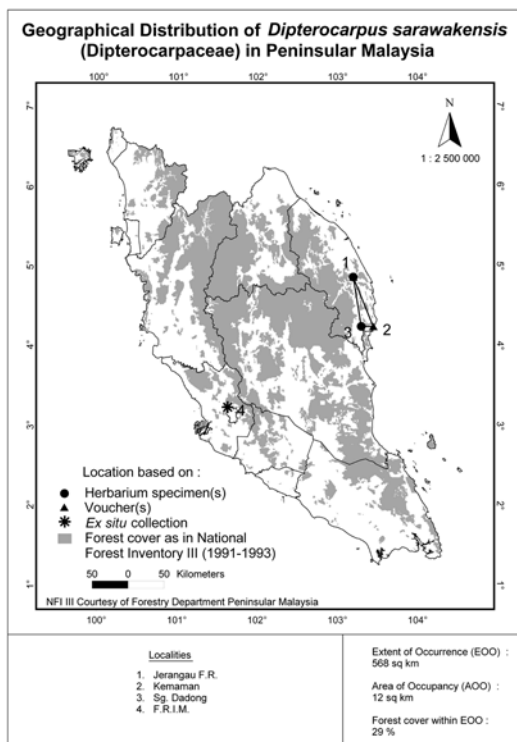
Peninsular Malaysia: Terengganu. **Sarawak:** Bintulu, Kuching, Lundu, Mukah and Tatau.

Habitat: Lowland forests at altitudes to 400 m.

Conservation status: CR A4c for Malaysia; CR A4c for Peninsular Malaysia; LC for Sarawak.

Conservation notes: In Sarawak, populations occur in the Bako National Park. In Peninsular Malaysia, to date, 113 trees have been located in Jerangau FR (Terengganu) comprising 63 trees in Compartment 45 (c. 164 ha) and 50 trees in Compartments 31 and 34 (combined area of c. 437 ha). The population in Compartment 31, Jerangau FR is now in a Genetic Resource Area.

Other assessments: possibly EX (Symington, 2004); VU, perhaps EN (Ashton, 2004).



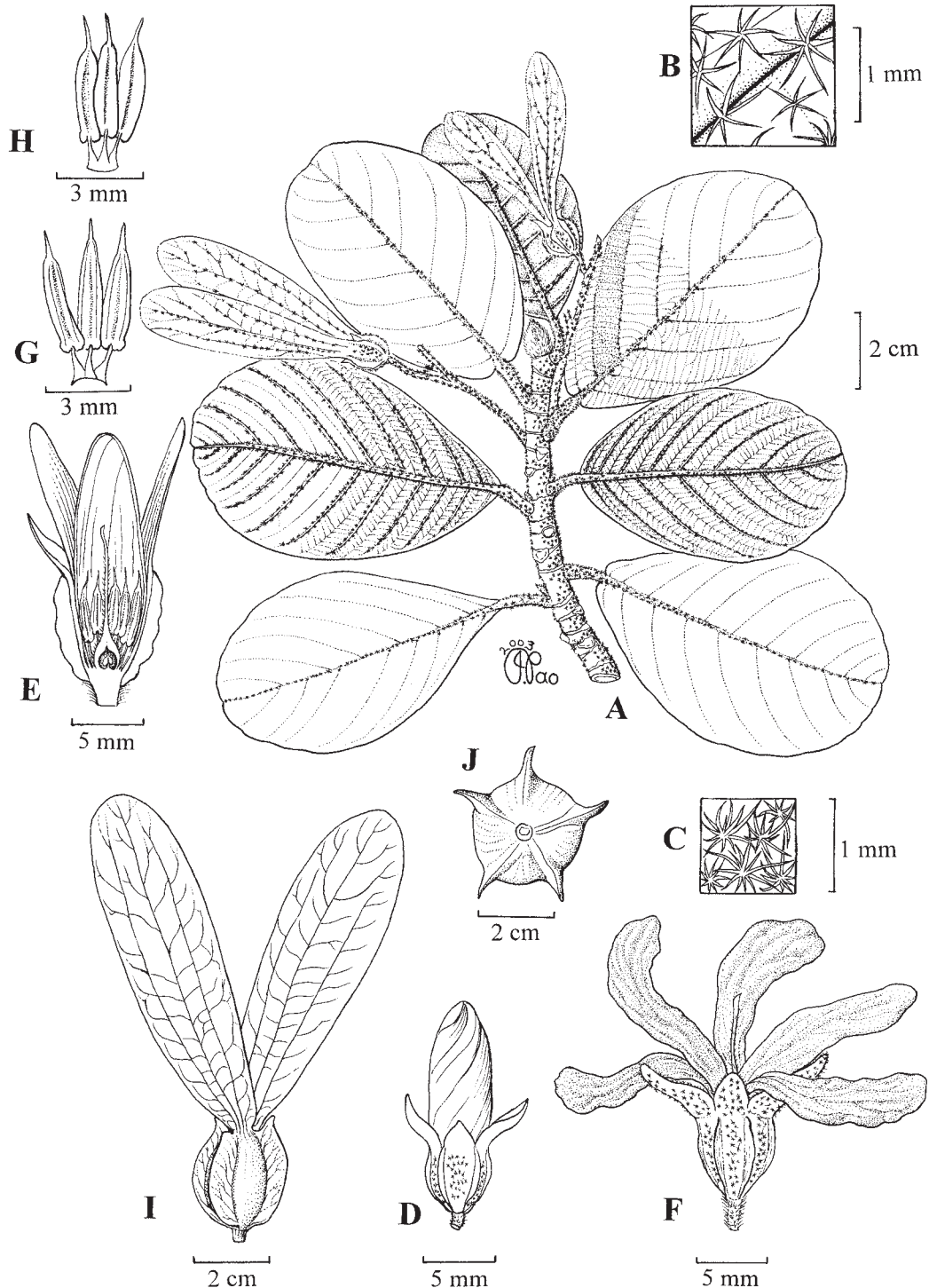
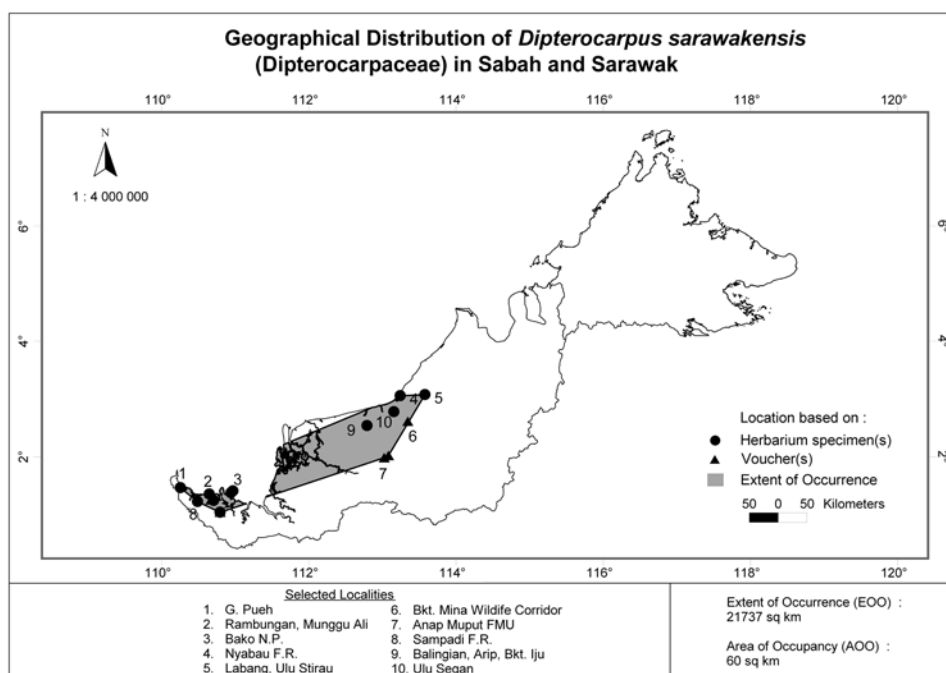


Fig. 4. *Dipterocarpus sarawakensis*. A, fruiting (young) leafy twig; B, detail of indumentum on lower leaf surface; C, indumentum on leaf bud, inflorescence and young fruit; D, flower bud; E, longitudinal section of flower bud; F, open flower; G, adaxial view of stamens; H, abaxial view of stamens; I, mature fruit; J, basal view of mature fruit calyx tube (A–C from SA 1288, D–H from S 23749, I–J from BRUN 5154) (Reproduced with permission from the Tree Flora of Sabah and Sarawak project).



Dipterocarpus semivestitus Slooten

Plates 8A–D

Vernacular name: Peninsular Malaysia: keruing padi.

Distribution: Peninsular Malaysia and Borneo (Kalimantan).

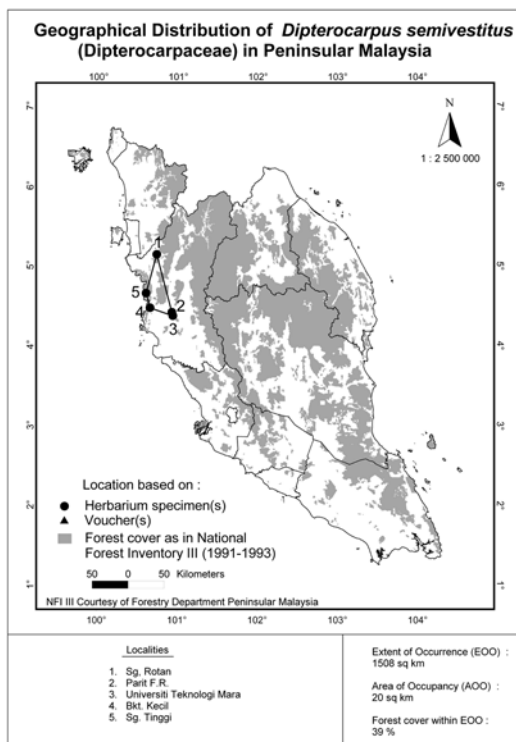
Peninsular Malaysia: Perak.

Habitat: Low-lying sometimes swampy grounds.

Conservation status: CR A4bc, C1 for Malaysia.

Conservation notes: Only one population has been discovered so far in the peninsula. To date, 53 trees have been located in a 55-ha swamp forest at Universiti Teknologi MARA campus at Seri Iskandar (Perak). Conservation efforts have been initiated by the University.

Other assessments: CR A1cd+2cd, B1+2c, C1, D (IUCN, 2010); possibly EX (Symington, 2004).



Dipterocarpus sublamellatus Foxw.

Vernacular name: Peninsular Malaysia, Sabah and Sarawak: keruing kerut.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sabah, Sarawak and Kalimantan).

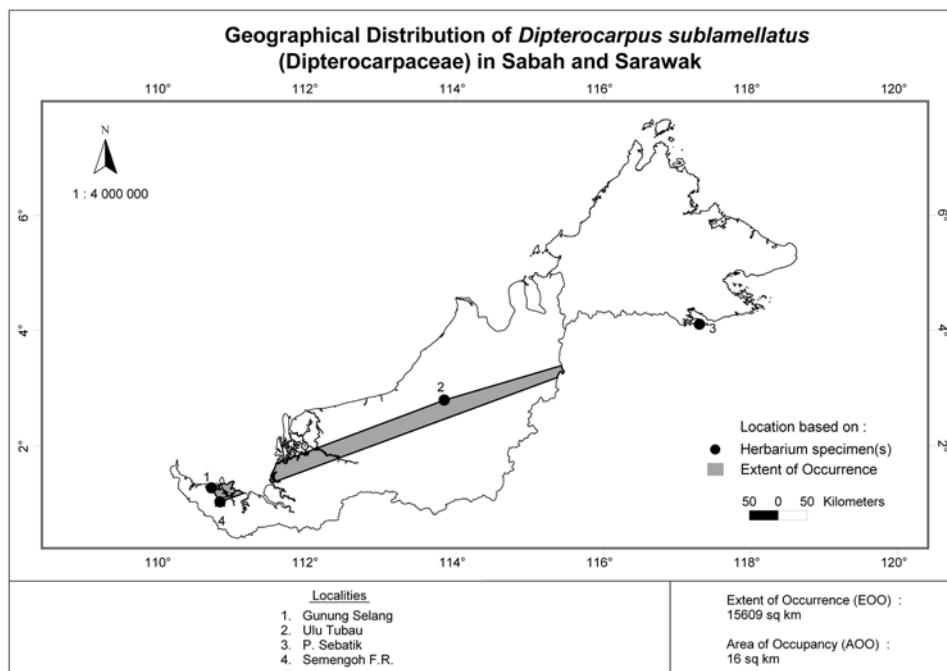
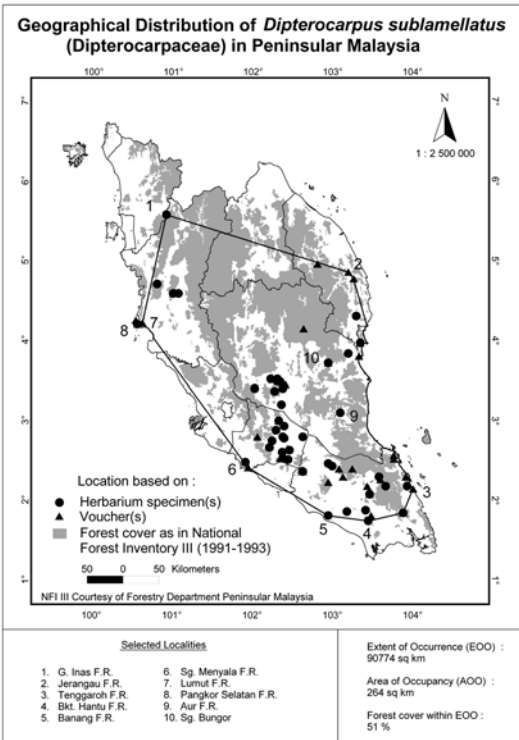
Peninsular Malaysia: Johor, Kedah, Negeri Sembilan, Pahang, Perak and Terengganu. **Sabah:** Tawau. **Sarawak:** Bintulu and Kuching.

Habitat: In Peninsular Malaysia, it occurs on undulating, well-drained land up 400 m altitude. In Sabah and Sarawak, it is found on low hills but mostly on periodically flooded sandy clay alluvium, sometimes with shallow peat.

Conservation status: EN B2ab(iii) for Malaysia; LC for Peninsular Malaysia; EN B2ab(iii) for Sabah and Sarawak.

Conservation notes: Many of the Forest Reserves where the species occurs have large tracts of natural forests. In Sabah and Sarawak, only one site, Semengoh FR, is in the network of Protected Areas and the species may be very close to being critically endangered.

Other assessments: EN A1cd+2cd (IUCN, 2010); EN, threats from land conversion (Symington, 2004); VU, threats from land conversion (Ashton, 2004).



Dipterocarpus tempehes Slooten

Plates 9A–D

Vernacular names: Sabah: keruing asam; Sarawak: keruing tempayan.

Distribution: Peninsular Malaysia and Borneo (Sabah, Sarawak and Kalimantan).

Peninsular Malaysia: Johor. **Sabah:** Beluran, Kinabatangan, Lahad Datu, Sandakan and Tawau.

Sarawak: Bintulu, Kuching, Lawas, Lundu and Tatau.

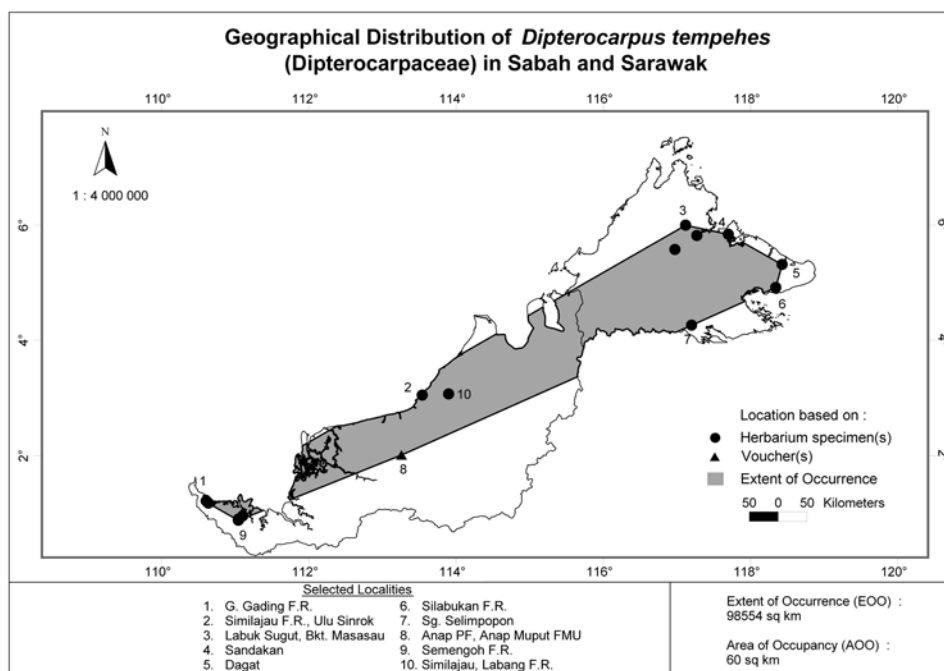
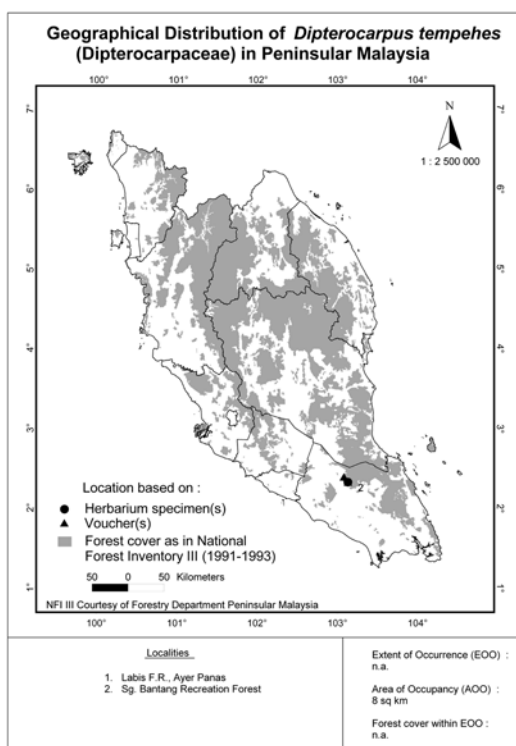
Habitat: Lowland forests on periodically flooded alluvium at altitudes below 300 m.

Conservation status: EN B2ab(iii) for Malaysia; EN B2ab(iii) for Peninsular Malaysia;

VU B2b(iii)+c(ii) for Sabah and Sarawak.

Conservation notes: In 2005, two populations were discovered in Labis FR, Johor. 133 trees greater than 1 cm dbh occur in Sg. Bantang Amenity Forest (Compartment 17; 216 ha) and 50 trees occur in Ayer Panas (Compartments 40, 55 dan 56; 409 ha).

Other assessments: CR A1cd+2cd, B1+2c (Oldfield *et al.*, 1998); VU, possibly EN from forest conversion threats (Ashton, 2004).



Dipterocarpus verrucosus Foxw. ex Slooten

Plates 10A–B

Vernacular name: Peninsular Malaysia, Sabah and Sarawak: keruing merah.

Distribution: Peninsular Thailand, Peninsular Malaysia and Borneo.

Peninsular Malaysia: Johor, Kelantan, Negeri Sembilan, Pahang, Perak, Selangor and Terengganu.

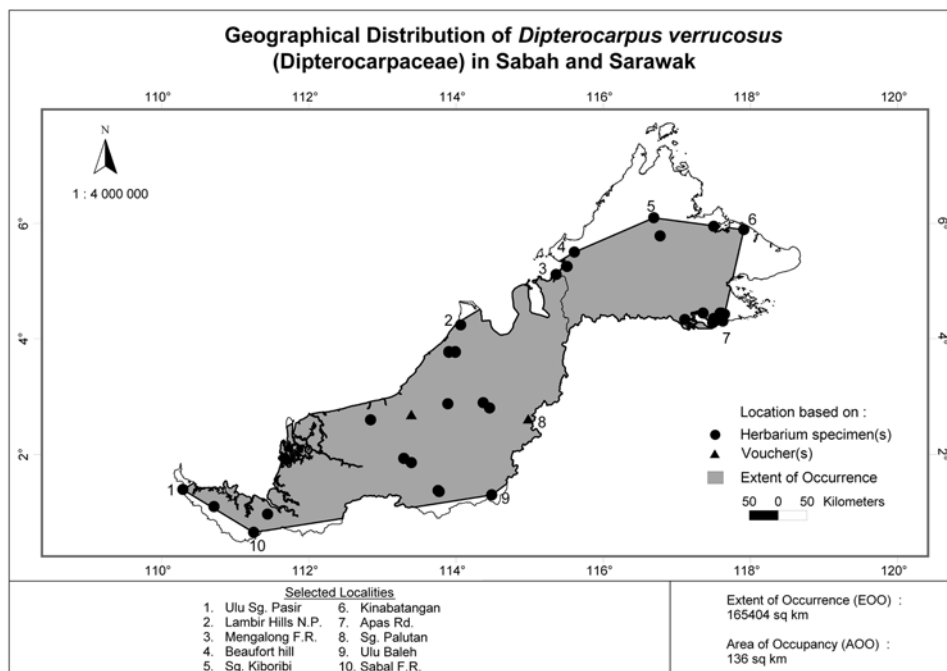
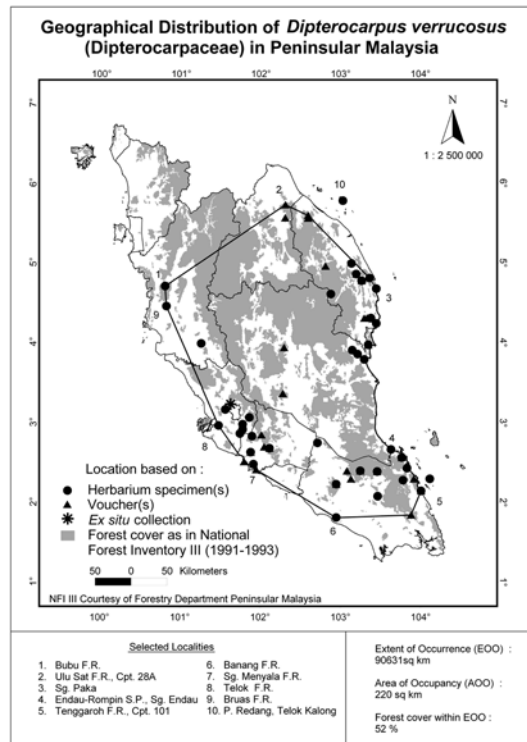
Sabah: Beaufort, Kinabatangan, Sandakan, Semporna, Sipitang and Tawau. **Sarawak:** Bau, Belaga, Bintulu, Kapit, Lundu, Marudi, Miri, Mukah, Simunjan and Sri Aman.

Habitat: Lowland to hill forests up to 800 m altitude.

Conservation status: NT for Malaysia.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 305,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: VU from logging and land conversion (Symington, 2004); VU (Ashton, 2004).



Dryobalanops aromatica Gaertn.f.

Plates 10C–D

Vernacular names: Peninsular Malaysia: kapur; Sabah: kapur barus; Sarawak: kapur peringgi.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sabah, Sarawak and Brunei).

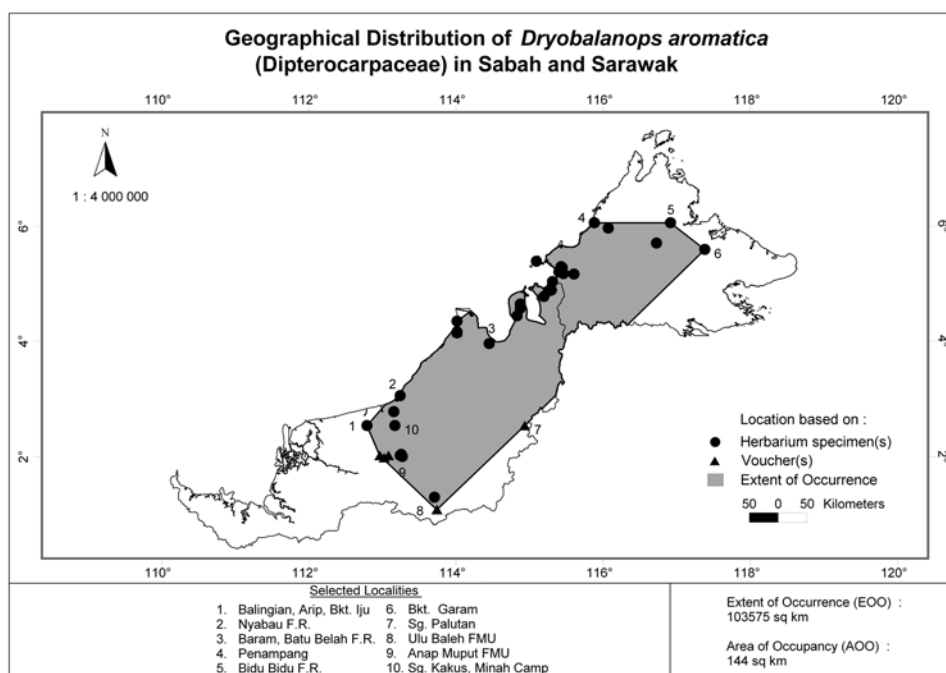
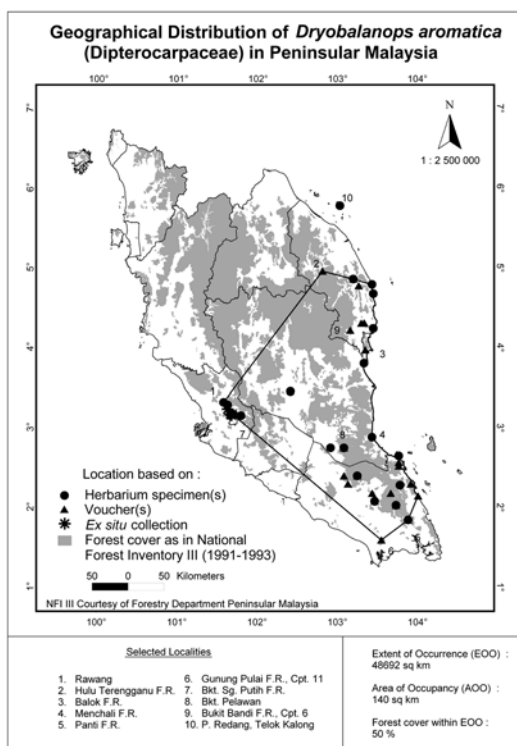
Peninsular Malaysia: Johor, Pahang, Selangor and Terengganu. **Sabah:** Beaufort, Beluran, Kinabatangan, Labuan, Papar, Penampang and Sipitang. **Sarawak:** Bintulu, Kapit, Lawas, Limbang, Marudi, Miri, Mukah and Tatau.

Habitat: Lowland forests at altitudes between 70 to 400 m, preferring steep slopes and ridges.

Conservation status: NT for Malaysia; LC for Peninsular Malaysia; NT for Sabah and Sarawak.

Conservation notes: In Peninsular Malaysia, the species is gregarious in areas where it occupies. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 1.27 million adult stems above 30 cm dbh in the Permanent Reserved Forests. At least 10,650 trees above 1 cm diameter were recorded from Lambir Hills 52-ha research plot in 1991. 86.4% of this had diameters less than 5 cm.

Other assessments: CR A1cd+2cd, B1+2c (IUCN, 2010); NT (Symington, 2004); VU (Ashton, 2004).



Dryobalanops beccarii Dyer

Fig. 5, Plates 11A–B

Vernacular names: Sabah: kapur merah; Sarawak: kapur bukit.

Distribution: Peninsular Malaysia and Borneo.

Peninsular Malaysia: Johor. **Sabah:** Beaufort, Beluran, Kinabatangan, Kudat, Kuala Penyu, Papar, Pitas, Sandakan, Sipitang and Tenom. **Sarawak:** Bau, Belaga, Bintulu, Kapit, Kuching, Lundu, Marudi, Miri, Simunjan and Tatau.

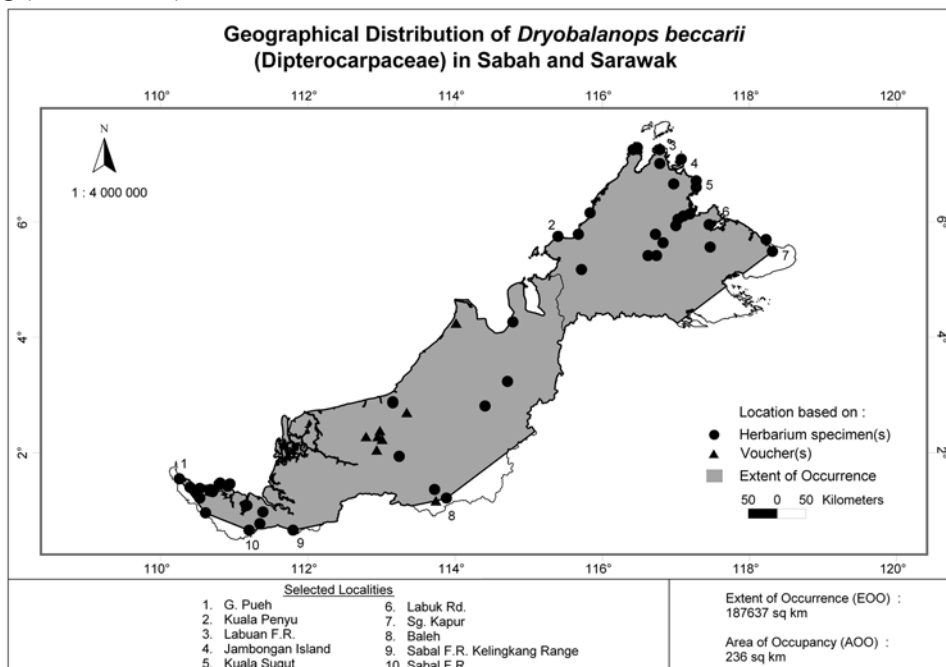
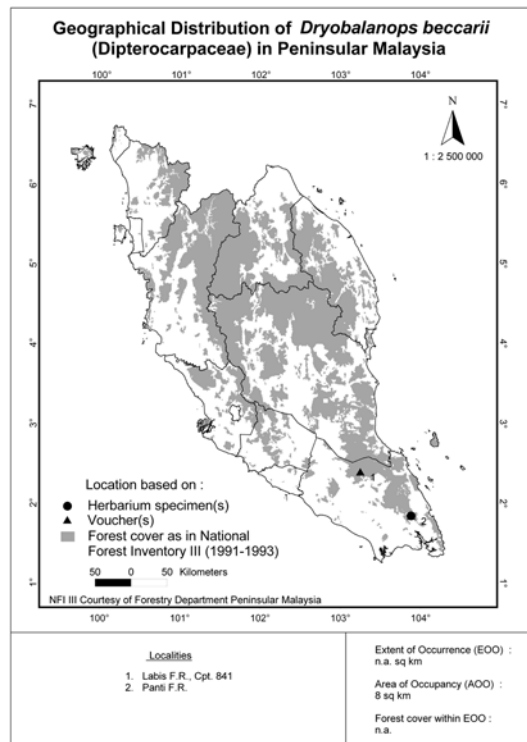
Habitat: Lowland to hill forests on sandstone and shale on high narrow ridges at altitudes to 700 m, on coastal sandstone formations and seasonally swamped alluvium.

Conservation status: EN B2ab(iii) for Malaysia; EN B2ab(iii) for Peninsular Malaysia; LC for Sabah and Sarawak.

Conservation notes: In 2004, the density of trees above 30 cm dbh in Compartments 6A and 6B of Panti FR was 25 trees per ha. 562 trees of larger than 1 cm dbh were found along ridges and slopes in an area of 1.47 ha. in Compartments 840 and 841, Labis FR. More trees exist in these compartments but no complete count was made. Compartment 841 is a Virgin Jungle Reserve. For Compartments 131 and 132 of Kluang FR, the sympatric association with *Dryobalanops aromatica* made enumeration difficult.

Compartments 131 and 132 are water catchment and amenity forest respectively. Attempts are being made to protect the population in Panti FR.

Other assessments: EN A1cd+2cd (IUCN, 2010); not VU however there is reduction of habitat through logging (Ashton, 2004).



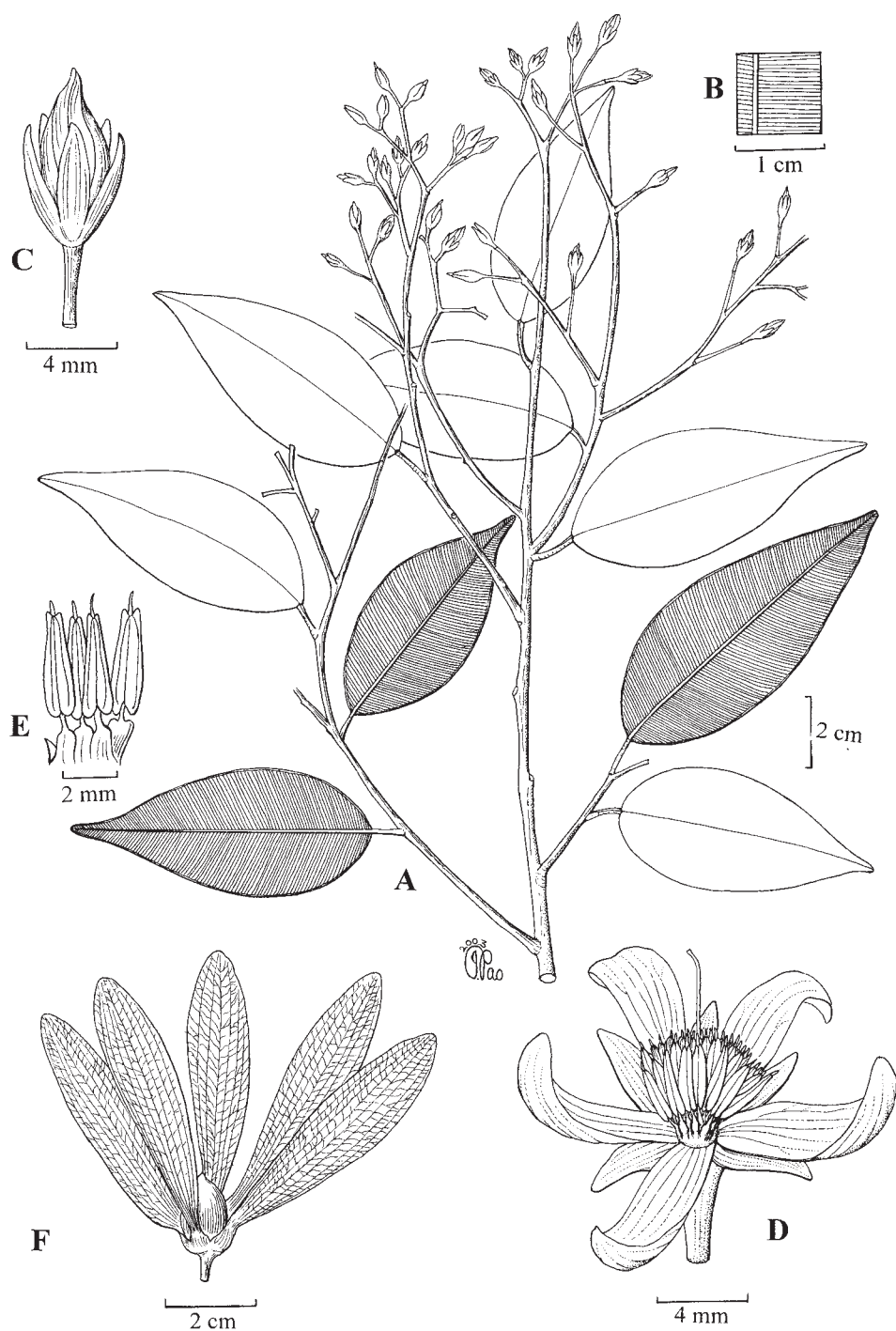


Fig. 5. *Dryobalanops beccarii*. A, flowering leafy twig; B, detail of venation on lower leaf surface; C, flower bud; D, open flower; E, adaxial view of stamens; F, mature fruit (A–B from *S* 23922, C from *SAN* 36331, D–E from *S* 7612, F from *S* 8591) (Reproduced with permission from the Tree Flora of Sabah and Sarawak project).

Dryobalanops oblongifolia Dyer ssp. *occidentalis* P.S.Ashton

Plates 11C–E

Vernacular name: Peninsular Malaysia: keladan.

Distribution: Sumatra and Peninsular Malaysia.

Peninsular Malaysia: Johor, Kelantan, Pahang, Perak, Selangor and Terengganu.

Habitat: Lowland dipterocarp forests in low-lying, usually poorly drained or periodically inundated soil and in the vicinity of streams.

Conservation status: LC for Malaysia.

Other assessments: EN A1cd, B1+2c (IUCN, 2010); VU, threats from habitat conversion (Symington, 2004).

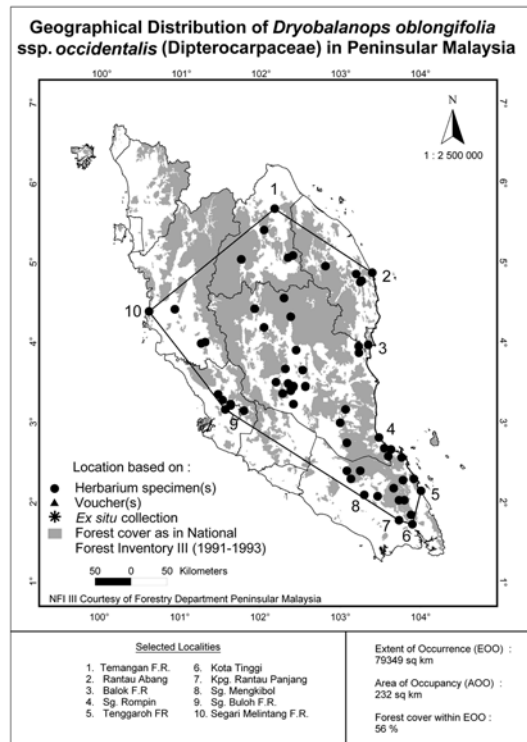
*Hopea apiculata* Symington

Plate 12A

Vernacular name: Peninsular Malaysia: resak melukut.

Distribution: Peninsular Malaysia.

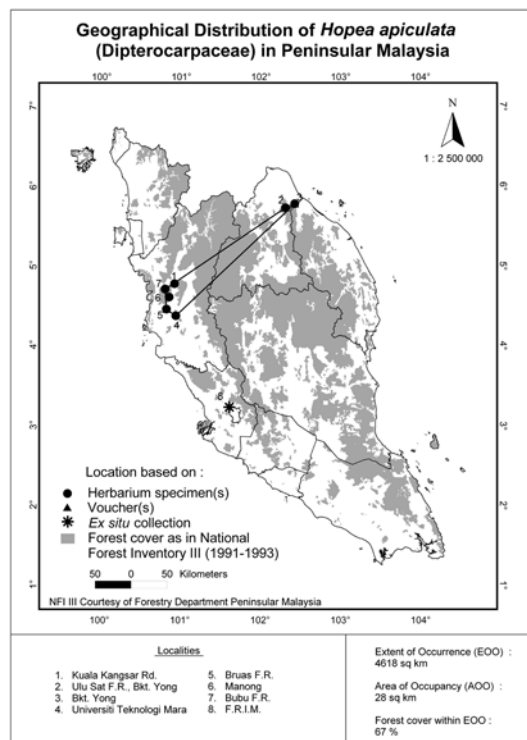
Peninsular Malaysia: Kelantan, Perak and Terengganu.

Habitat: Lowland to hill dipterocarp forests up to 610 m altitude.

Conservation status: EN B1b(iii)+c(ii) for Malaysia.

Conservation notes: No populations are known to occur in the network of Totally Protected Areas.

Other assessments: CR A1c, B1+2c (IUCN, 2010).



Hopea auriculata Foxw.

Plates 12B–D

Distribution: Peninsular Malaysia.

Peninsular Malaysia: Johor, Pahang and Perak.

Habitat: Hills and ridges between 250 to 650 m altitude.

Conservation status: CR A4c for Malaysia.

Conservation notes: Populations in South Pangkor and Panti FR are in the Virgin Jungle Reserves. The locality in Johor has only a small number of individuals.

Other assessments: EN A1c, B1+2c (IUCN, 2010).

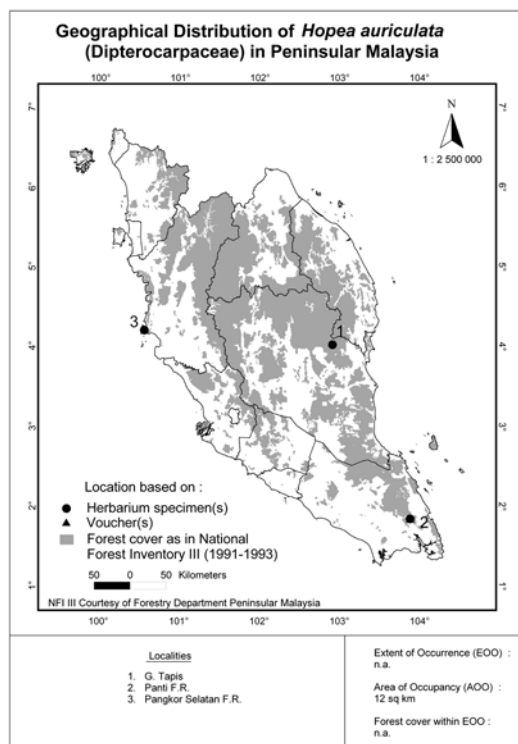
*Hopea beccariana* Burck

Plate 13A

Vernacular names: Peninsular Malaysia: merawan batu; Sabah: selangan penak; Sarawak: cengal pasir.

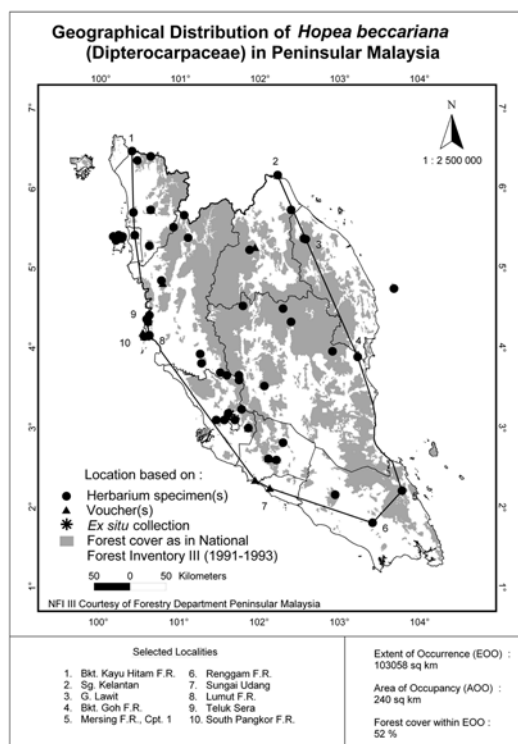
Distribution: Peninsular Thailand, Peninsular Malaysia and Borneo (Sabah, Sarawak and Kalimantan).

Peninsular Malaysia: Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Penang, Perak, Selangor and Terengganu. **Sabah:** Beluran, Kinabatangan, Kota Kinabalu, Kudat, Lahad Datu, Ranau, Sandakan, Sipitang and Tenom. **Sarawak:** Belaga, Bintulu, Kuching, Lawas, Limbang, Lundu, Marudi, Miri, Simunjan and Song.

Habitat: Lowland to upper hill forests of coastal hills and along ridges at altitudes of 150 to 1,200 m altitude.

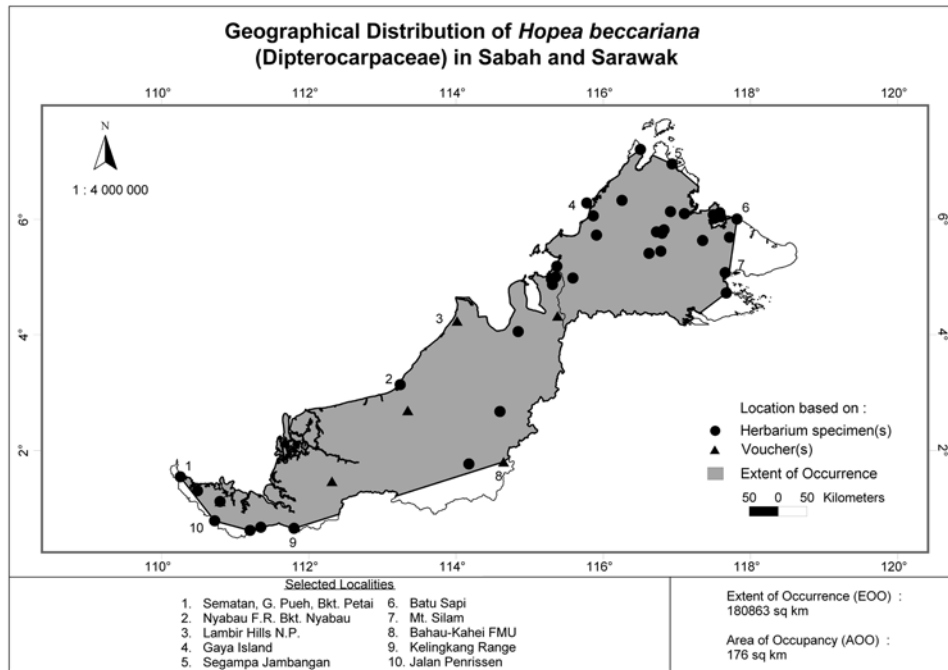
Conservation status: LC for Malaysia.

Conservation notes: The species occurs in the network of Totally Protected Areas. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 560,000 adult stems above 30 cm dbh in the Permanent Reserved Forests. In 1991, at least 360 trees above



1 cm diameter were recorded from Lambir Hills 52-ha research plot. 76.8% of this had diameters less than 5 cm.

Other assessments: CR A1cd+2cd (IUCN, 2010); VU and locally EN, threats from logging (Symington, 2004); VU, threats from land conversion and logging (Ashton, 2004).



Hopea biltonensis P.S.Ashton

Plates 13B–C

Distribution: Peninsular Malaysia and Sumatra.

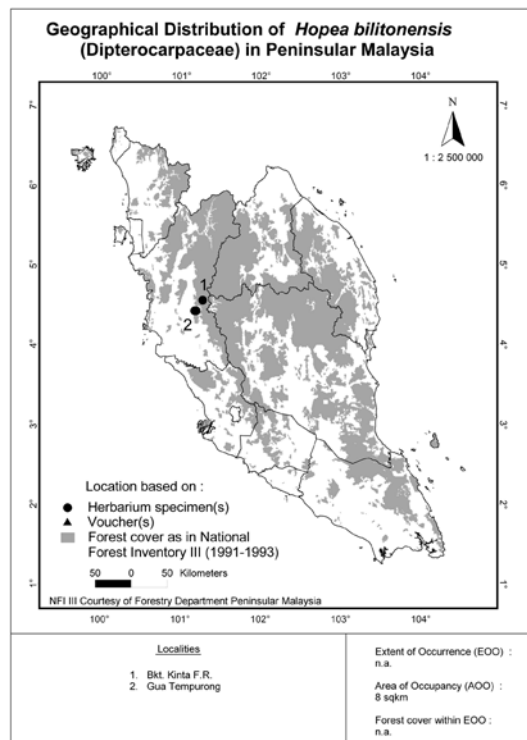
Peninsular Malaysia: Perak.

Habitat: Limestone hills.

Conservation status: CR A4c, B1ab(iii) for Malaysia.

Conservation notes: To date, only two populations have been located. At Gua Tempurung, 243 trees of 1 cm dbh and above occupy an approximate area of about 0.90 ha. 77 trees of 1 cm dbh and greater occur on the slopes of Gunung Gajah, occupying approximately 0.28 ha. This population is sited in a quarry.

Other assessments: CR A1c+2c, B1+2c (IUCN, 2010).



Hopea bracteata Burck var. *penangiana* Symington

Vernacular names: Peninsular Malaysia: merawan ungu, damar mata kuching.

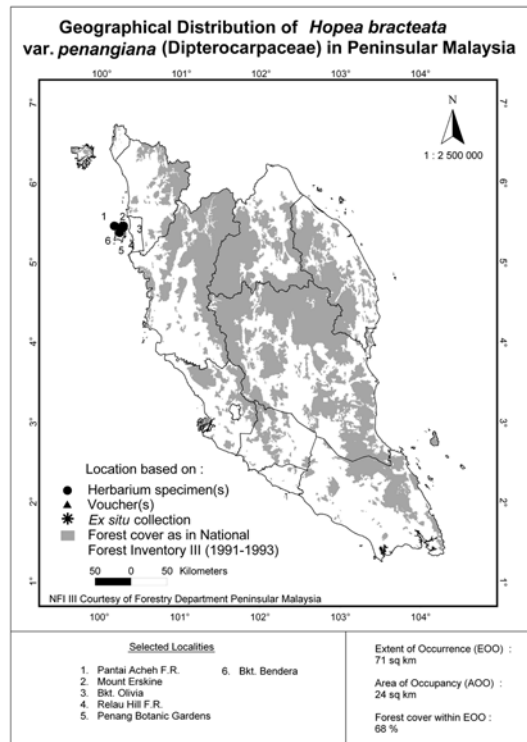
Distribution: Peninsular Malaysia.

Peninsular Malaysia: Penang.

Habitat: Lowland to hill dipterocarp forests.

Conservation status: CR B1b(iii)+c(iii) for Malaysia.

Conservation notes: Trees are found in the Penang Botanical Gardens and areas adjacent to the Gardens. Information on the habitat status for some localities is required.

*Hopea bracteata* Burck var. *perakensis* Symington

Vernacular name: Peninsular Malaysia: merawan ungu.

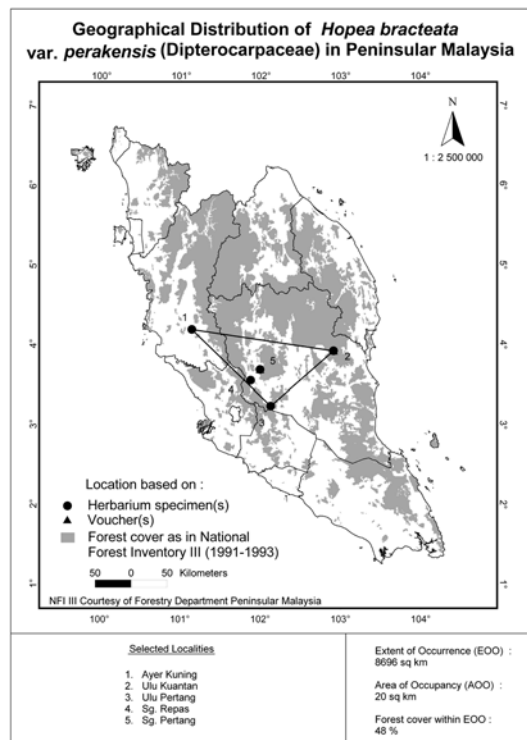
Distribution: Peninsular Malaysia.

Peninsular Malaysia: Pahang and Perak.

Habitat: Lowland dipterocarp forests between 200 to 300 m altitude.

Conservation status: EN B2ab(iii) for Malaysia.

Conservation notes: Information on the habitat status of all localities is required.



Hopea coriacea Burck

Plates 14A–B

Vernacular names: Peninsular Malaysia: giam hantu; Sarawak: garang buaya.

Distribution: Peninsular Malaysia and Borneo (Sarawak, Brunei and Kalimantan).

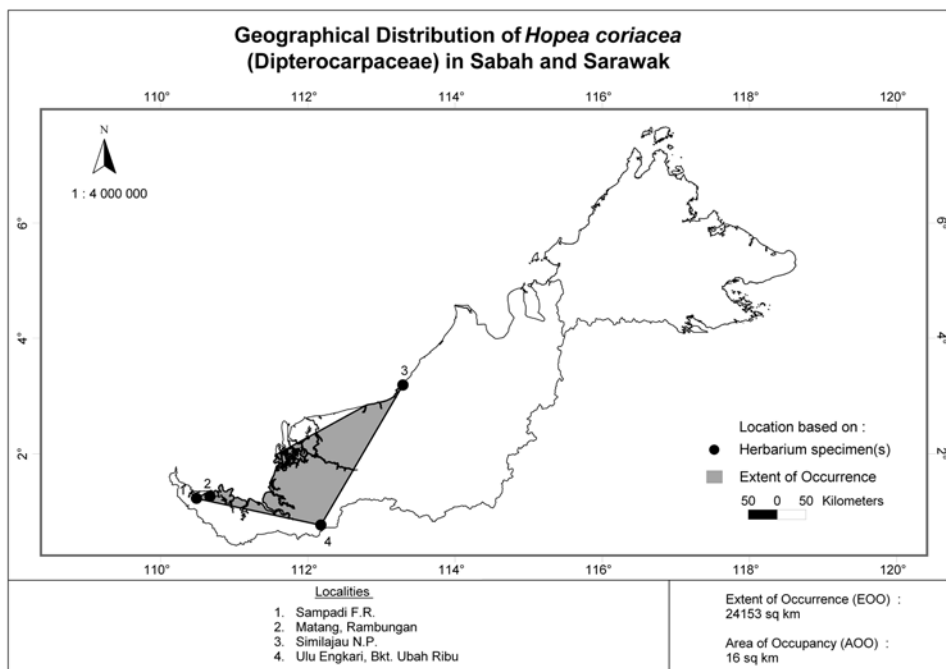
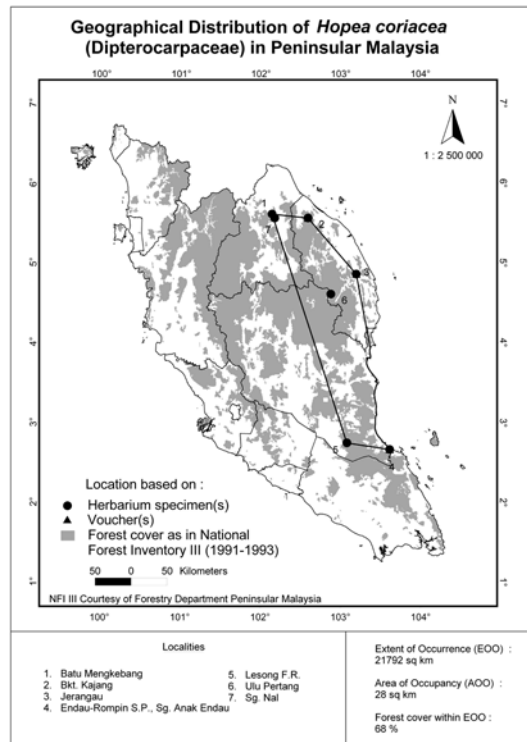
Peninsular Malaysia: Kelantan, Pahang and Terengganu. **Sarawak:** Bintulu, Kuching, Lubok Antu and Lundu.

Habitat: Lowland forests along banks of small rivers at altitudes below 400 m.

Conservation status: EN B2ab(iii)+c(iii) for Malaysia.

Conservation notes: It occurs in the network of Totally Protected Areas.

Other assessments: CR A1cd+2cd, B1+2c, C1, D (IUCN, 2010); may now be EX (Symington, 2004); rare and CR, threats from logging and forest conversion (Ashton, 2004).



Hopea dryobalanoides Miq.

Fig. 6

Vernacular names: Peninsular Malaysia and Sarawak: mata kucing hitam; Sabah: selangan daun kapur.

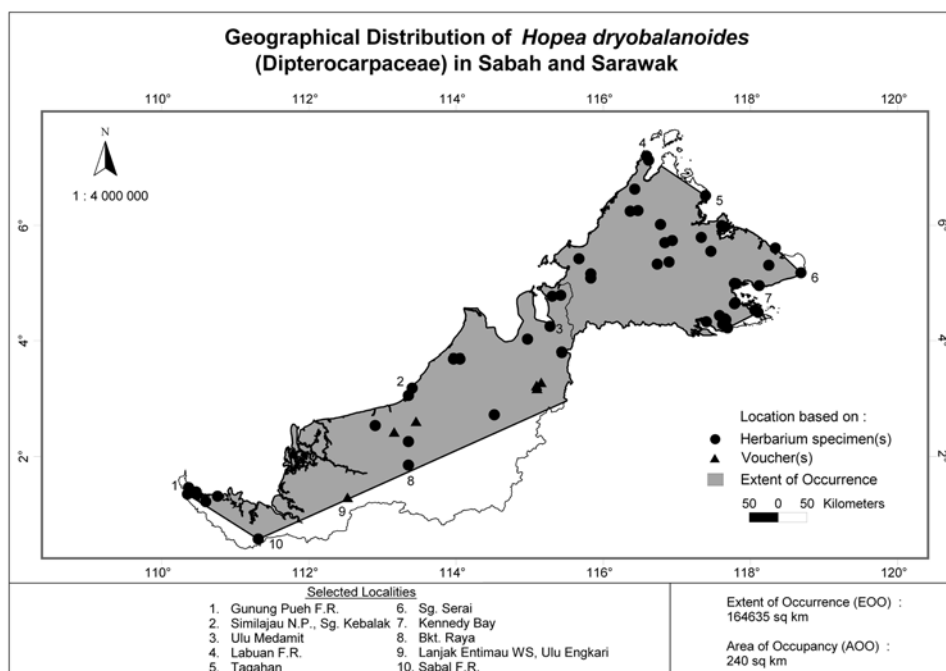
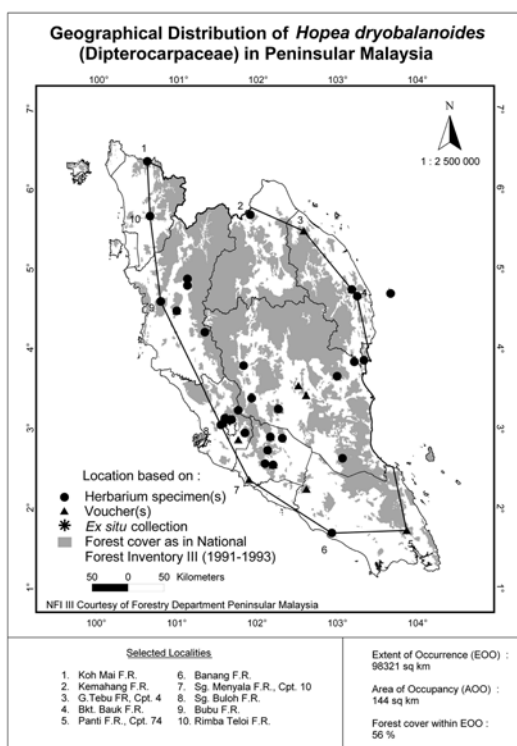
Distribution: Sumatra, Peninsular Malaysia and Borneo.

Peninsular Malaysia: Johor, Kedah, Kelantan, Negeri Sembilan, Pahang, Perak, Selangor and Terengganu. **Sabah:** Beaufort, Beluran, Kinabatangan, Kota Kinabalu, Kudat, Lahad Datu, Ranau, Sandakan, Semporna, Tawau and Tenom. **Sarawak:** Belaga, Bintulu, Kapit, Kuching, Lawas, Limbang, Lubok Antu, Lundu, Marudi, Miri, Mukah, Serian and Tatau.

Habitat: Lowland to hill forests at altitudes to 600 m.

Conservation status: LC for Malaysia.

Other assessments: EN (Symington, 2004); not VU (Ashton, 2004).



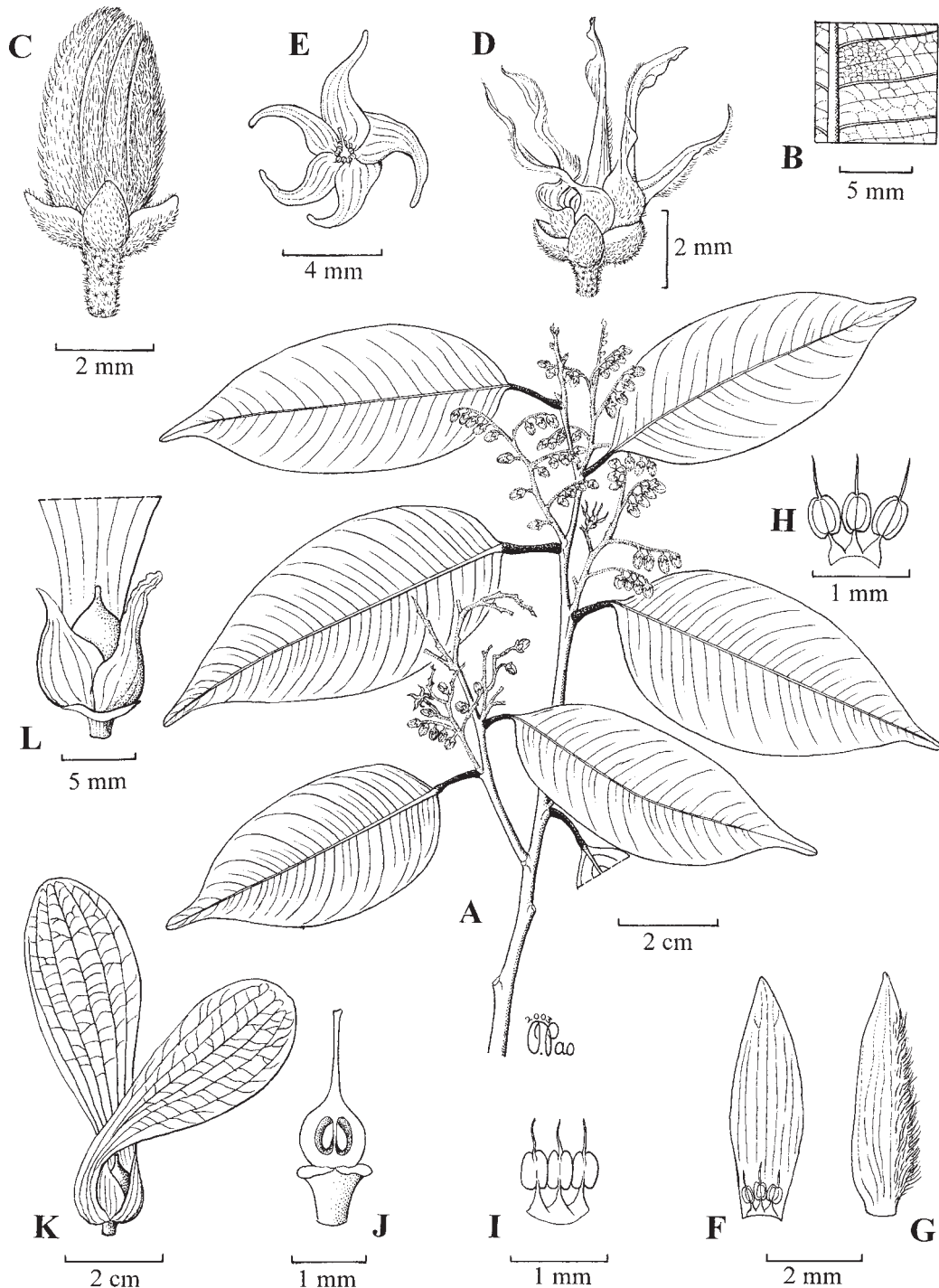


Fig. 6. *Hopea dryobalanoides*. A, flowering leafy twig; B, detail of venation on lower leaf surface; C, flower bud; D, side view of open flower; E, top view of open flower; F, adaxial view of petal with stamens; G, abaxial view of petal; H, adaxial view of stamens; I, abaxial view of stamens; J, longitudinal section of gynoecium; K, fruit; L, fruit with the large calyx lobes removed (A–J from *SAN 15186*, K–L from *SAN 100048*) (Reproduced with permission from the Tree Flora of Sabah and Sarawak project).

Hopea dyeri F.Heim

Vernacular names: Peninsular Malaysia: merawan palit; Sabah: selangan daun halus; Sarawak: luis palit.

Distribution: Peninsular Malaysia and Borneo.

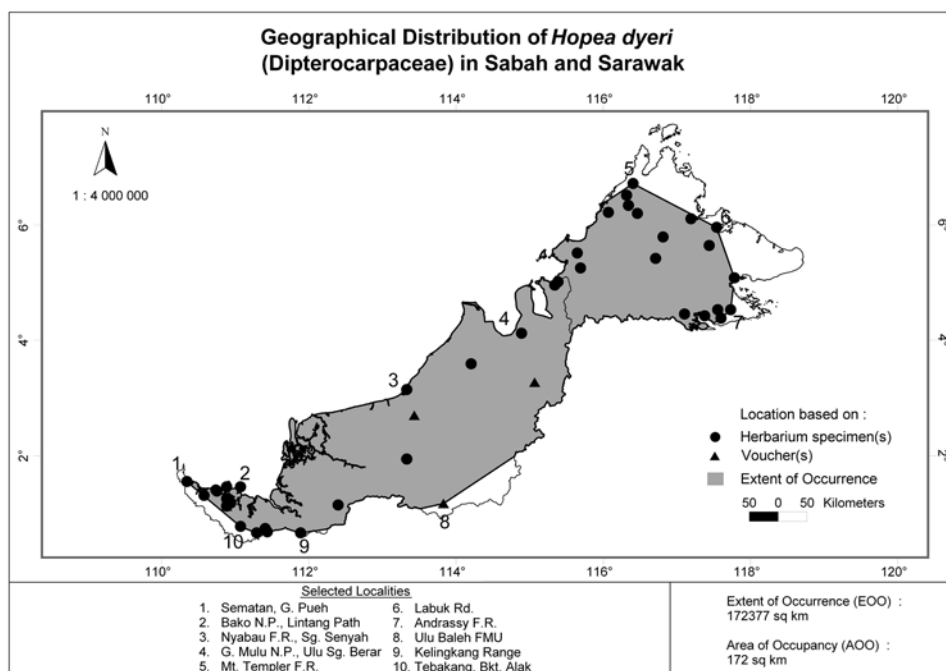
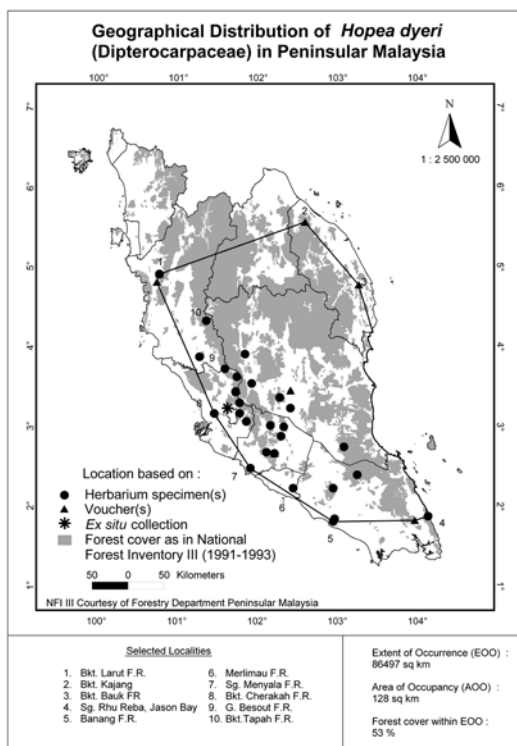
Peninsular Malaysia: Johor, Malacca, Negeri Sembilan, Pahang, Perak, Selangor and Terengganu.

Sabah: Beaufort, Beluran, Kinabatangan, Kota Belud, Kota Marudu, Lahad Datu, Ranau, Sandakan, Sipitang and Tawau. **Sarawak:** Bintulu, Kapit, Kuching, Lawas, Limbang, Lubok Antu, Lundu, Marudi, Serian, Simunjan and Sri Aman.

Habitat: Lowland to hill forests up to 1,000 m altitude and along sandstone ridges.

Conservation status: NT for Malaysia.

Other assessments: EN, threats from habitat conversion (Symington, 2004).



Hopea ferrea Lanessan

Vernacular name: Peninsular Malaysia: giam malut, cengal batu.

Distribution: Indo-China, Thailand and Peninsular Malaysia.

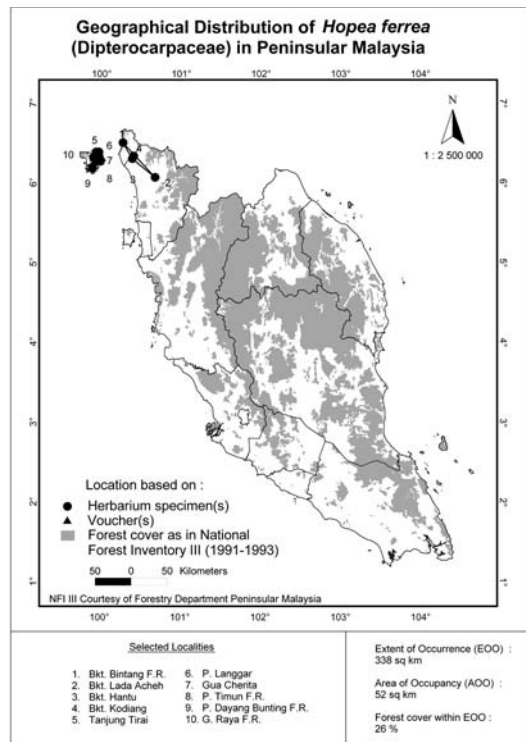
Peninsular Malaysia: Kedah and Perlis.

Habitat: Seasonally dry tropical rain forests on rocky limestone islands and on granite.

Conservation status: NT for Malaysia.

Conservation notes: Although the species is not known to occur in the network of Protected Areas and is found only in two states, development in the rocky limestone coastal and inland habitats is patchy and mining activities are often localised. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 465,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: EN A1cd+2cd, B1+2c (IUCN, 2010); EN from development and logging (Symington, 2004).



Hopea ferruginea Parijs

Vernacular names: Peninsular Malaysia: mata kuching merah; Sabah: selangan mata kuching.

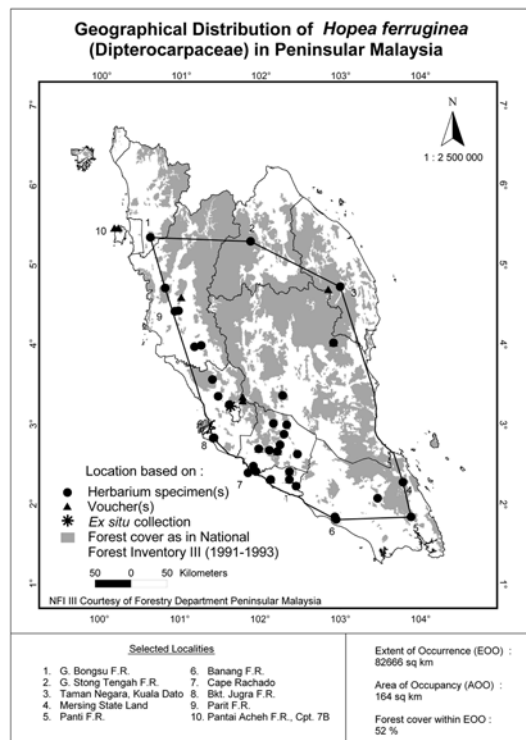
Distribution: Sumatra, Peninsular Malaysia and Borneo.

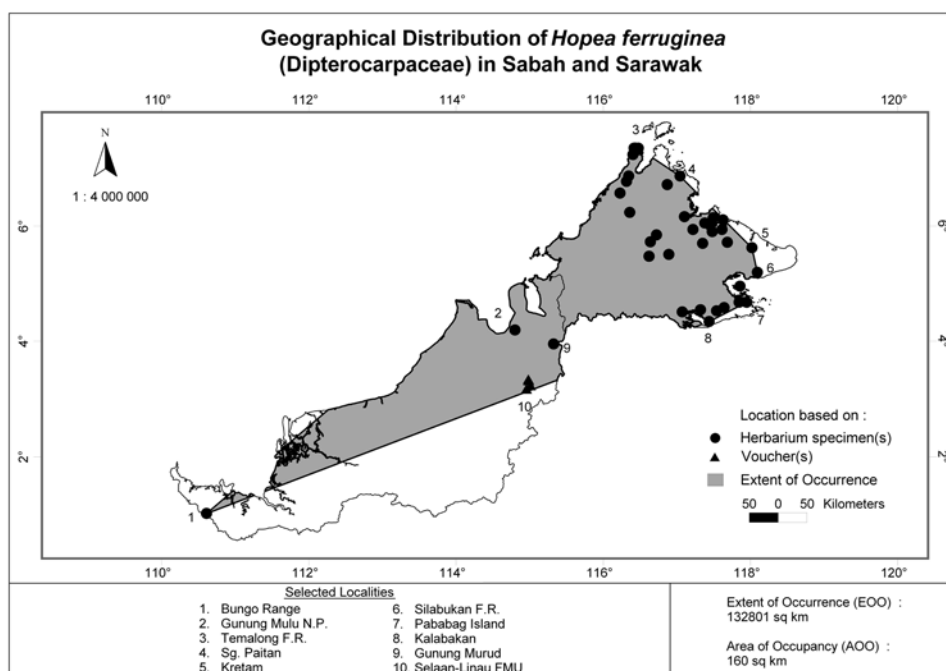
Peninsular Malaysia: Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Penang, Perak, Selangor and Terengganu. **Sabah:** Beluran, Kinabatangan, Kota Belud, Kota Kinabalu, Kota Marudu, Kudat, Lahad Datu, Ranau, Sandakan, Semporna and Tawau. **Sarawak:** Bau, Limbang and Marudi.

Habitat: Lowland to hill forests up to 750 m altitude.

Conservation status: LC for Malaysia.

Other assessments: CR A1c+2c (IUCN, 2010); EN, threats from forest conversion (Symington, 2004); VU (Ashton, 2004).





Hopea glaucescens Symington

Plates 14C–D

Vernacular name: Peninsular Malaysia: merawan kelabu.

Distribution: Peninsular Malaysia.

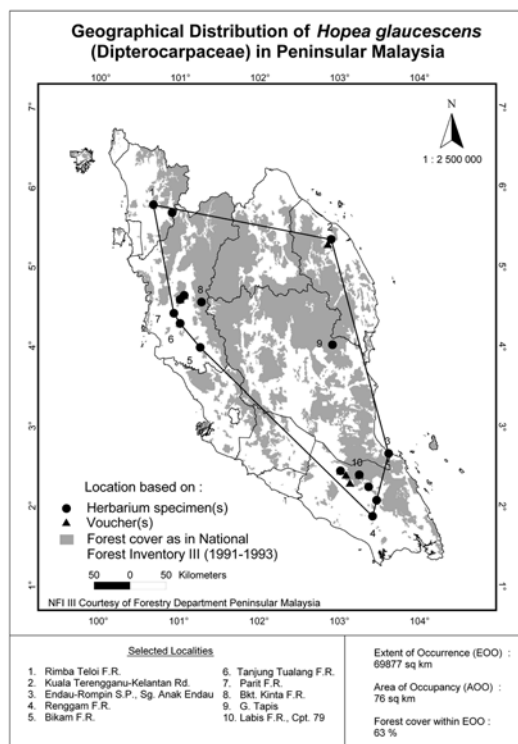
Peninsular Malaysia: Johor, Kedah, Pahang, Perak and Terengganu.

Habitat: Lowland to hill forests up to 500 m altitude.

Conservation status: VU A4c for Malaysia.

Conservation notes: Although its extent of occurrence is large, several of the Forest Reserves where collections were made are no longer in existence. Several populations are known in the Endau-Rompin State Park.

Other assessments: CR A1c+2c, B1+2c (IUCN, 2010); CR (Symington, 2004).



Hopea griffithii Kurz

Plates 15A–B

Vernacular names: Peninsular Malaysia: merawan jantan; Sarawak: luis jantan.

Distribution: Myanmar, Peninsular Thailand, Peninsular Malaysia and Borneo.

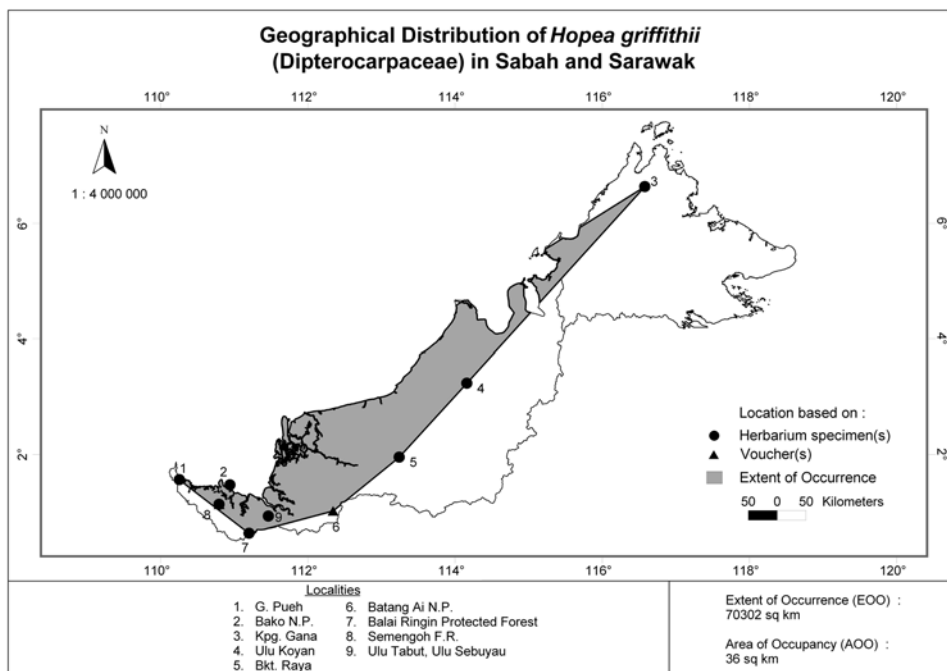
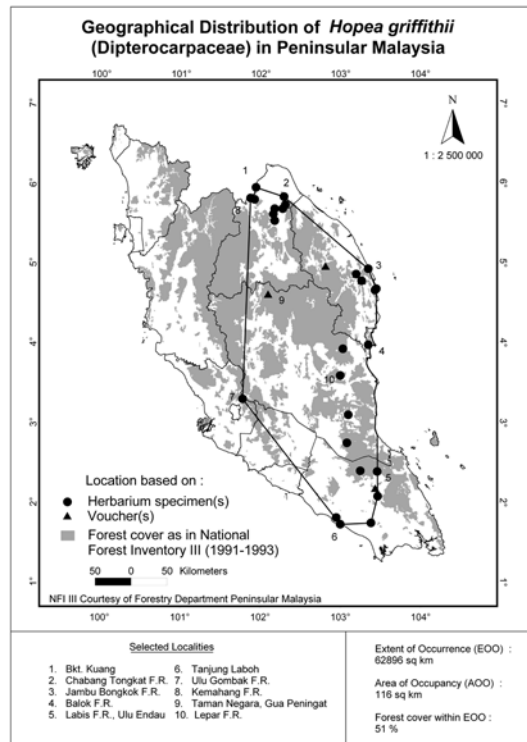
Peninsular Malaysia: Johor, Kelantan, Pahang, Selangor and Terengganu. **Sabah:** Kota Marudu and Ranau. **Sarawak:** Kapit, Kuching, Lundu and Simunjan.

Habitat: Lowland to hill forests up to 500 m altitude.

Conservation status: NT for Malaysia.

Conservation notes: Several populations in Sarawak are found in the network of Totally Protected Areas. Many of the Forest Reserves where the species occurs are forested.

Other assessments: VU A1cd+2cd (IUCN, 2010); maybe EN, threats from habitat conversion and logging (Symington, 2004); VU (Ashton, 2004).



Hopea helferi (Dyer) Brandis

Vernacular name: Peninsular Malaysia: lintah bukit.

Distribution: Andamans, Myanmar, Thailand, Cambodia and Peninsular Malaysia.

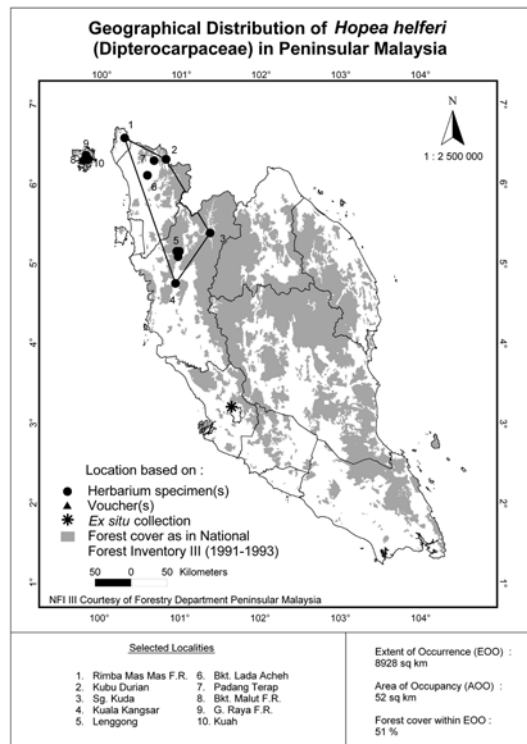
Peninsular Malaysia: Kedah, Perak and Perlis.

Habitat: Seasonally dry tropical forest and lowland dipterocarp forest especially on sedimentary rocks up to 230 m altitude.

Conservation status: VU B1ab(iii) for Malaysia.

Conservation notes: Many of the Forest Reserves where the species occurs are small fragments. No populations are known in the network of Totally Protected Areas.

Other assessments: CR A1cd+2cd, B1+2c (IUCN, 2010); CR (Symington, 2004).

*Hopea johorensis* Symington

Vernacular name: Peninsular Malaysia: mata kuching pipit.

Distribution: Peninsular Malaysia.

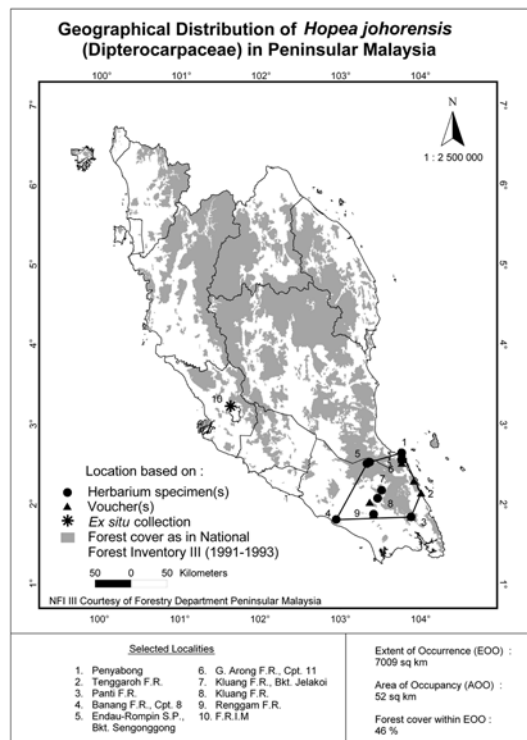
Peninsular Malaysia: Johor.

Habitat: Lowland to hill dipterocarp forests.

Conservation status: VU B1ab(iii) for Malaysia.

Conservation notes: The species occurs in Endau-Rompin State Park, Johor, which is a Totally Protected Area.

Other assessments: CR A1cd, B1+2c (IUCN, 2010); VU (Symington, 2004).



Hopea kerangasensis P.S.Ashton

Vernacular names: Peninsular Malaysia: merawan kerangas; Sarawak: luis kerangas.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sabah, Sarawak and Kalimantan).

Peninsular Malaysia: Pahang and Terengganu.

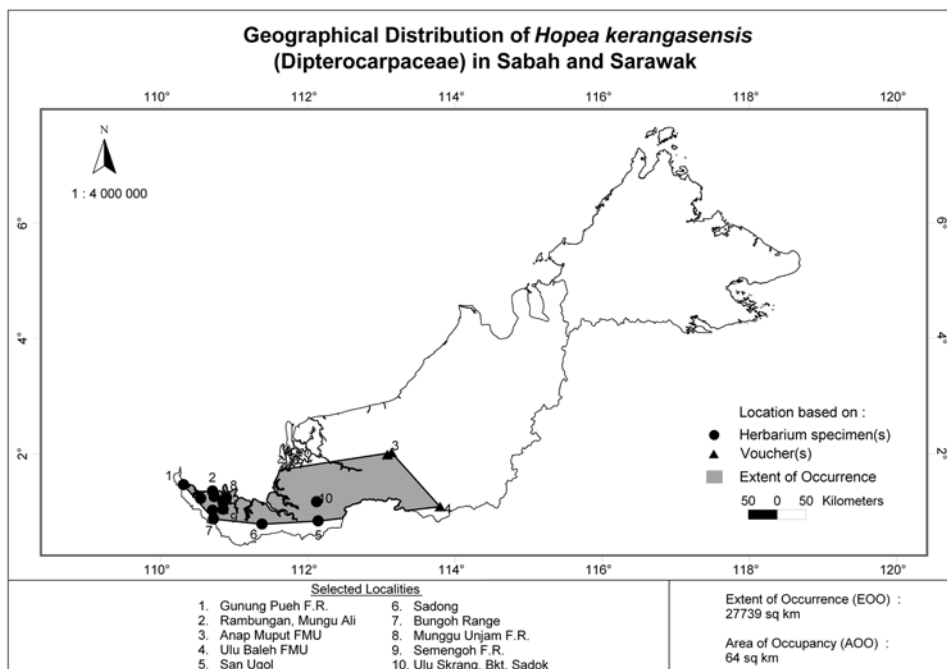
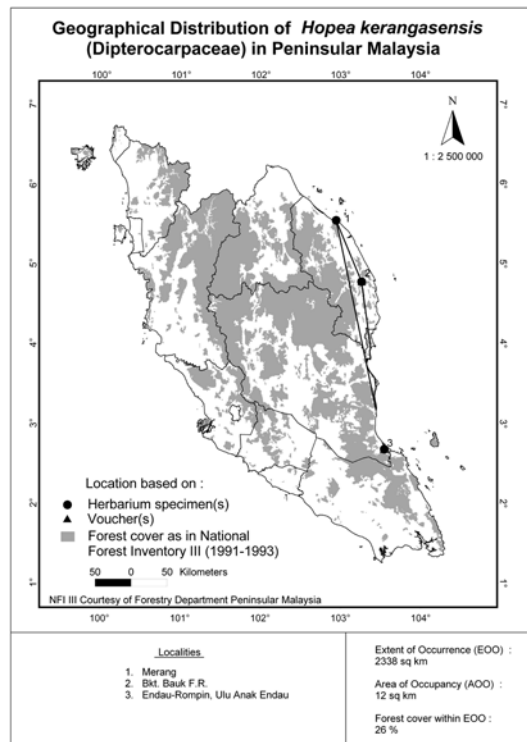
Sabah: Kinabatangan. **Sarawak:** Bau, Kapit, Kuching, Lundu, Simunjan, Sri Aman and Tatau.

Habitat: Lowland forests at altitudes below 300 m and heath forests.

Conservation status: EN A4c for Malaysia; EN A4c for Peninsular Malaysia; VU A4c for Sarawak.

Conservation notes: The species is reported from the Kinabatangan district of Sabah (Ashton, 2004). It occurs in Semengoh FR, Sarawak. In Peninsular Malaysia, the species occurs in Endau-Rompin State Park, Johor.

Other assessments: CR A1c, B1+2c (IUCN, 2010); EN, threats from forest conversion (Symington, 2004); EN (Ashton, 2004).



Hopea latifolia Symington

Plate 15C

Vernacular names: Peninsular Malaysia: merawan daun bulat; Sarawak: luis daun bulat.

Distribution: Peninsular Malaysia and Borneo.

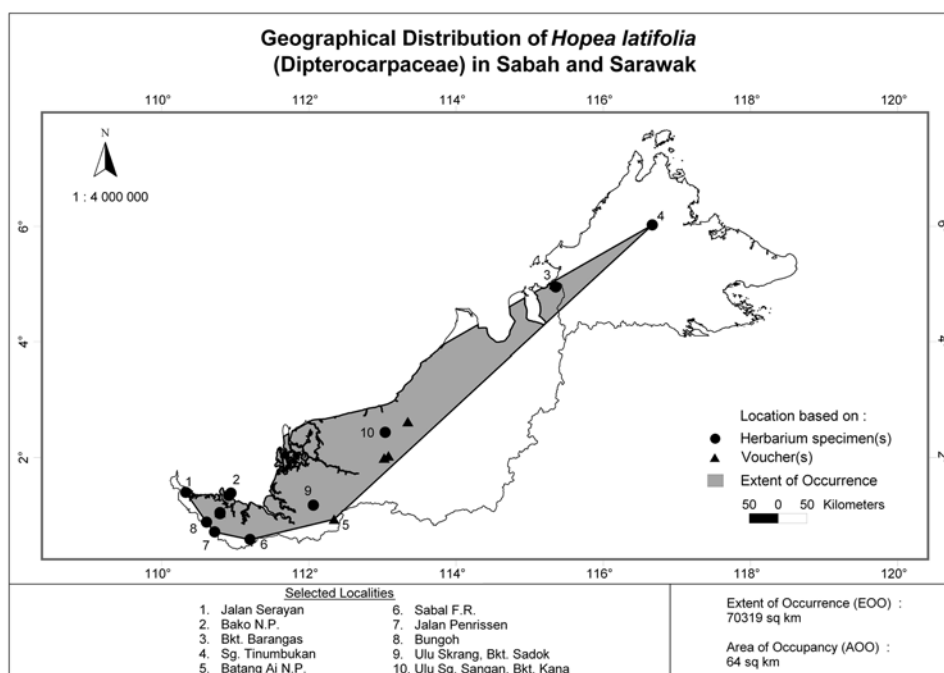
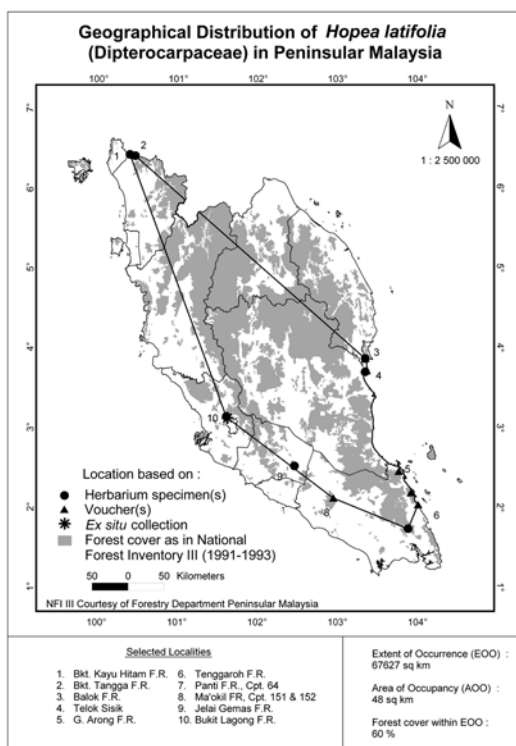
Peninsular Malaysia: Johor, Kedah, Negeri Sembilan, Pahang, Perlis and Selangor. **Sabah:** Beluran. **Sarawak:** Bau, Kuching, Lawas, Lubok Antu, Lundu, Simunjan, Sri Aman and Tatau.

Habitat: Lowland to hill forests up to 400 m altitude and on limestone hills.

Conservation status: VU B2b(iii)+c(ii) for Malaysia; VU B2b(iii)+c(ii) for Peninsular Malaysia; NT for Sabah and Sarawak.

Conservation notes: In Peninsular Malaysia, almost all the Forest Reserves where the species occurs are small fragments. In Sabah and Sarawak, populations occur in the Arboreta and National Parks.

Other assessments: CR A1c, B1+2c (IUCN, 2010); CR from habitat conversion (Symington, 2004); VU (Ashton, 2004).



Hopea mengarawan Miq.

Vernacular names: Peninsular Malaysia: merawan penak.

Distribution: Sumatra, Peninsular Malaysia, Singapore and Borneo (Sabah, Sarawak and Kalimantan).

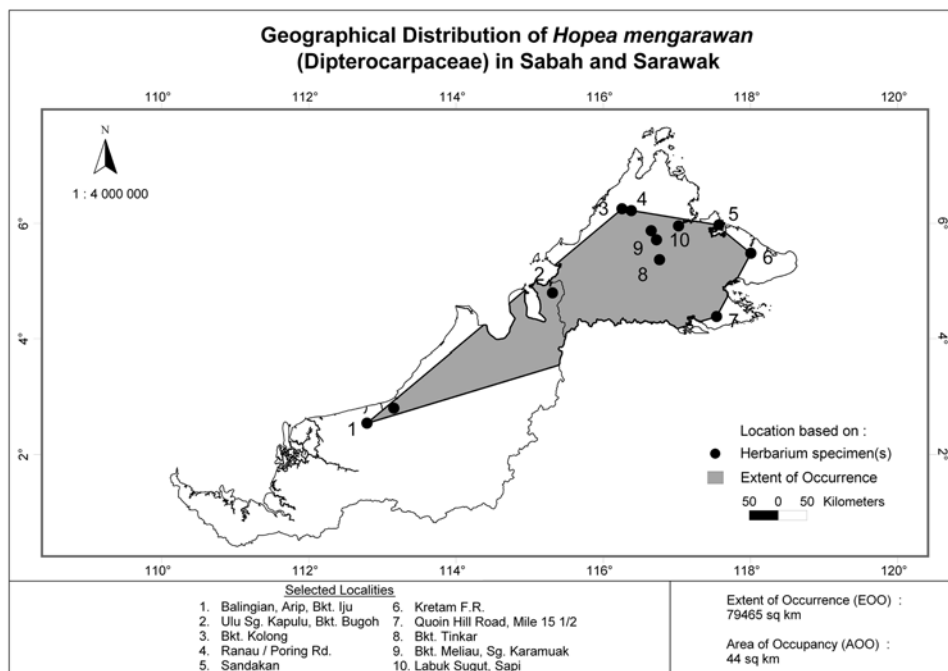
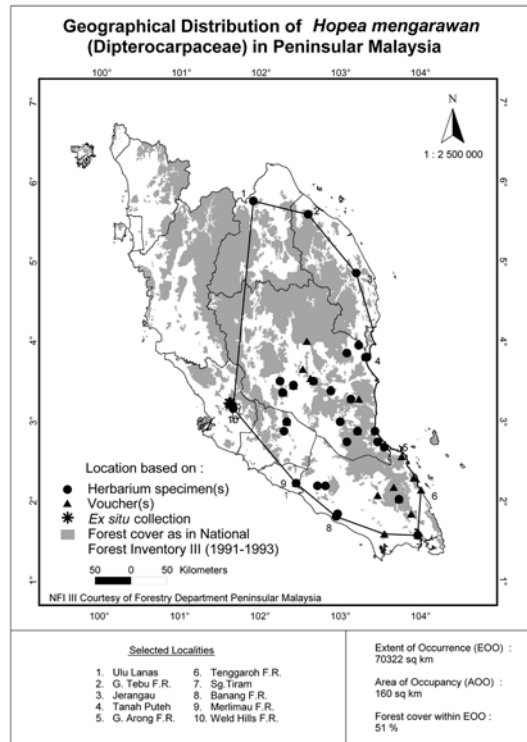
Peninsular Malaysia: Johor, Kelantan, Malacca, Negeri Sembilan, Pahang and Terengganu. **Sabah:** Beluran, Kinabatangan, Lahad Datu, Ranau, Sandakan and Tawau. **Sarawak:** Bintulu, Mukah and Lawas.

Habitat: Lowland forests at altitudes below 200 m, often in swampy areas and sometimes in peat swamp.

Conservation status: VUB2b(iii)+c(ii) for Malaysia; LC for Peninsular Malaysia; VU B2b(iii)+c(ii) for Sabah and Sarawak.

Conservation notes: Populations occur in the network of Totally Protected Areas, e.g., Endau-Rompin State Park, Johor and in several research forests.

Other assessments: CR A1cd, B1+2c (IUCN, 2010); EN from habitat conversion (Symington, 2004); inexplicably rare and CR throughout Borneo (Ashton, 2004).



Hopea montana Symington

Vernacular names: Peninsular Malaysia: merawan gunung; Sabah: selangan bukit.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sabah).

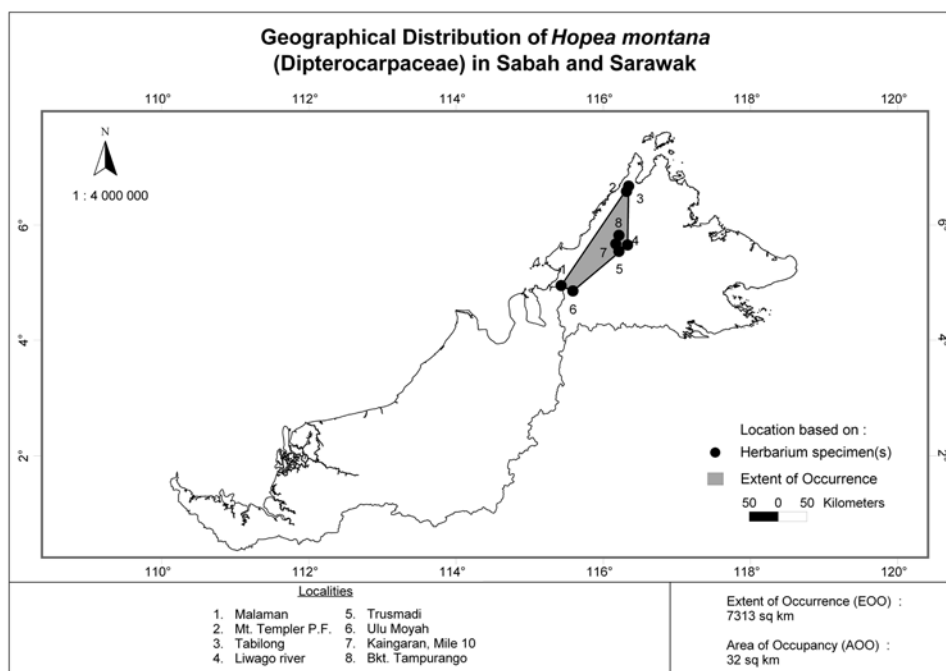
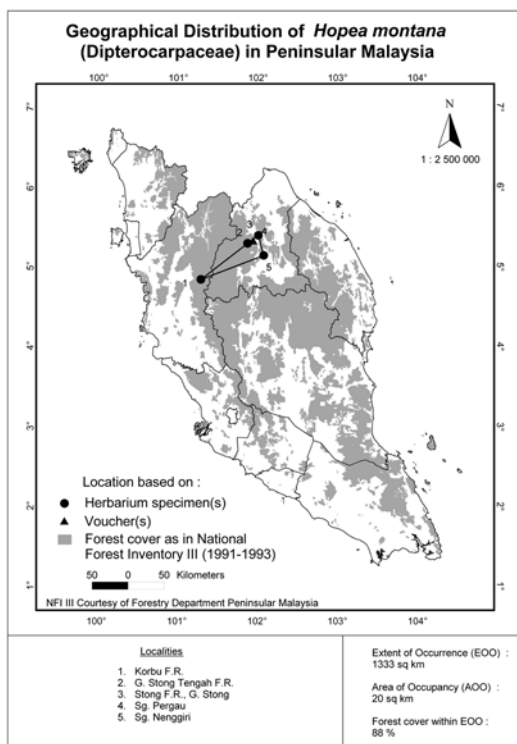
Peninsular Malaysia: Kelantan and Perak. **Sabah:** Keningau, Kota Belud, Ranau, Sipitang and Tambunan.

Habitat: Hill forests up to 1,200 m altitude.

Conservation status: NT for Malaysia.

Conservation notes: In Peninsular Malaysia, although the EOO allows an Endangered category under criterion B, it does not fully satisfy the requirements of the criterion. Furthermore, populations are found in a totally protected area.

Other assessments: CR B1+2c, D (IUCN, 2010); VU (Symington, 2004); probably VU, rare but locally frequent with most of its habitats outside the National Parks (Ashton, 2004).



Hopea myrtifolia Miq.

Vernacular name: Peninsular Malaysia: mata kucing beludu.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Kalimantan).

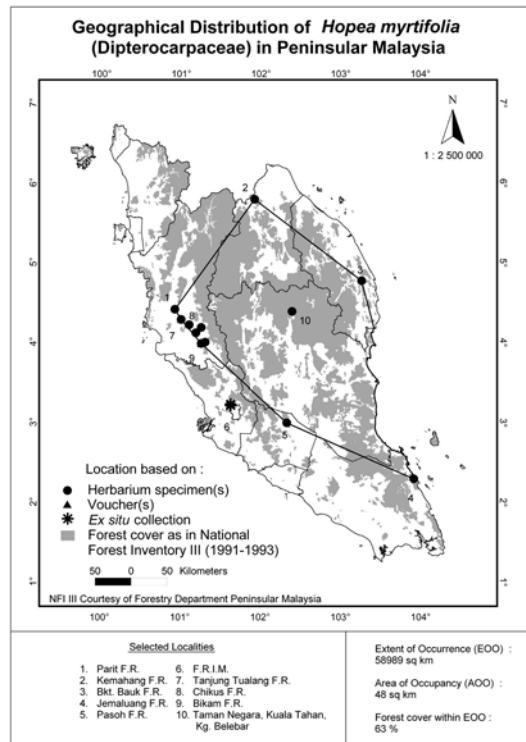
Peninsular Malaysia: Johor, Kelantan, Negeri Sembilan, Pahang, Perak and Terengganu.

Habitat: Lowland dipterocarp forests.

Conservation status: VU B2b(iii)+c(ii) for Malaysia.

Conservation notes: There are populations in the Taman Negara National Park and in research forests. Some of the Forest Reserves where it occurs are small fragments.

Other assessments: CR from forest conversion and logging (Symington, 2004).



Hopea nervosa King

Vernacular names: Peninsular Malaysia: merawan jangkang; Sabah: selangan jangkang; Sarawak: luis jangkang.

Distribution: Peninsular Malaysia and Borneo.

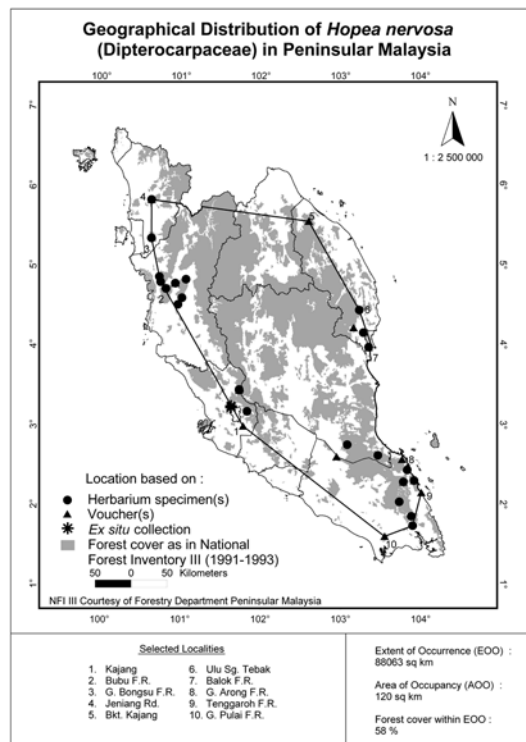
Peninsular Malaysia: Johor, Kedah, Pahang, Perak, Selangor and Terengganu. **Sabah:** Beaufort, Beluran, Lahad Datu, Kinabatangan, Keningau and Tenom.

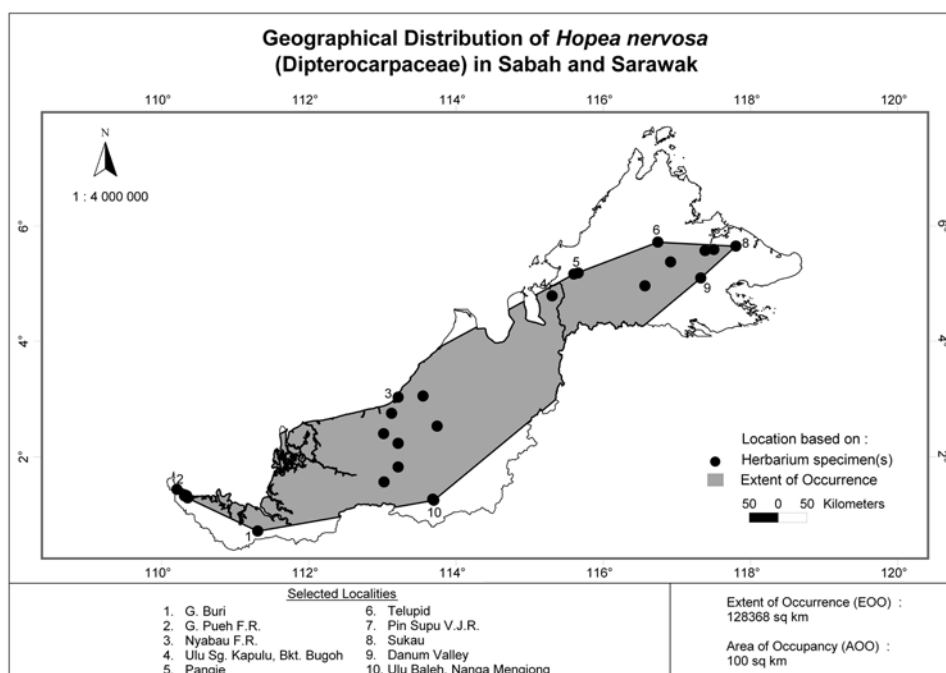
Sarawak: Belaga, Bintulu, Kapit, Lawas, Lundu, Samarahan and Tatau.

Habitat: Lowland to hill forests up to 600 m altitude.

Conservation status: NT for Malaysia; NT for Peninsular Malaysia; LC for Sabah and Sarawak.

Conservation notes: Although extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 60,000 adult stems (above 30 cm dbh) in the Permanent Reserved Forests, the species is observed to be more common. Other assessments: CR A1c, B1+2c (IUCN, 2010); EN, threats from forest conversion and logging (Symington, 2004); VU, threats from forest conversion (Ashton, 2004).





Hopea nutans Ridl.

Vernacular name: Peninsular Malaysia, Sabah and Sarawak: giam.

Distribution: Peninsular Malaysia and Borneo.

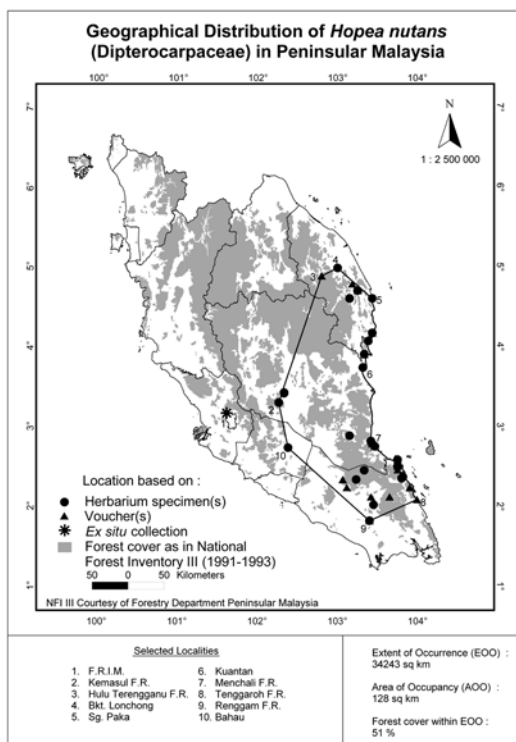
Peninsular Malaysia: Johor, Negeri Sembilan, Pahang and Terengganu. **Sabah:** Beaufort, Beluran, Kinabatangan, Kota Kinabalu, Lahad Datu, Ranau, Sandakan, Semporna, Tawau and Tenom. **Sarawak:** Kuching and Lundu.

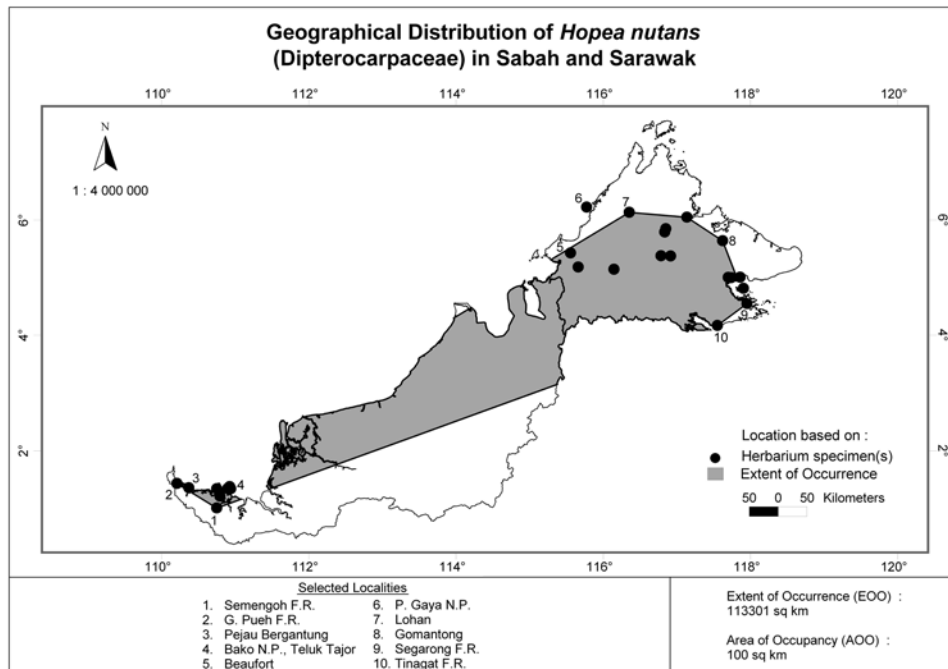
Habitat: Lowland to coastal hill forests up to 650 m altitude, in swamp forests, limestone and ultrabasic soils.

Conservation status: VUB2b(iii)+c(ii) for Malaysia; NT for Peninsular Malaysia; VU B2b(iii)+c(ii) for Sabah and Sarawak.

Conservation notes: In Peninsular Malaysia, the species is found in many Forest Reserves. In Sabah and Sarawak, several populations occur in the network of Totally Protected Areas. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 355,000 adult stems (above 30 cm dbh) in the Permanent Reserved Forests.

Other assessments: CR A1cd+2cd, B1+2c (IUCN, 2010); EN, threats from habitat conversion and logging (Symington, 2004); EN (Ashton, 2004).





Hopea odorata Roxb.

Vernacular name: Peninsular Malaysia: cengal pasir.

Distribution: Andamans, Myanmar, Indo-China, Thailand and Peninsular Malaysia.

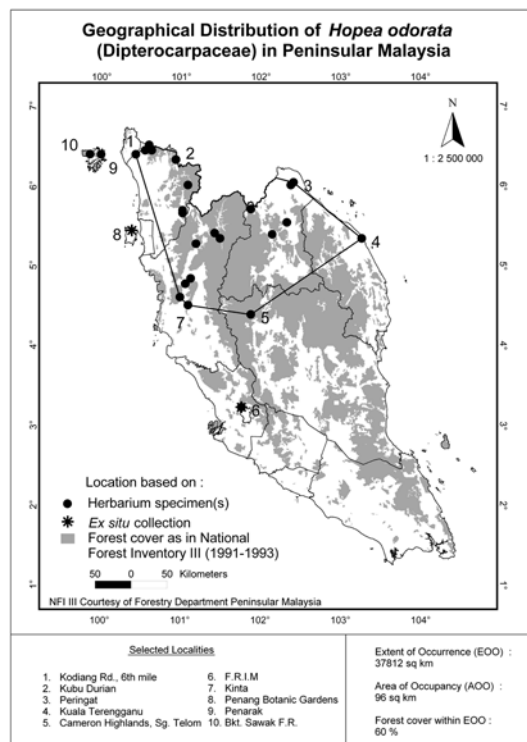
Peninsular Malaysia: Kedah, Kelantan, Pahang, Perak and Terengganu.

Habitat: Lowland dipterocarp forests and seasonally dry tropical rain forests, along riverbanks.

Conservation status: VU B2b(iii)+c(ii) for Malaysia.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 66,000 adult stems above 30 cm dbh in the Permanent Reserved Forests. The species is widely planted throughout the peninsula as a wayside tree.

Other assessments: VU A1cd+2cd (IUCN, 2010); EN (Symington, 2004).



Hopea pachycarpa (F.Heim) Symington

Fig. 7, Plates 16A–B

Vernacular names: Peninsular Malaysia: bayan; Sarawak: merkokong.

Distribution: Sumatra, Peninsular Malaysia and Borneo.

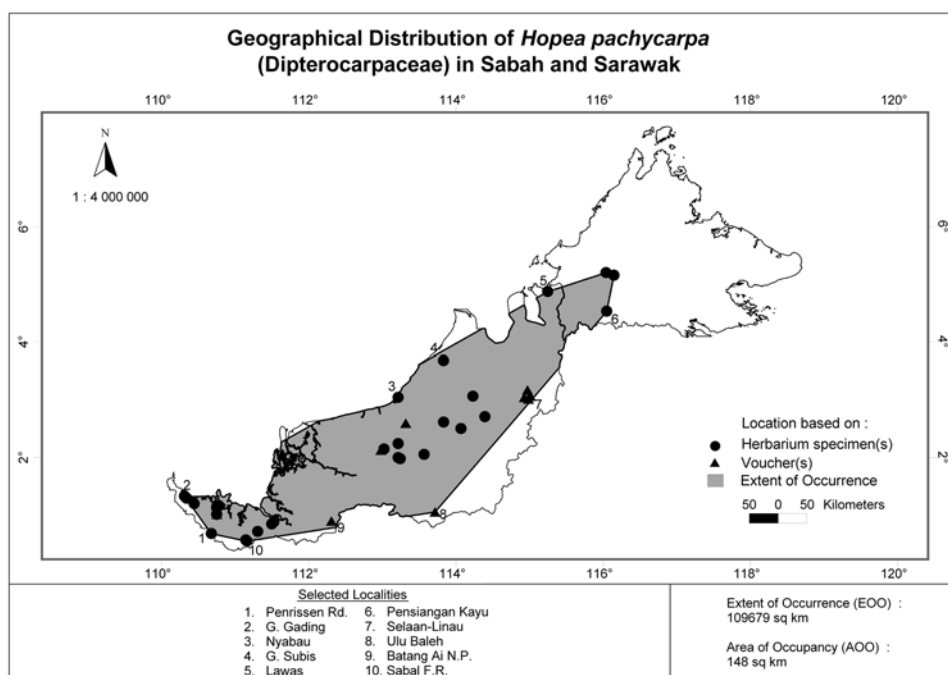
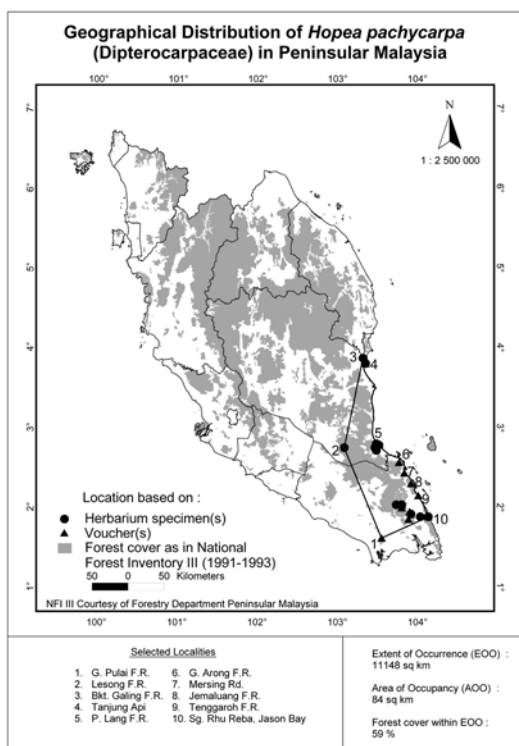
Peninsular Malaysia: Johor and Pahang. **Sabah:** Keningau and Nabawan. **Sarawak:** Belaga, Bintulu, Kapit, Kuching, Lawas, Lubok Antu, Lundu, Marudi, Miri, Serian, Simunjan, Sri Aman and Tatau.

Habitat: Lowland forests at altitudes below 400 m, in swamp forests and streamsides.

Conservation status: EN B2b(iii)+c(ii) for Malaysia; EN B2b(iii)+c(ii) for Peninsular Malaysia; VU B2b(iii)+c(ii) for Sabah and Sarawak.

Conservation notes: Although the species is widespread in Sarawak, it is considered threatened in Sabah with none of its populations known to be protected. Populations in Peninsular Malaysia are not known to occur in the Protected Areas network. At least three populations in the state of Johor, i.e., two in the district of Kota Tinggi and one in the district of Johor Bahru are currently extant.

Other assessments: VU A1c+2c (IUCN, 2010); CR and perhaps EX (Symington, 2004); VU (Ashton, 2004).



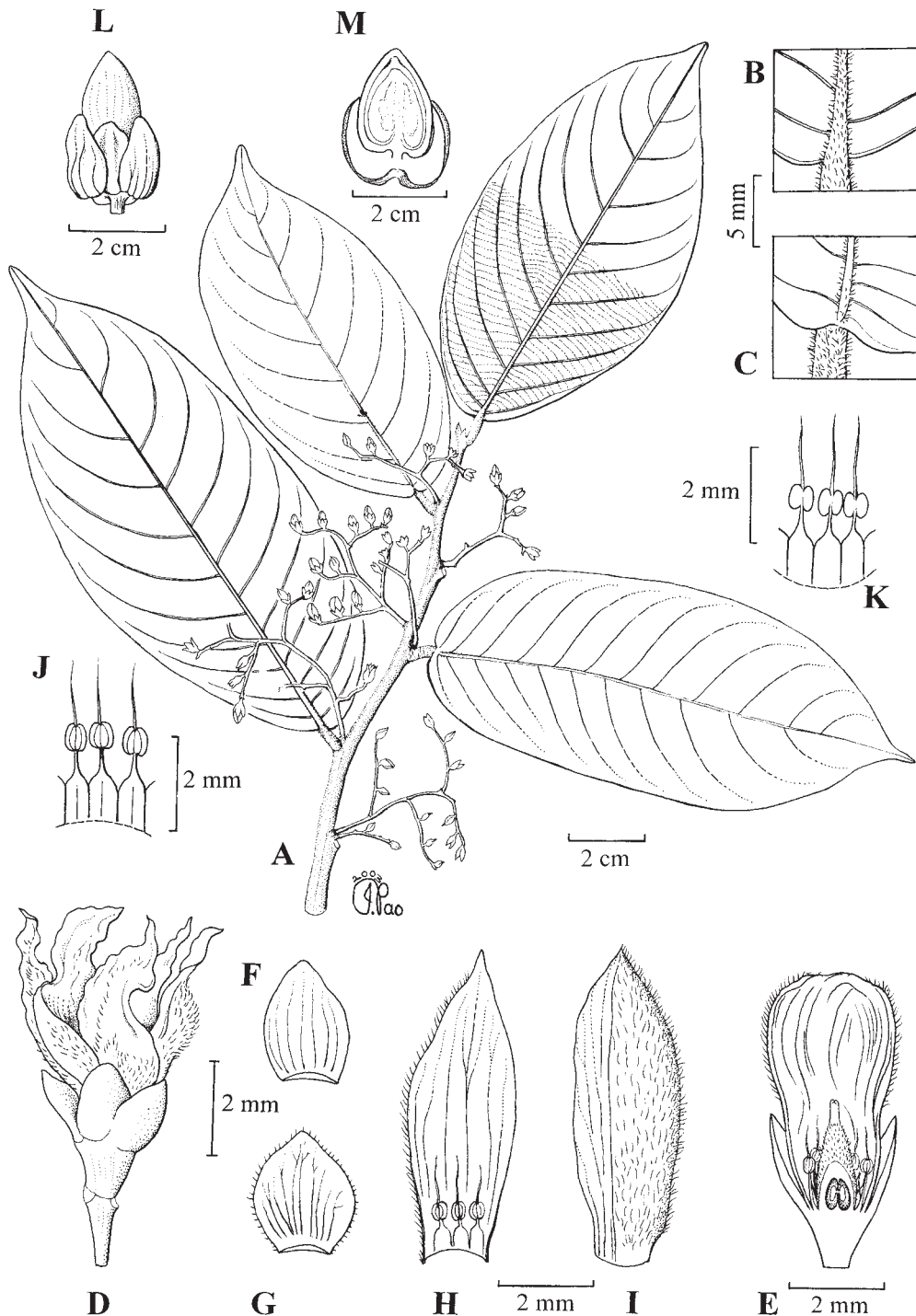


Fig. 7. *Hopea pachycarpa*. A, flowering leafy twig; B, detail of indumentum on lower leaf surface; C, detail of indumentum on upper leaf surface; D, open flower; E, longitudinal section of opened flower; F, adaxial view of outer sepal; G, adaxial view of inner sepal; H, adaxial view of petal with stamens; I, abaxial view of petal; J, adaxial view of stamens; K, abaxial view of stamens; L, fruit; M, longitudinal section of fruit (A–K from *S* 21300, L–M from *S* 36881) (Reproduced with permission from the Tree Flora of Sabah and Sarawak project).

Hopea pedicellata (Brandis) Symington

Vernacular name: Peninsular Malaysia and Sarawak: mata kucing bukit.

Distribution: Peninsular Thailand, Peninsular Malaysia and Borneo (Sabah, Sarawak and Kalimantan).

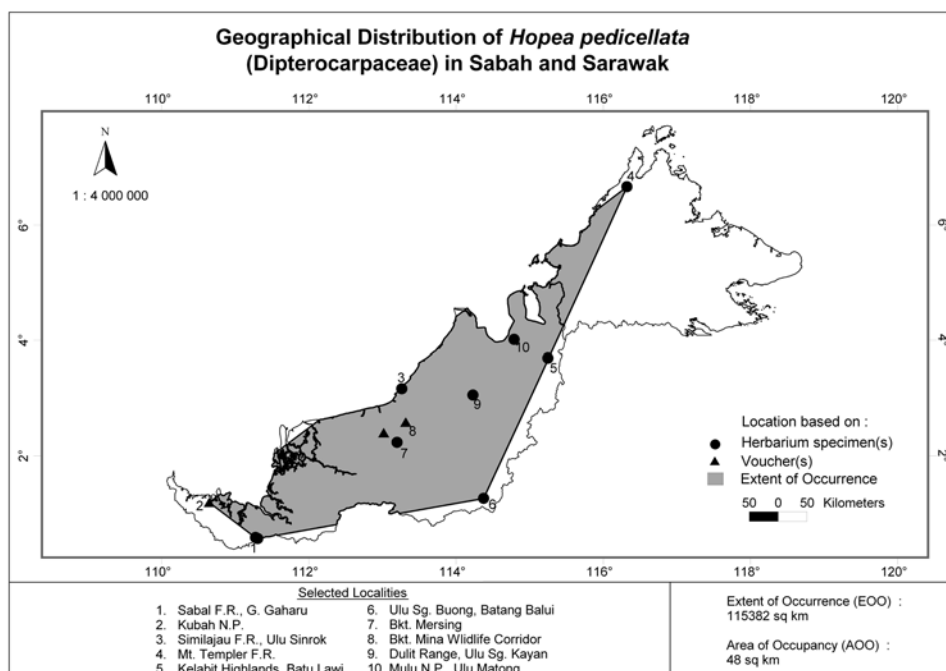
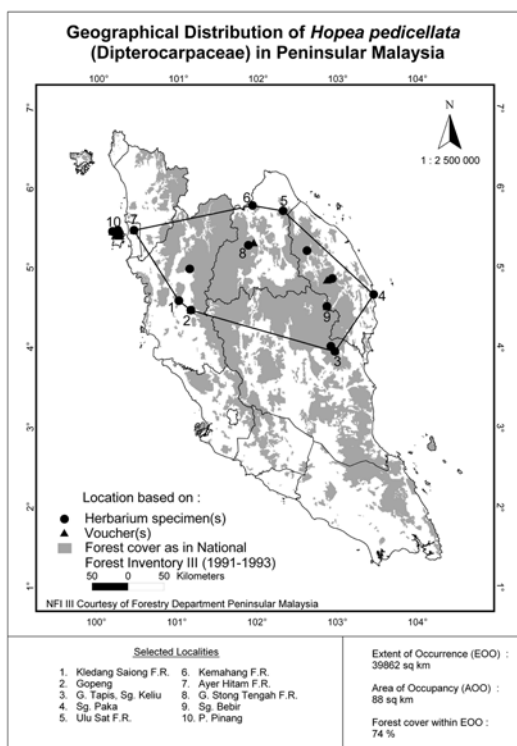
Peninsular Malaysia: Kelantan, Pahang, Perak, Penang and Terengganu. **Sabah:** Kota Belud. **Sarawak:** Belaga, Bintulu, Limbang, Marudi, Simunjan and Tatau.

Habitat: Lowland to hill forests on undulating land and ridges at altitudes to 600 m.

Conservation status: NT for Malaysia.

Conservation notes: The species is scattered and many of the Forest Reserves where it occurs have large tracts of forested areas. Because of its rather poor form, the timber may not be used in trade.

Other assessments: EN A1c+2c (IUCN, 2010); VU, threats from habitat conversion and logging (Symington, 2004); VU (Ashton, 2004).



Hopea pierrei Hance

Vernacular name: Peninsular Malaysia: merawan palung.

Distribution: Indo-China, Thailand and Peninsular Malaysia.

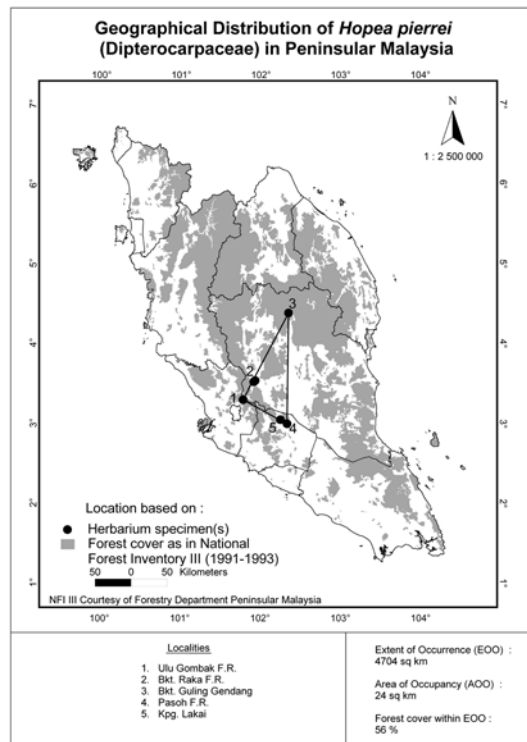
Peninsular Malaysia: Negeri Sembilan, Pahang and Selangor.

Habitat: Lowland to hill forests up to 650 m altitude.

Conservation status: VU B1ab(iii) for Malaysia.

Conservation notes: A population occurs in Taman Negara National Park.

Other assessments: EN A1c+2c, B1+2c, C1, D (IUCN, 2010); EN, threats from habitat conversion and logging (Symington, 2004).



Hopea polyalathioides Symington

Vernacular name: Peninsular Malaysia: giam rambai.

Distribution: Peninsular Malaysia.

Peninsular Malaysia: Johor and Negeri Sembilan.

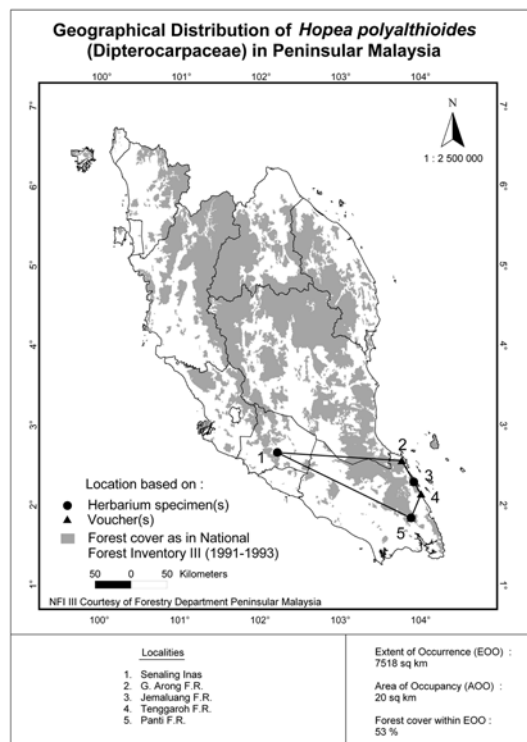
Habitat: Lowland dipterocarp forests.

Conservation status: EN B2ab(iii) for Malaysia.

Conservation notes: Six populations comprising c. 200 trees have so far been found in four Forest Reserves in Johor. Attempts are being made to protect the population in Pantu FR. The remaining reserves are small fragments.

Other assessments: CR A1c+2c, B1+2c, C1, D (IUCN, 2010); maybe EX (Symington, 2004).

Plates 16C–D



Hopea pubescens Ridl.

Vernacular name: Peninsular Malaysia: merawan bunga.

Distribution: Peninsular Malaysia.

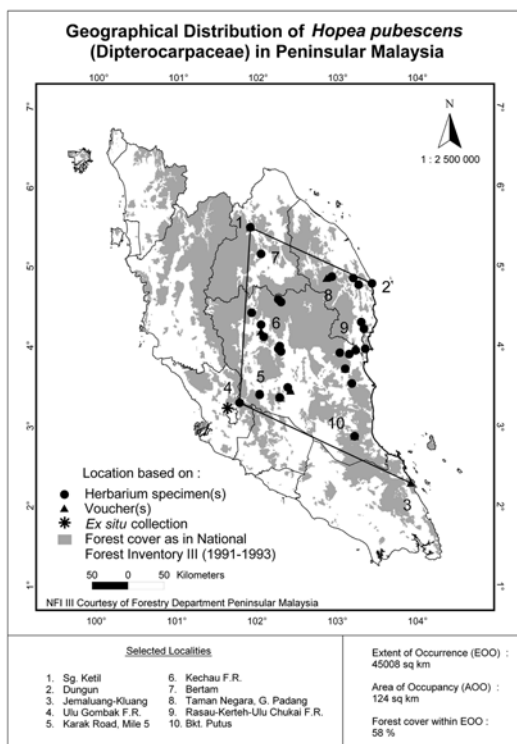
Peninsular Malaysia: Johor, Kelantan, Pahang, Selangor and Terengganu.

Habitat: Lowland dipterocarp forests, on well drained flat land and low hills.

Conservation status: VU A4c for Malaysia.

Conservation notes: Populations occur in the Taman Negara National Park. Several areas where the species is known are no longer under forest cover. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 98,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: CR A1c, B1+2c (IUCN, 2010); EN with threats from agriculture (Symington, 2004).

*Hopea sangal* Korth.

Vernacular names: Peninsular Malaysia: merawan siput; Sabah and Sarawak: gagil.

Distribution: Myanmar, Peninsular Thailand, Peninsular Malaysia, Sumatra, Java, Bali and Borneo.

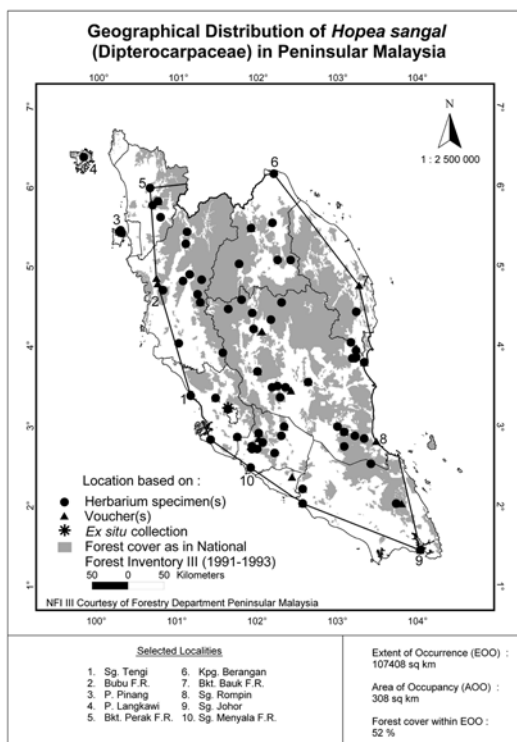
Peninsular Malaysia: Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Penang, Perak, Selangor and Terengganu. **Sabah:** Beluran, Kinabatangan, Kudat, Lahad Datu, Ranau, Sandakan, Semporna, Tawau and Tenom. **Sarawak:** Bau, Belaga, Bintulu, Kuching and Lundu.

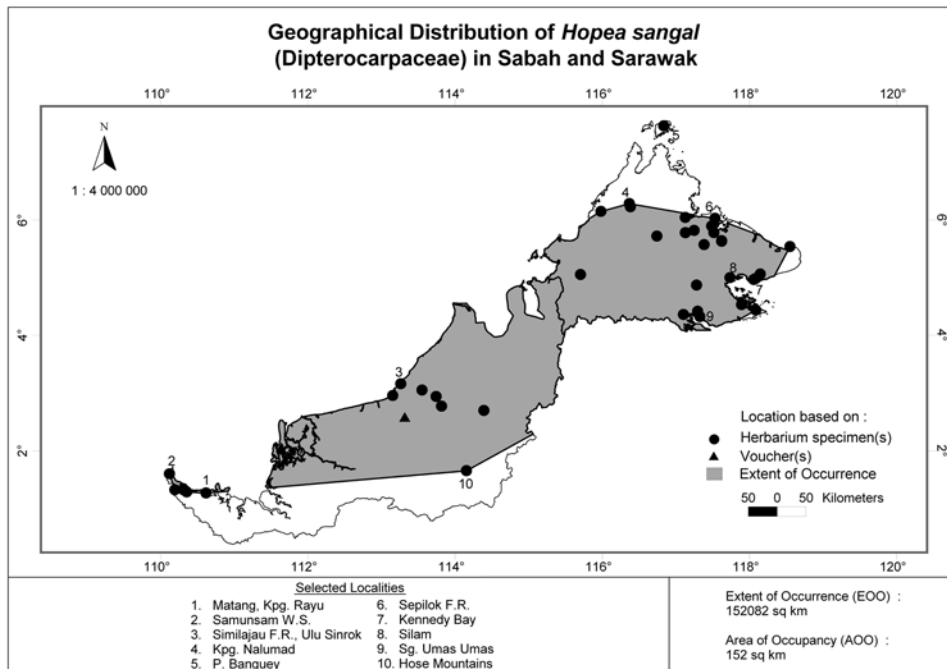
Habitat: Lowland to hill forests up to 500 m altitude near riverbanks and in seasonally dry tropical rain forests.

Conservation status: NT for Malaysia.

Conservation notes: In 1985, at least 18 trees above 1 cm diameter were recorded from the Pasoh 50-ha research plot. 72.3% had diameters less than 5 cm. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 30,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: CR A1cd, B1+2c, C1, D (IUCN, 2010); VU (Ashton, 2004; Symington, 2004).





Hopea semicuneata Symington

Vernacular names: Peninsular Malaysia: sama rupa cengal; Sabah: selangan batu jantan.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sabah and Sarawak).

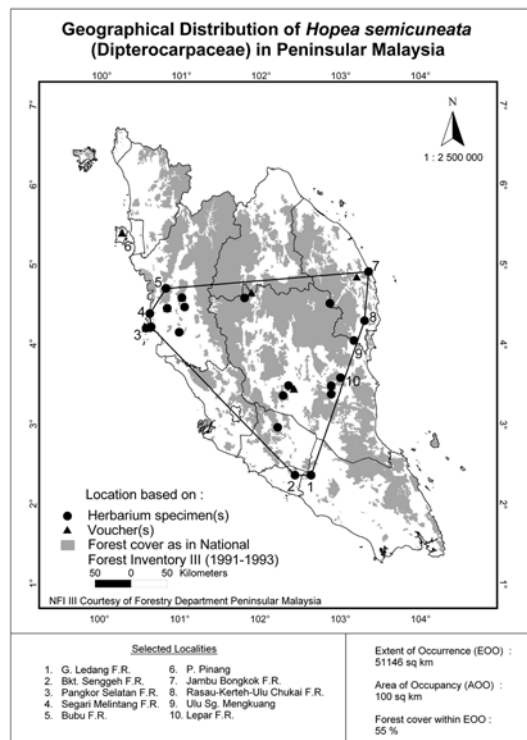
Peninsular Malaysia: Johor, Malacca, Negeri Sembilan, Pahang, Penang, Perak and Terengganu.

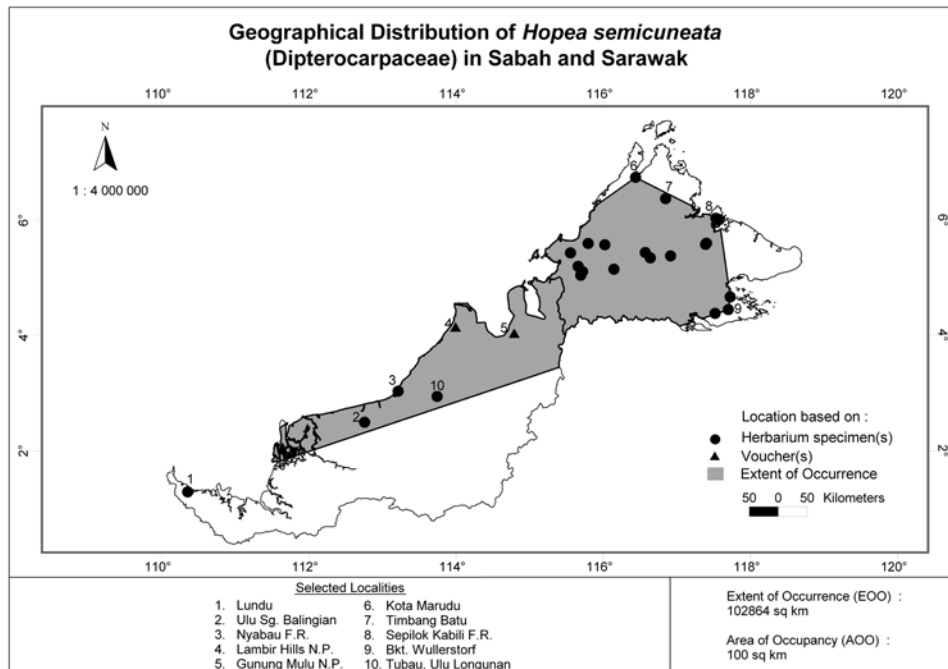
Sabah: Beaufort, Keningau, Kinabatangan, Kota Marudu, Lahad Datu, Papar, Sandakan, Tawau and Tenom. **Sarawak:** Bintulu, Lundu, Miri and Mukah.

Habitat: Lowland to hill forests up to 400 m altitude and in coastal forests and periodically flooded alluvium.

Conservation status: VUB2b(iii)+c(ii) for Malaysia; NT for Peninsular Malaysia; VU B2b(iii)+c(ii) for Sabah and Sarawak.

Other assessments: CR A1cd, B1+2c (IUCN, 2010); CR, threats from habitat conversion in the lowlands (Symington, 2004); EN (Ashton, 2004).





Hopea subalata Symington

Plates 17A–B

Vernacular name: Peninsular Malaysia: merawan kanching.

Distribution: Peninsular Malaysia.

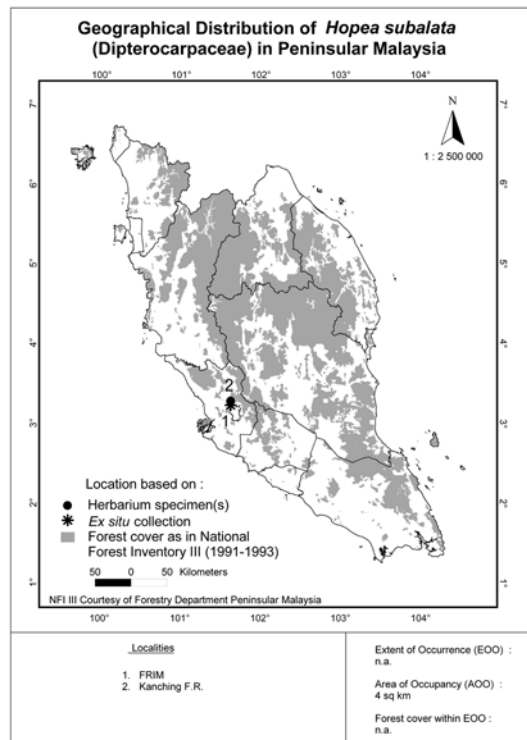
Peninsular Malaysia: Selangor (Kanching).

Habitat: Lowland dipterocarp forests.

Conservation status: CR B2ab(iii) for Malaysia.

Conservation notes: One site is now a High Conservation Value Forest. The EN D1 category and criterion given by Oldfield *et al.* (1998) was upgraded to CR A4cB2 (Chua *et al.*, 2004).

Other assessments: CR B1ab(i,ii,iii,iv)+2ab(i,ii,iii,iv) + C2a(i) (IUCN, 2010); VU (Symington, 2004).



Hopea sub lanceolata Symington

Plates 17C–E

Vernacular name: Peninsular Malaysia: merawan jeruai.

Distribution: Peninsular Malaysia.

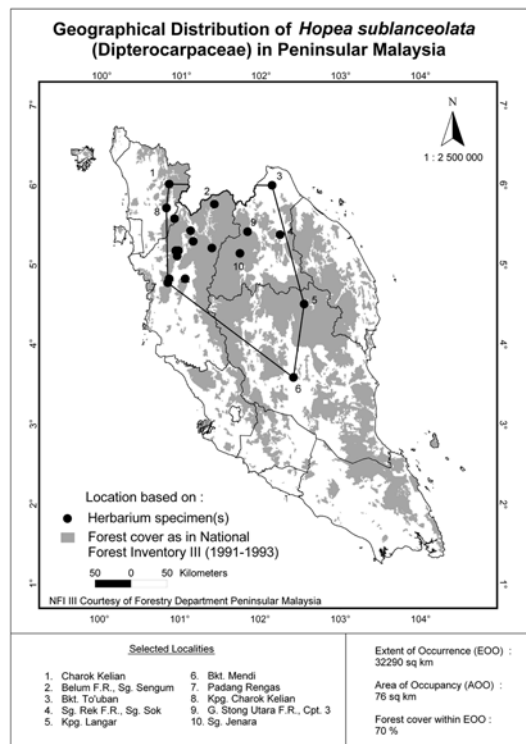
Peninsular Malaysia: Kedah, Kelantan, Pahang and Perak.

Habitat: Lowland dipterocarp forests on undulating land and low spurs of hills between 70 to 150 m altitude.

Conservation status: NT for Malaysia.

Conservation notes: One population occurs in the Royal Belum State Park.

Other assessments: CR A1c, B1+2c (IUCN, 2010); CR, little of its habitat remains (Symington, 2004).

*Hopea sulcata* Symington

Plates 18A–B

Vernacular name: Peninsular Malaysia: merawan meranti.

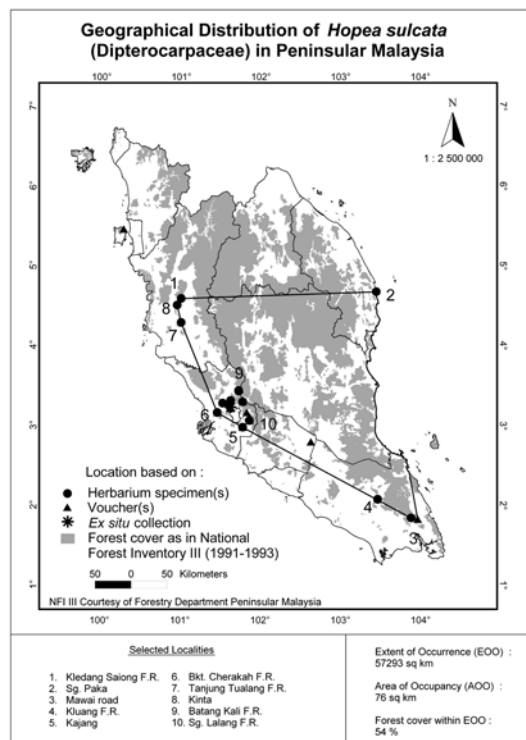
Distribution: Peninsular Malaysia.

Peninsular Malaysia: Johor, Negeri Sembilan, Penang, Perak, Selangor and Terengganu.

Habitat: Lowland to hill forests on ridges between 100 and 400 m altitude.

Conservation status: NT for Malaysia.

Other assessments: CR A1c, B1+2c (IUCN, 2010); VU, threats from forest conversion (Symington, 2004).



Neobalanocarpus heimii (King) P.S.Ashton

Plates 18C–D

Vernacular name: Peninsular Malaysia: chengal.

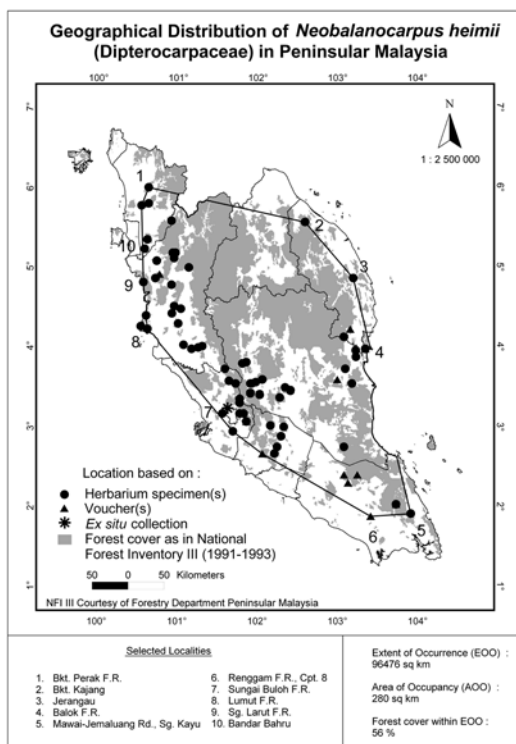
Distribution: Peninsular Thailand and Peninsular Malaysia.

Peninsular Malaysia: Johor, Kedah, Negeri Sembilan, Pahang, Perak, Selangor and Terengganu.

Habitat: Lowland to hill dipterocarp forests up to 900 m altitude.

Conservation status: NT for Malaysia.

Conservation notes: Although the species is widespread and found in abundance in many forest reserves, it is a highly sought-after timber and is selectively felled according to harvesting criteria. No populations have been recorded so far from the network of Totally Protected Areas, except for those in research forests. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 279,000 adult stems above 30 cm dbh in the Permanent Reserved Forests. In Pasoh FR, Negeri Sembilan, at least 3,291 trees above 1 cm diameter were recorded from a 50-ha research plot in 1985. 88.9% of this had diameters less than 5 cm. Other assessments: VU A1cd (IUCN, 2010); VU (Symington, 2004).

*Parashorea densiflora* Slooten et Symington

Vernacular name: Peninsular Malaysia: meranti pasir.

Distribution: Peninsular Malaysia.

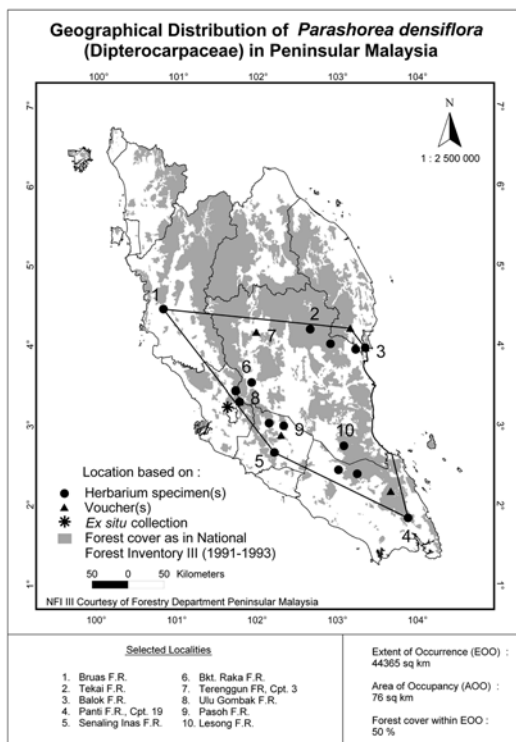
Peninsular Malaysia: Johor, Negeri Sembilan, Pahang, Perak, Selangor and Terengganu.

Habitat: Lowland to hill dipterocarp forests up to 450 m altitude.

Conservation status: NT for Malaysia.

Conservation notes: Populations occur in the research forest at Pasoh FR, Negeri Sembilan. Populations occur in the research forest at Pasoh FR. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 324,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: EN A1cd, B1+2c (IUCN, 2010); EN, perhaps CR with threats from land conversion (Symington, 2004).



Parashorea globosa Symington

Vernacular name: Peninsular Malaysia: meranti pasir daun besar.

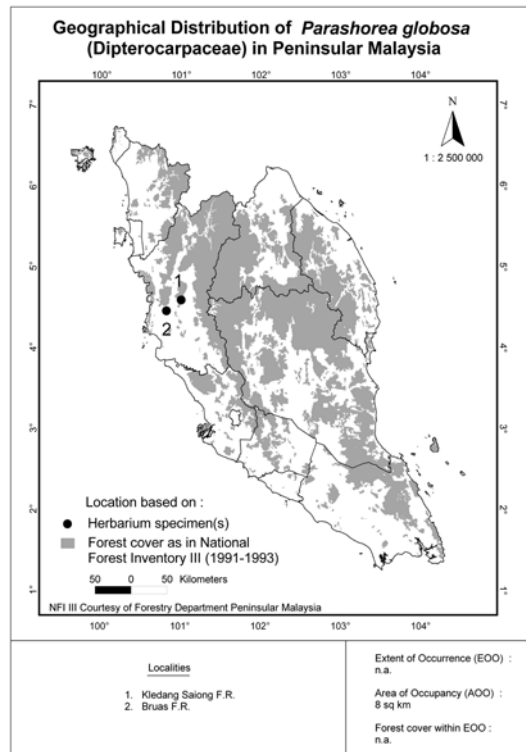
Distribution: Sumatra and Peninsular Malaysia.

Peninsular Malaysia: Perak.

Habitat: Lowland dipterocarp forests.

Conservation status: CR B2b(iii)+c(ii) for Malaysia.

Conservation notes: No population occurs in the Totally Protected Areas network. One locality is no longer forested. There has been no collection after the 1940s. Several individuals have been located in Kledang Saiong FR in 2009; the search is on-going. Other assessments: EN B1+2e, D (IUCN, 2010); CR from land conversion (Symington, 2004).



Parashorea stellata Kurz

Vernacular name: Peninsular Malaysia: gerutu-gerutu.

Distribution: Myanmar, Indo-China, Thailand and Peninsular Malaysia.

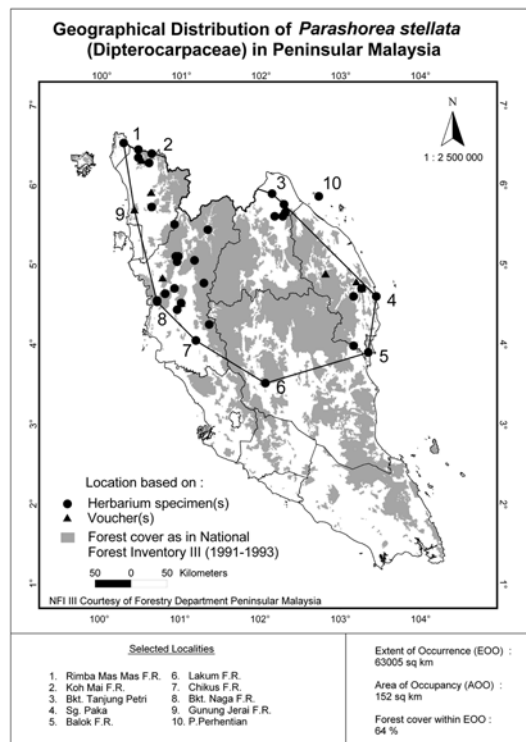
Peninsular Malaysia: Kedah, Kelantan, Pahang, Perak, Perlis and Terengganu.

Habitat: Lowland and hill dipterocarp forests up to 500 m altitude.

Conservation status: LC for Malaysia.

Conservation notes: Some of the Forest Reserves where the species occurs have large tracts of forested areas. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 805,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: CR A1cd, B1+2c (IUCN, 2010); CR (Symington, 2004).



Plates 19A–C

Shorea acuminata Dyer

Plates 20A–B

Vernacular name: Peninsular Malaysia: meranti rambai daun.

Distribution: Sumatra and Peninsular Malaysia.

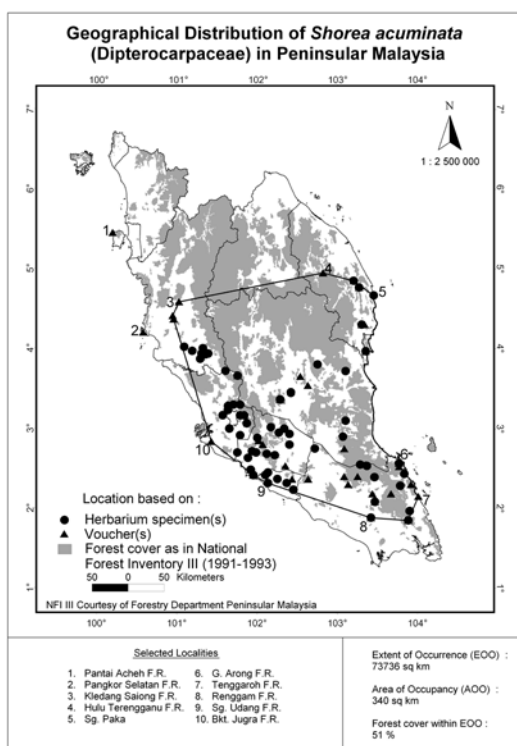
Peninsular Malaysia: Johor, Malacca, Negeri Sembilan, Pahang, Penang, Perak, Selangor and Terengganu.

Habitat: Lowland forests including regenerated logged-over forests up to 300 m altitude.

Conservation status: LC for Malaysia.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 1.54 million adult stems above 30 cm dbh in the Permanent Reserved Forests. At least 2,211 trees above 1 cm diameter were recorded from the Pasoh 50-ha research plot in 1985 with 85.2% having diameters less than 5 cm.

Other assessments: CR A1cd (IUCN, 2010); NT (Symington, 2004).

*Shorea assamica* Dyer ssp. *globifera* (Ridl.) Symington

Vernacular name: Peninsular Malaysia: meranti pipit.

Distribution: Peninsular Thailand, Peninsular Malaysia and Sumatra.

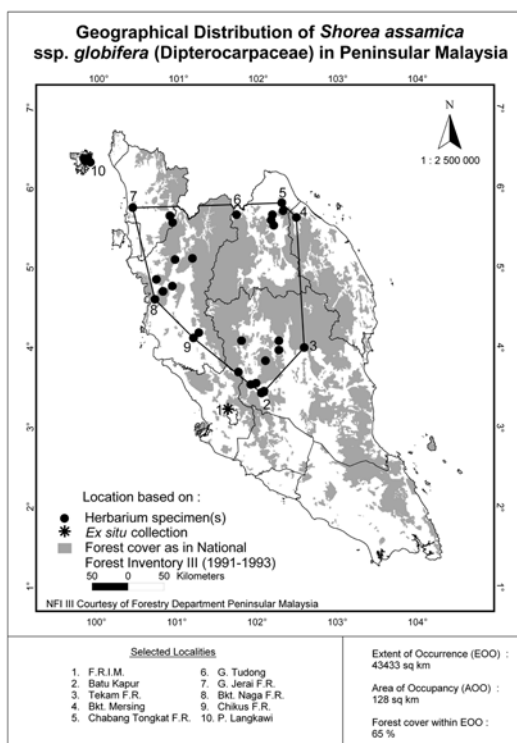
Peninsular Malaysia: Kedah, Kelantan, Pahang, Perak and Terengganu.

Habitat: Lowland to hill dipterocarp forests.

Conservation status: NT for Malaysia.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 111,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: CR A1cd (IUCN, 2010); CR (except in Langkawi) (Symington, 2004).



Shorea atrinervosa Symington

Fig. 8

Vernacular names: Peninsular Malaysia: balau hitam; Sabah and Sarawak: selangan batu hitam.

Distribution: Sumatra, Peninsular Malaysia and Borneo.

Peninsular Malaysia: Pahang and Terengganu.

Sabah: Beaufort, Beluran, Kinabatangan, Lahad Datu, Ranau, Sandakan, Sipitang, Tawau and Tenom.

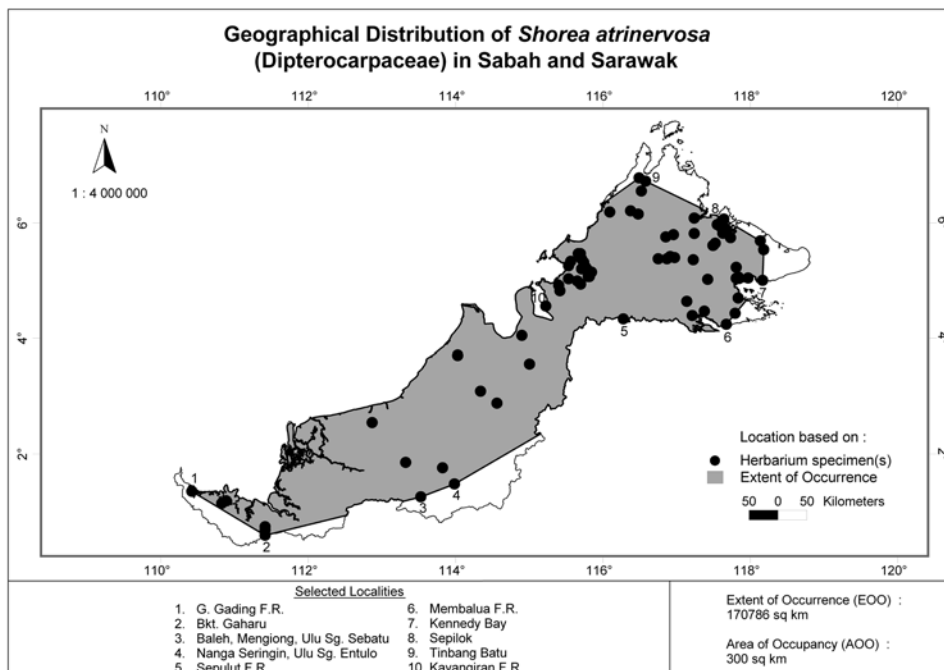
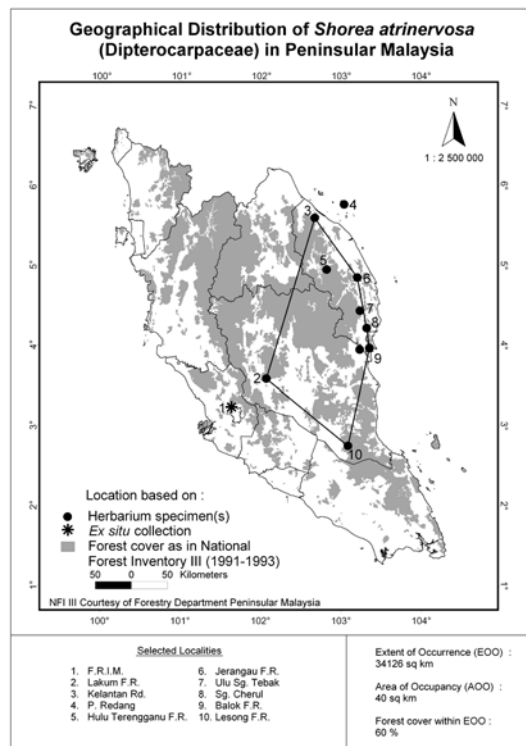
Sarawak: Bintulu, Kapit, Kuching, Lawas, Lundu, Marudi, Miri, Mukah, Simunjan and Tatau.

Habitat: Lowland to hill forests at altitudes to 600 m.

Conservation status: EN A4c for Malaysia; EN A4c for Peninsular Malaysia; LC for Sabah and Sarawak.

Conservation notes: In Peninsular Malaysia, the species is not known in the network of Protected Areas. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 15,000 adult stems above 30 cm dbh in the Permanent Reserved Forests. At least 227 trees above 1 cm diameter were recorded from Lambir Hills 52-ha research plot in 1991 with 71.4% having diameters less than 5 cm.

Other assessments: VU or may now be EN, from habitat conversion threats (Symington, 2004); VU (Ashton, 2004).



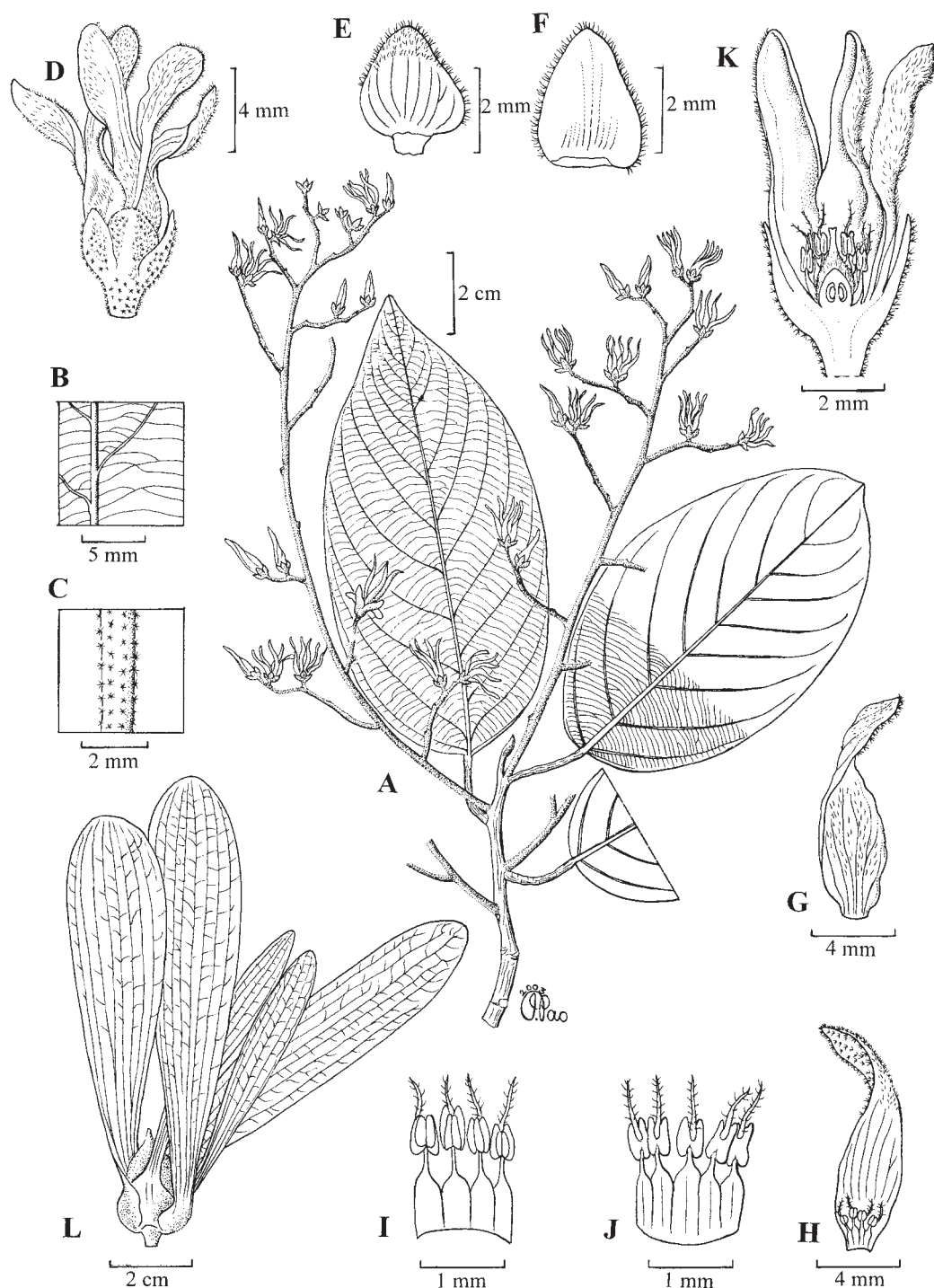


Fig. 8. *Shorea atrinervosa*. A, flowering leafy twig; B, detail of venation on lower leaf surface; C, detail of indumentum on midrib; D, open flower; E, adaxial view of outer sepal; F, adaxial view of inner sepal; G, abaxial side of petal; H, adaxial side of petal with stamens; I, adaxial view of stamens; J, abaxial view of stamens; K, longitudinal section of opened flower; L, fruit (A–C from *SAN 15091*, D–K from *SAN 27274*, L from *SAN 16957*) (Reproduced with permission from the Tree Flora of Sabah and Sarawak project).

Shorea balanocarpoides Symington

Vernacular names: Peninsular Malaysia: damar katup; Sarawak: lun gondol.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sarawak and Brunei).

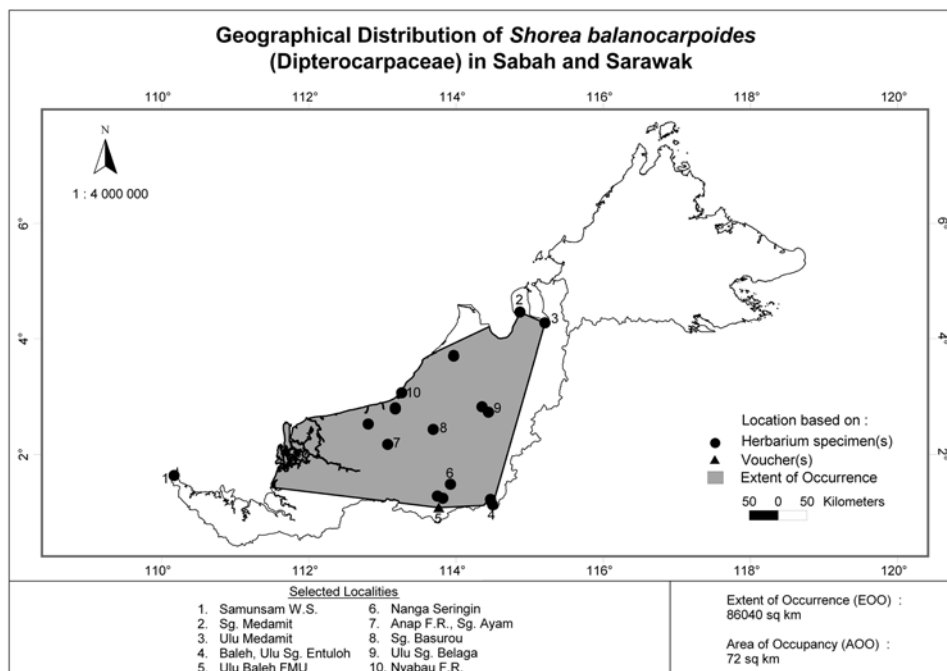
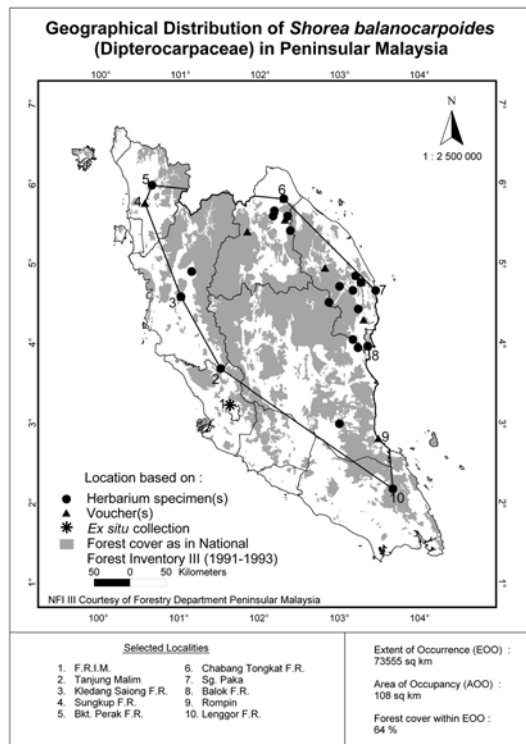
Peninsular Malaysia: Johor, Kedah, Kelantan, Pahang, Perak and Terengganu. **Sarawak:** Belaga, Bintulu, Kapit, Limbang, Lundu and Miri.

Habitat: Lowland to hill forests up to 700 m altitude.

Conservation status: NT for Malaysia; LC for Peninsular Malaysia; NT for Sarawak.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 763,000 stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: EN A1cd (IUCN, 2010); EN from logging and habitat conversion (Symington, 2004); VU (Ashton, 2004).



Shorea bentongensis Foxw.

Vernacular name: Peninsular Malaysia: meranti mengkai.

Distribution: Peninsular Malaysia.

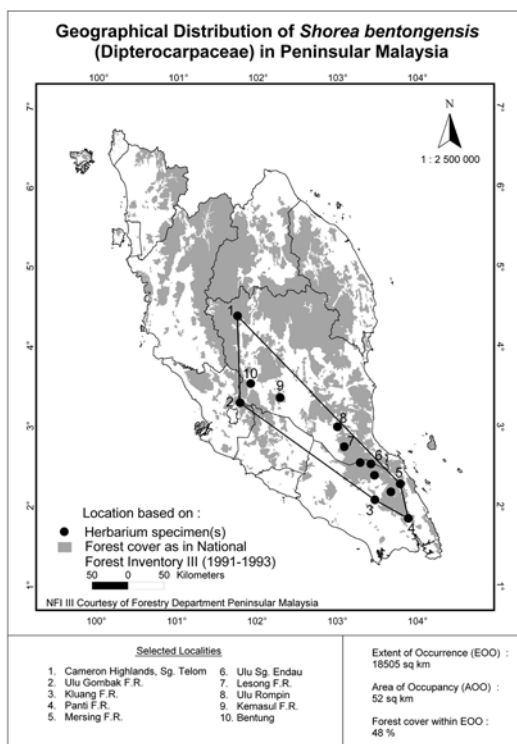
Peninsular Malaysia: Johor, Pahang and Selangor.

Habitat: Lowland to hill dipterocarp forests.

Conservation status: EN B2b(iii)+c(iv) for Malaysia.

Conservation notes: Populations occur in the Endau-Rompin State Park. Many of the Forest Reserves where it is known are extant.

Other assessments: EN A1c (IUCN, 2010); EN with threats from habitat conversion (Symington, 2004).

*Shorea blumutensis* Foxw.

Plates 20C–D

Vernacular names: Peninsular Malaysia: damar hitam kelim, meranti kelim.

Distribution: Sumatra and Peninsular Malaysia.

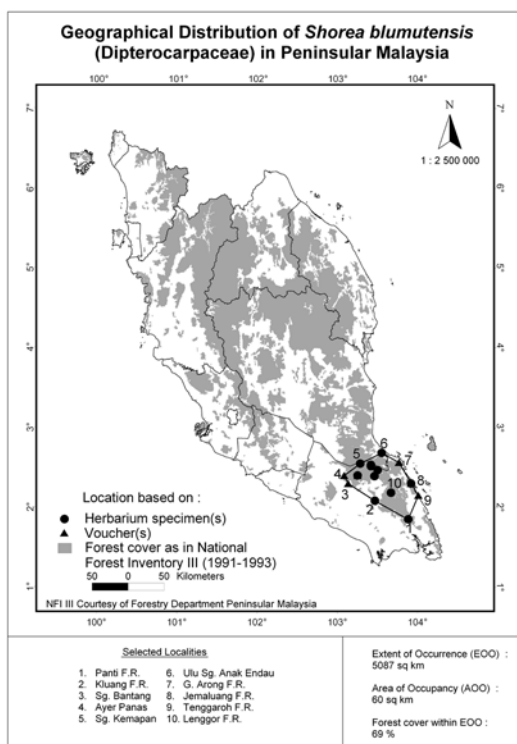
Peninsular Malaysia: Johor and Pahang.

Habitat: Lowland to hill dipterocarp forests up to 450 m altitude.

Conservation status: EN B1b(iii)+c(iii) for Malaysia.

Conservation notes: Although endangered, the forest cover change has stabilised since the mid 1990s. Populations are found in the Endau-Rompin State Park. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 30,000 adult stems (above 30 cm dbh) in the Permanent Reserved Forests.

Other assessments: CR A1cd+2cd (IUCN, 2010); CR, threats from logging (Symington, 2004).



Shorea bracteolata Dyer

Vernacular names: Peninsular Malaysia and Sarawak: meranti pa'ang; Sabah: melapi pa'ang.

Distribution: Sumatra, Peninsular Malaysia, Singapore and Borneo.

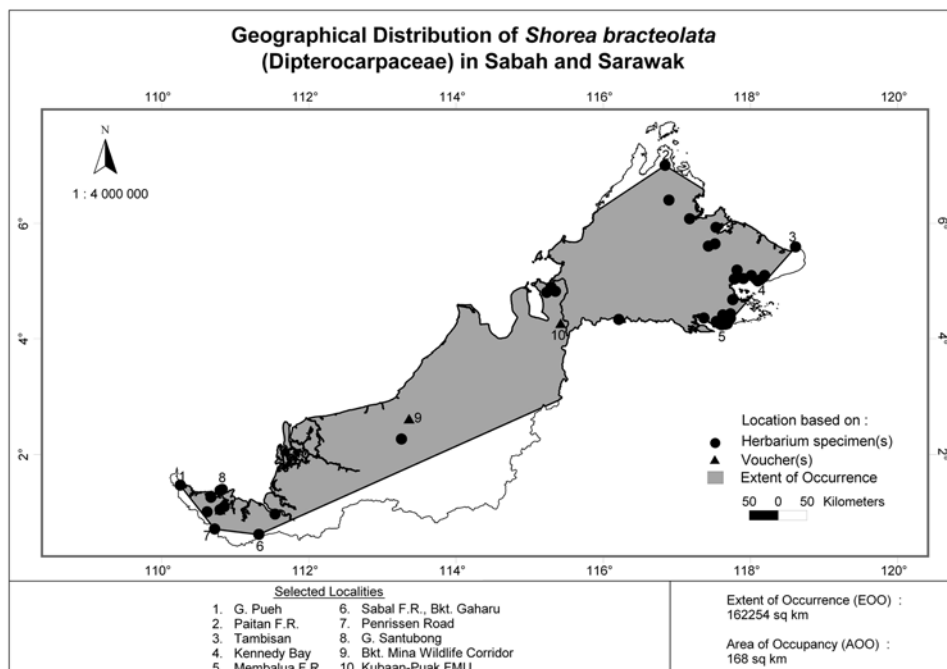
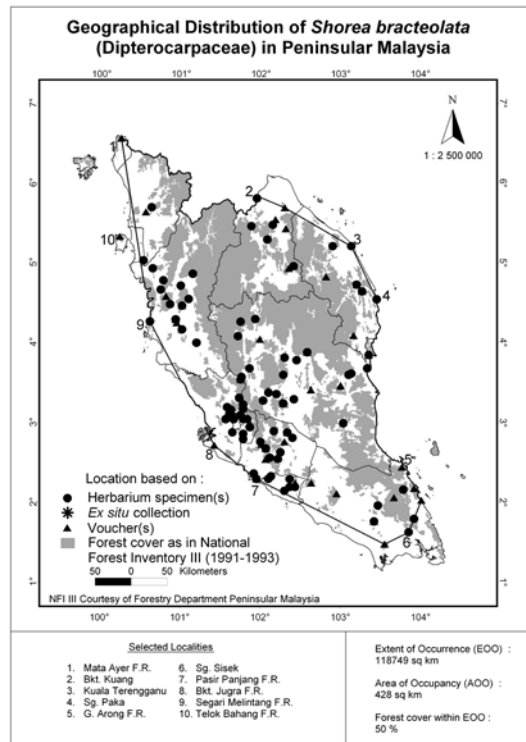
Peninsular Malaysia: Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Penang, Perak, Perlis, Selangor and Terengganu. **Sabah:** Beluran, Kinabatangan, Lahad Datu, Pitas, Sandakan and Tawau. **Sarawak:** Kuching, Lundu, Lawas, Simunjan, Sri Aman and Tatau.

Habitat: Lowland to hill forests up to 700 m altitude, often on coastal hills.

Conservation status: NT for Malaysia; LC for Peninsular Malaysia; NT for Sabah and Sarawak.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 2 million stems above 30 cm dbh in the Permanent Reserved Forests. In 1985, at least 1,135 trees above 1 cm diameter were recorded from the 50-ha research plot at Pasoh FR. 82.5% of this had diameters less than 5 cm.

Other assessments: EN A1cd+2cd (IUCN, 2010); EN, threats from habitat conversion (Symington, 2004); VU (Ashton, 2004).



Shorea ciliata King

Vernacular name: Peninsular Malaysia: balau gunung.

Distribution: Peninsular Malaysia.

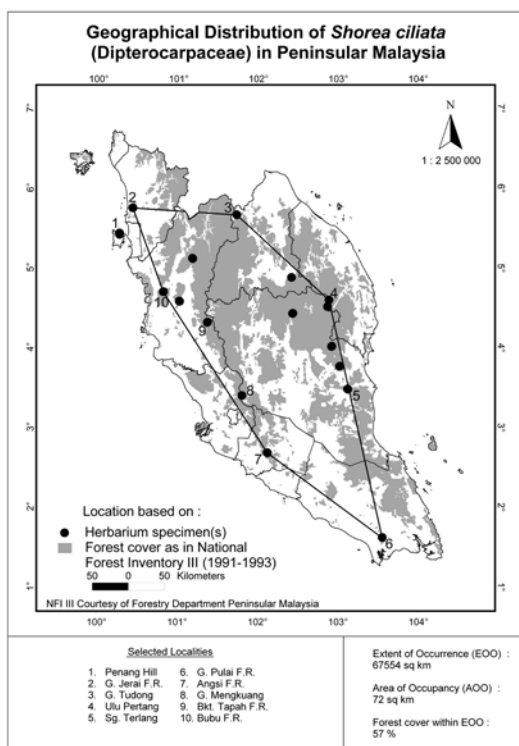
Peninsular Malaysia: Johor, Kedah, Kelantan, Negeri Sembilan, Pahang, Penang, Perak and Terengganu.

Habitat: Hill dipterocarp forests between 300 m (in coastal ranges) to 1,100 m altitude.

Conservation status: NT for Malaysia.

Conservation notes: Areas above 1,000 m altitude are classed under the Land Capability Classification System. Forest areas in coastal ranges are severely fragmented. There is a need to gazette coastal ranges as totally protected.

Other assessments: EN A1cd+2cd (IUCN, 2010); EN, threats from logging (Symington, 2004).



Shorea collina Ridl.

Vernacular name: Peninsular Malaysia: balau merah.

Distribution: Peninsular Malaysia.

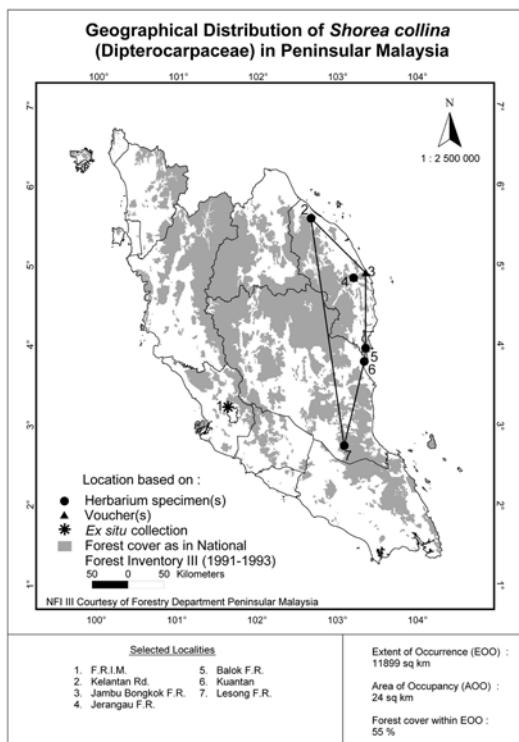
Peninsular Malaysia: Pahang and Terengganu.

Habitat: Lowland dipterocarp forests.

Conservation status: VU B1ab(iii) for Malaysia.

Conservation notes: No populations are known to occur in the network of Protected Areas. The Forest Reserves where it occurs are fragmented. The habitat status for several State Land areas requires checking. Johor has been mistakenly recorded in Symington (2004). Extrapolation from the Peninsular Malaysian Third National Forest Inventory (1991) data gave an estimated 78,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: CR A1cd+2cd, C2a (IUCN, 2010); CR, threats from forest conversion (Symington, 2004).



Shorea curtisii Dyer ex Brandis ssp. *curtisii*

Plates 21A–C

Vernacular name: Peninsular Malaysia, Sabah and Sarawak: seraya.

Distribution: Peninsular Thailand, Sumatra, Peninsular Malaysia and Borneo (Sabah, Sarawak and Brunei).

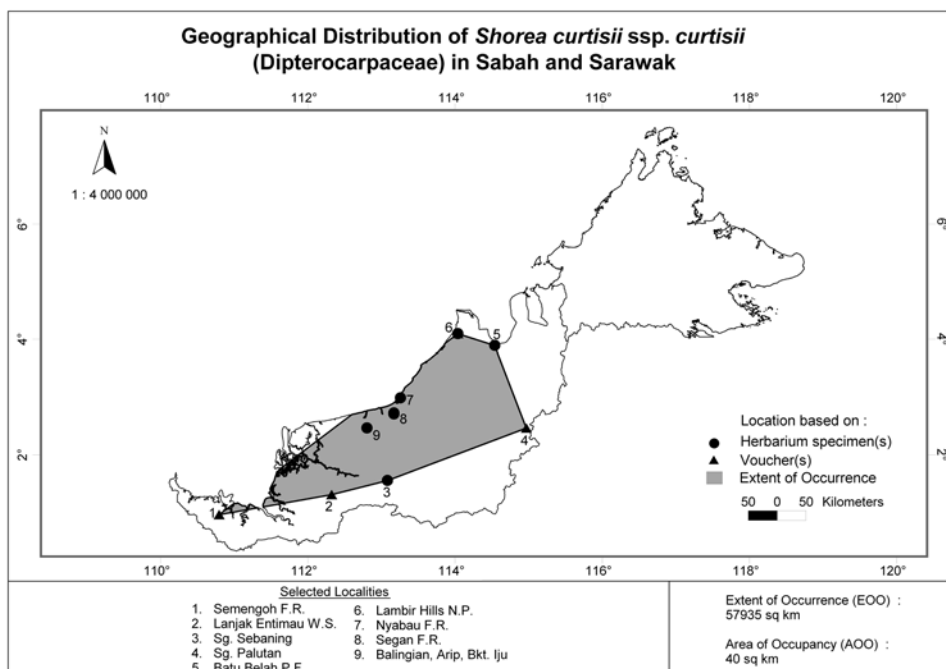
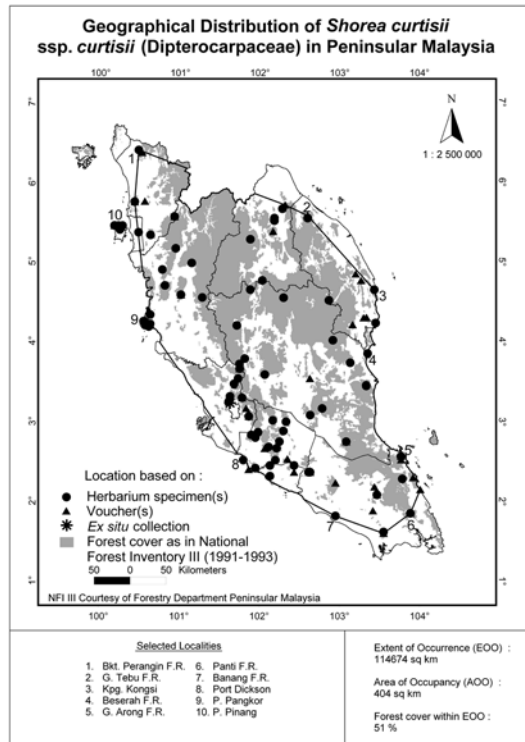
Peninsular Malaysia: Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Penang, Perak, Selangor and Terengganu. **Sabah:** Sipitang. **Sarawak:** Bintulu, Kapit, Miri and Mukah.

Habitat: Lowland to upper hill forests up to 1,200 m altitude and in seasonally dry tropical rain forests and coastal hills.

Conservation status: NT for Malaysia; LC for Peninsular Malaysia; NT for Sabah and Sarawak.

Conservation notes: The species is reported from the Sipitang district in Sabah (Ashton, 2004). It occurs in the network of Totally Protected Areas. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 11.6 million stems above 30 cm dbh in the Permanent Reserved Forests. In 1991, at least 163 trees above 1 cm diameter were recorded from Lambir Hills 52-ha research plot. 52.8% of this had diameters less than 5 cm.

Other assessments: LR/lc (IUCN, 2010); LC (Symington, 2004); VU in Sarawak, CR in Sabah (Ashton, 2004).



Shorea curtisii Dyer ex King ssp. *grandis* P.S.Ashton

Plate 22A

Vernacular name: Peninsular Malaysia: seraya daun besar.

Distribution: Peninsular Malaysia.

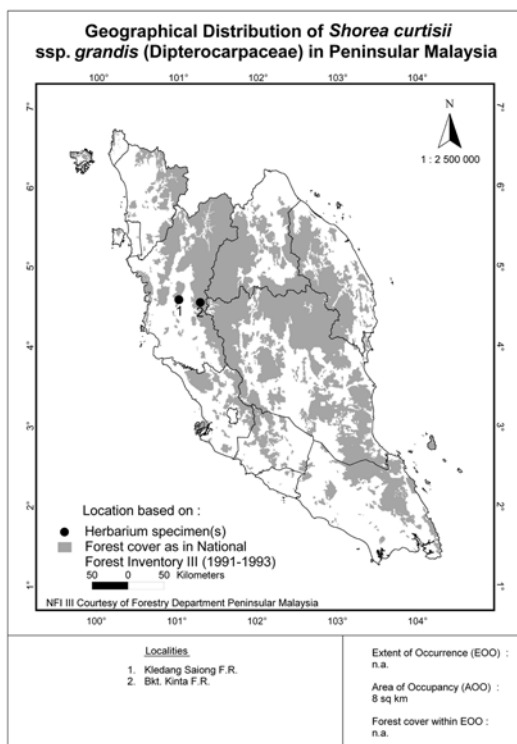
Peninsular Malaysia: Perak.

Habitat: Lowland to hill dipterocarp forests.

Conservation status: EN B1ab(iii) for Malaysia.

Conservation notes: Large tracts of forest remain in the respective Forest Reserves. However none of the sites are totally protected.

Other assessment: EN, threats from logging (Symington, 2004).

*Shorea dasyphylla* Foxw.

Vernacular name: Peninsular Malaysia and Sarawak: meranti batu.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sabah, Sarawak and Kalimantan).

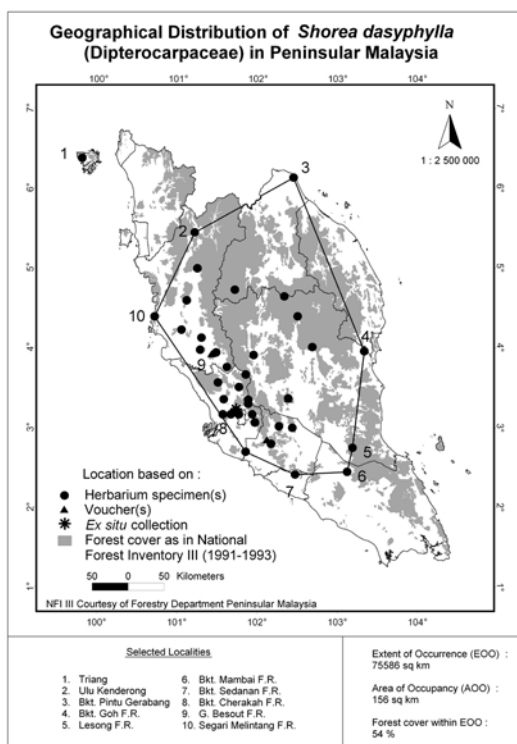
Peninsular Malaysia: Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Perak and Selangor. **Sabah:** Keningau and Tambunan.

Sarawak: Bau, Bintulu, Kapit, Kuching, Lawas, Limbang, Lundu, Samarahan and Simunjan.

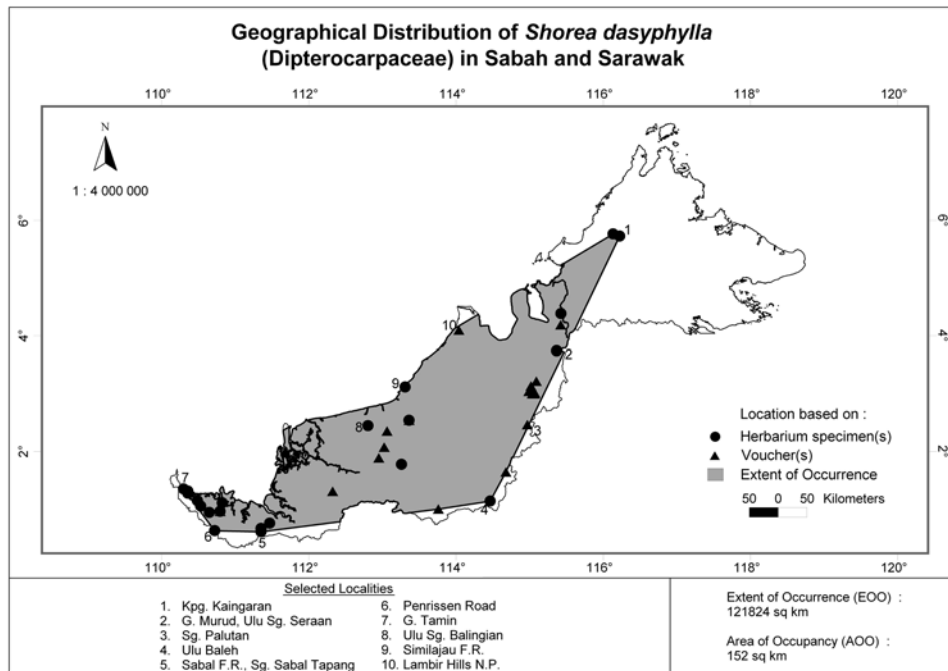
Habitat: Lowland forests.

Conservation status: VU A4c for Malaysia; VU A4c for Peninsular Malaysia; NT for Sabah and Sarawak.

Conservation notes: In Peninsular Malaysia, the species is reported as being only occasionally seen. Although some of the Forest Reserves where it occurs are no longer extant, there are populations sited in the network of Totally Protected Areas. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 47,000 adult stems above 30 cm dbh in the Permanent Reserved Forests. In 1991, at least 6 trees above 1 cm diameter were recorded from Lambir Hills 52-ha research plot



with 50% having diameters less than 5 cm. In the 50-ha research plot in Pasoh FR, at least 43 trees above 1 cm diameter were recorded in 1985; 69.8% of this had diameters less than 5 cm. Other assessments: EN A1cd (IUCN, 2010); EN, perhaps CR, with threats from land conversion and logging (Symington, 2004); VU, threats from land conversion (Ashton, 2004).



Shorea dealbata Foxw.

Plates 22B–D

Vernacular name: Peninsular Malaysia and Sarawak: meranti bumbung.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sarawak).

Peninsular Malaysia: Pahang and Terengganu.

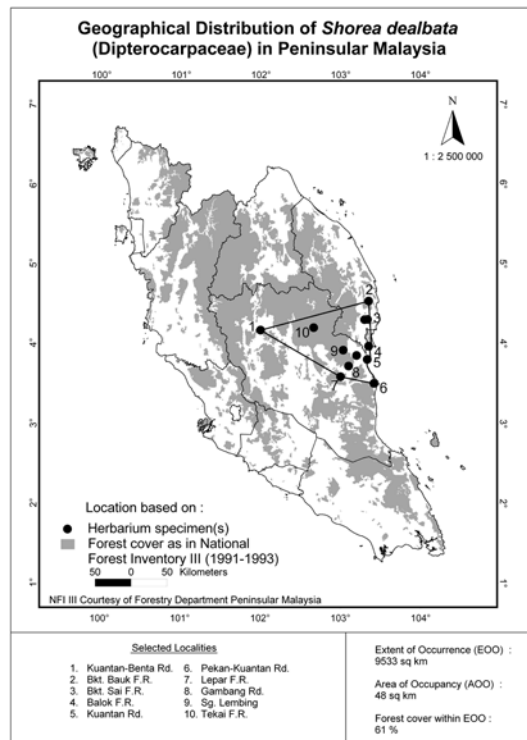
Sarawak: Kuching, Mukah, Lundu and Tatau.

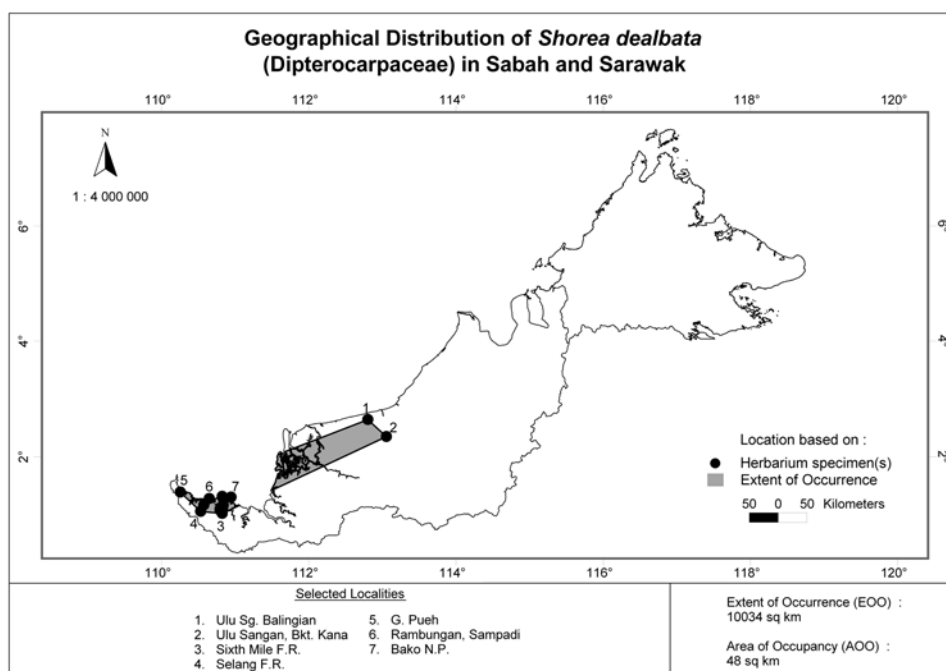
Habitat: Lowland to hill forests at altitudes to 600 m, also in coastal swamps and adjoining flat areas, heath forest on white sand terraces and on sandstone plateau.

Conservation status: EN B2b(iii)+c(ii) for Malaysia; EN B2b(iii)+c(ii) for Peninsular Malaysia; VU B1ab(iii) for Sarawak.

Conservation notes: The species occurs in Bako National Park, Sarawak. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 4,000 adult stems (above 30 cm dbh) in the Permanent Reserved Forests.

Other assessments: CR A1cd+2cd, C2a (IUCN, 2010); CR (Symington, 2004); VU (Ashton, 2004).





Shorea exelliptica Meijer

Vernacular names: Peninsular Malaysia: balau tembaga; Sabah and Sarawak: selangan batu tembaga.

Distribution: Peninsular Malaysia and Borneo.

Peninsular Malaysia: Johor, Kedah, Pahang, Perak and Terengganu. **Sabah:** Beluran, Kinabatangan, Lahad Datu, Sandakan, Sipitang and Tawau.

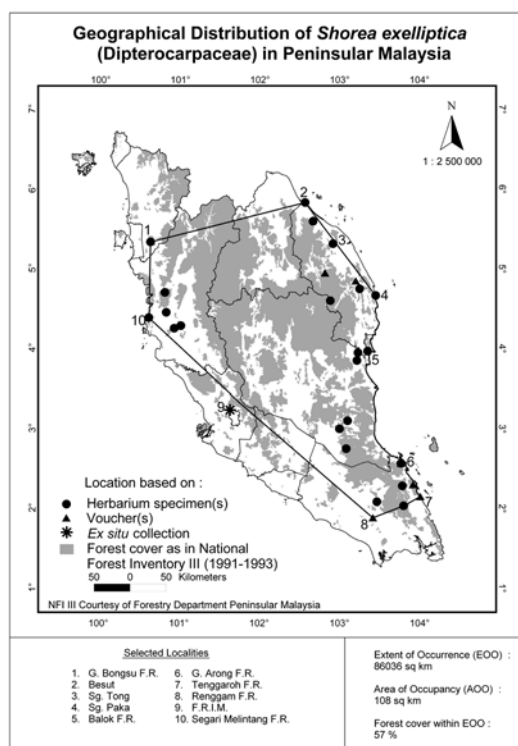
Sarawak: Belaga, Kapit, Kuching, Lawas, Limbang, Marudi, Miri and Song.

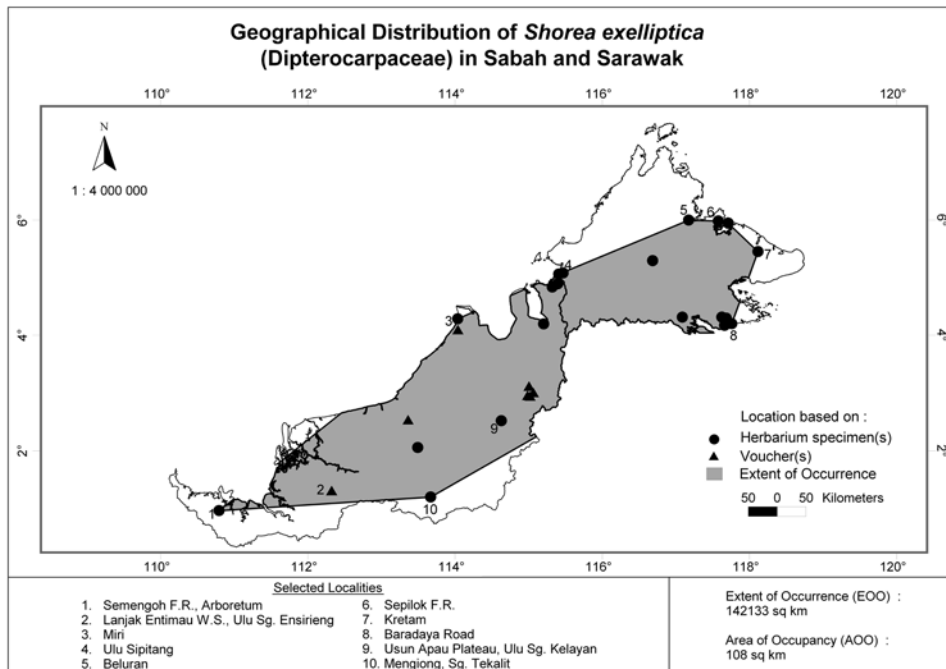
Habitat: Lowland to hill forests at altitudes to 600 m.

Conservation status: VU A4c for Malaysia; VU A4c for Peninsular Malaysia; NT for Sabah and Sarawak.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 10,000 adult stems (above 30 cm dbh) in the Permanent Reserved Forests.

Other assessment: VU with threats from logging (Ashton, 2004).





Shorea faguetiana F.Heim

Vernacular names: Peninsular Malaysia: damar siput; Sabah: seraya kuning siput; Sarawak: lun siput.

Distribution: Peninsular Thailand, Peninsular Malaysia and Borneo.

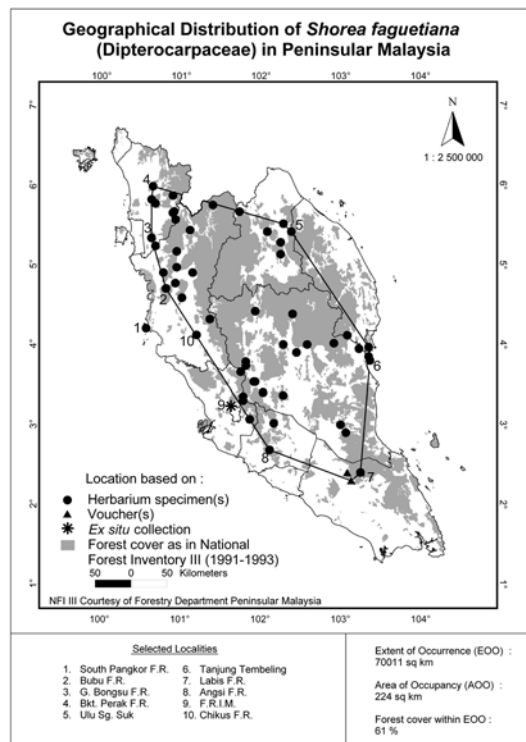
Peninsular Malaysia: Johor, Kedah, Kelantan, Negeri Sembilan, Pahang, Perak, Selangor and Terengganu. **Sabah:** Beaufort, Beluran, Keningau, Kinabatangan, Lahad Datu, Ranau, Sandakan, Sipitang, Tawau and Tenom. **Sarawak:** Bau, Belaga, Bintulu, Kapit, Kuching, Lawas, Limbang, Lundu, Marudi, Miri, Simunjan, Song and Tatau.

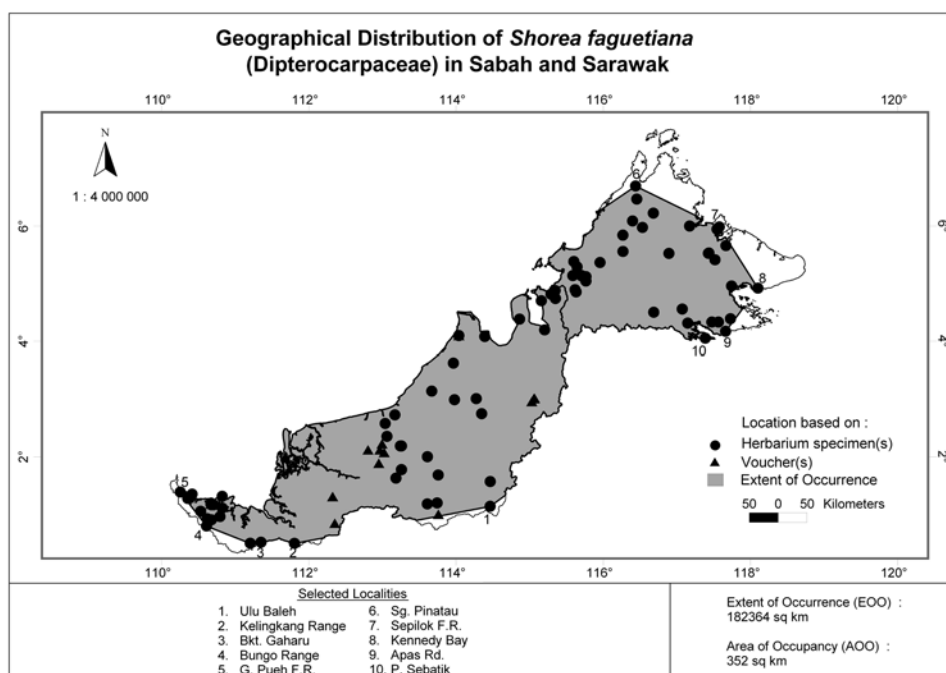
Habitat: Lowland to hill forests at altitudes to 1,000 m.

Conservation status: NT for Malaysia; NT for Peninsular Malaysia; LC for Sabah and Sarawak.

Conservation notes: The species occurs in the network of Totally Protected Areas. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 53,000 stems above 30 cm dbh in the Permanent Reserved Forests. At least 100 trees above 1 cm diameter were recorded from Lambir Hills 52-ha research plot in 1985; 51.0% had diameters less than 5 cm.

Other assessments: EN A1cd (IUCN, 2010); NT (Symington, 2004); probably not VU (Ashton, 2004).





Shorea falcifera Dyer ex Brandis

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sarawak).

Peninsular Malaysia: Pahang and Terengganu.

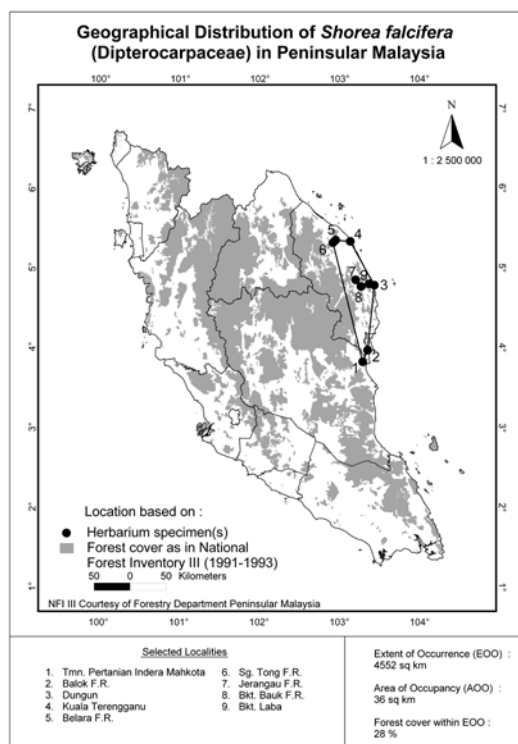
Sarawak: Belaga, Kapit, Kuching, Lundu, Marudi, Simunjan, Sri Aman and Tatau.

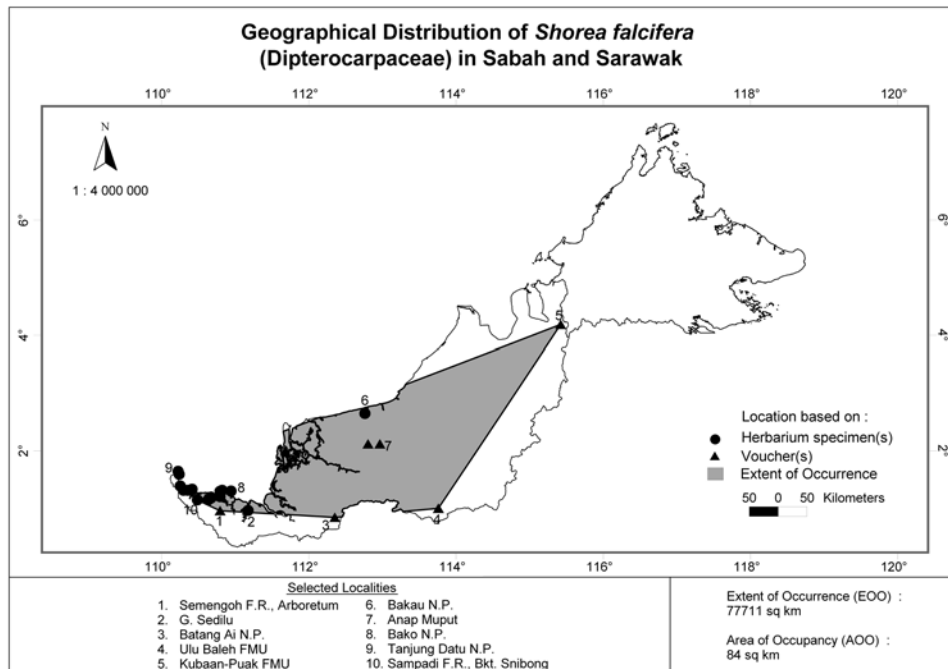
Habitat: Lowland to coastal hill forests at altitudes to 200 m, on periodically dry slopes and ridges near the coast, sometimes gregarious on rocky headlands.

Conservation status: EN A4c for Malaysia; EN A4c for Peninsular Malaysia; VU B2b(iii)+c(ii) for Sarawak.

Conservation notes: It occurs in Bako National Park, Sarawak.

Other assessments: EN A1cd (IUCN, 2010); EN with little of its habitat remains (Symington, 2004); VU (Ashton, 2004).





Shorea farinosa Fisher

Vernacular name: Peninsular Malaysia: temak merah.

Distribution: Myanmar, Peninsular Thailand and Peninsular Malaysia.

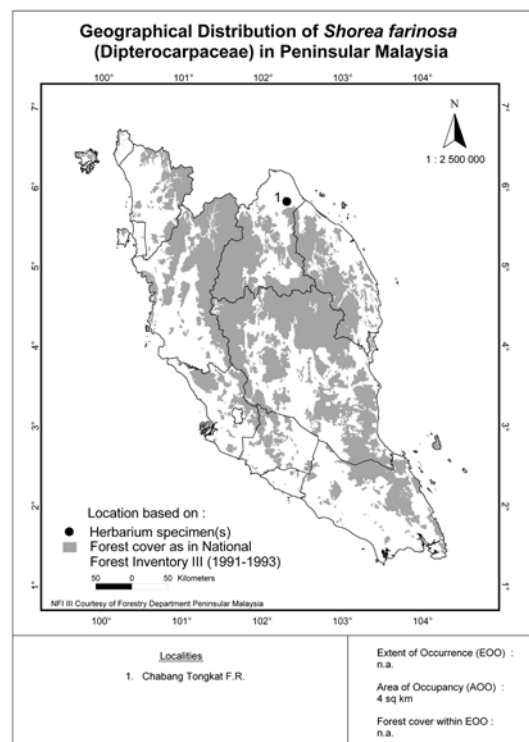
Peninsular Malaysia: Kelantan.

Habitat: Lowland and hill dipterocarp forests.

Conservation status: DD for Malaysia.

Conservation notes: Identification is a problem as the specimen is without flowers or fruits.

Other assessments: CR A1cd, C2a (Oldfield *et al.*, 1998).



Shorea foxworthyi Symington

Vernacular names: Peninsular Malaysia: balau bukit; Sabah: selangan batu bersisik; Sarawak: selangan batu bukit.

Distribution: Sumatra, Peninsular Thailand, Peninsular Malaysia and Borneo.

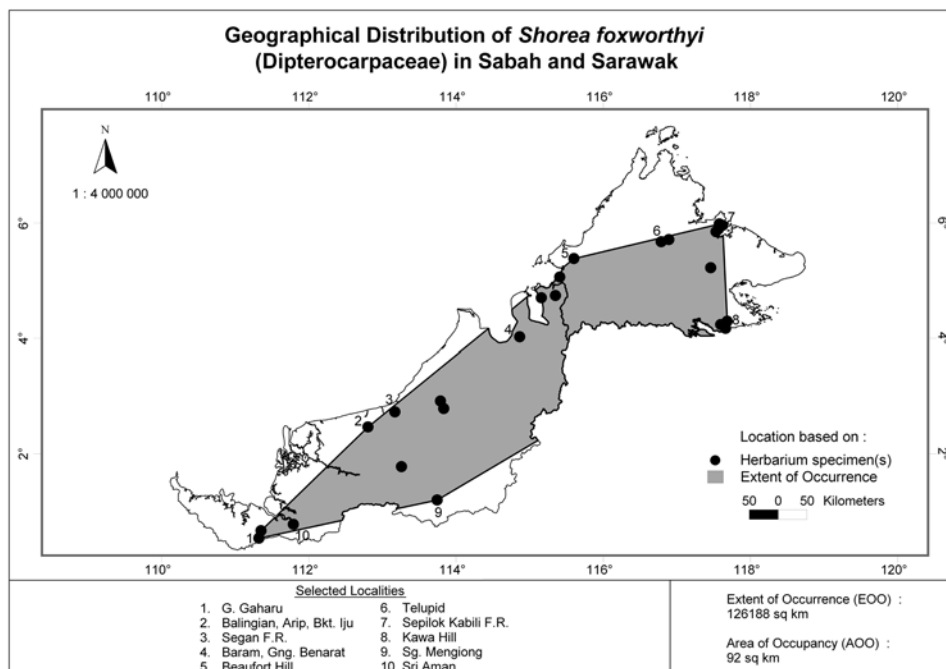
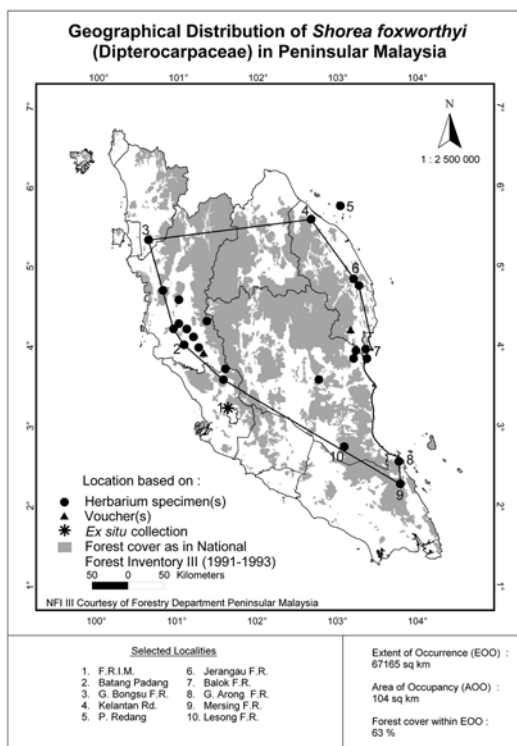
Peninsular Malaysia: Johor, Kedah, Pahang, Perak, Selangor and Terengganu. **Sabah:** Beaufort, Beluran, Kinabatangan, Sandakan, Sipitang and Tawau. **Sarawak:** Bintulu, Kapit, Lawas, Marudi, Miri, Mukah, Samarahan, Simunjan and Sri Aman.

Habitat: Lowland to hill forests at altitudes to 700 m.

Conservation status: VU A4c for Malaysia; VU A4c for Peninsular Malaysia; NT for Sabah and Sarawak.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 23,000 adult stems (above 30 cm dbh) in the Permanent Reserved Forests.

Other assessments: CR A1cd (IUCN, 2010); CR, threats from habitat conversion (Symington, 2004); EN through the loss of its natural habitats (Ashton, 2004).



Shorea gibbosa Brandis

Vernacular names: Peninsular Malaysia: damar hitam gajah; Sabah: seraya kuning gajah; Sarawak: lun gajah.

Distribution: Sumatra, Peninsular Malaysia, Singapore and Borneo.

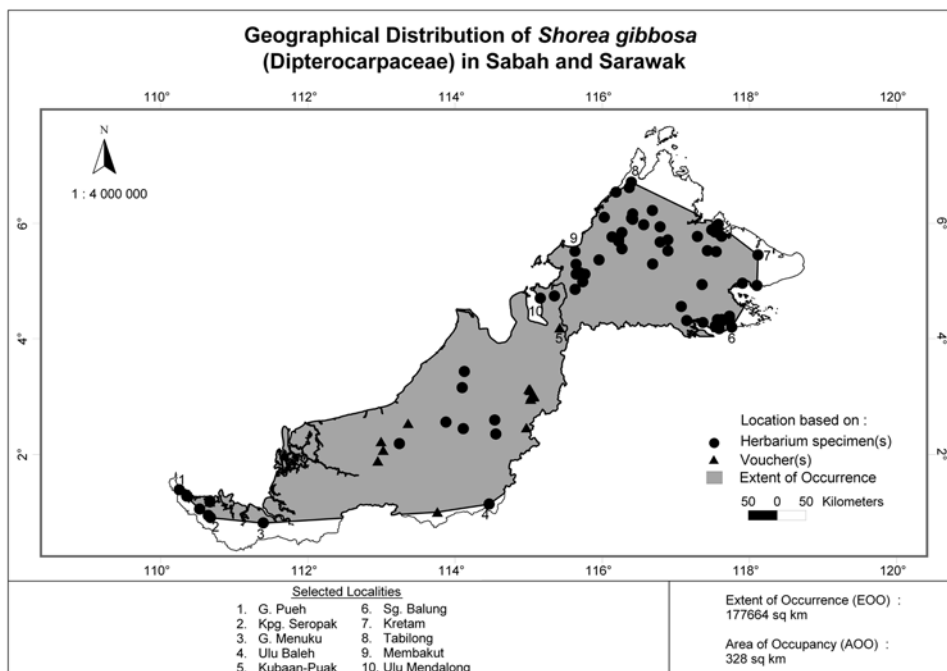
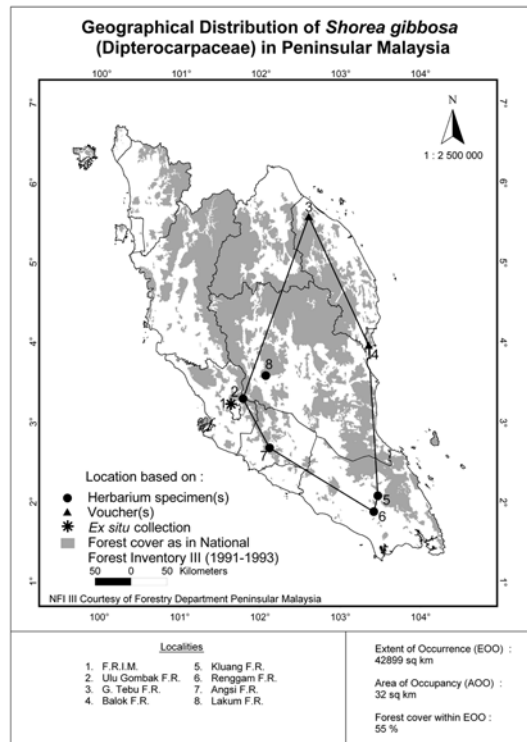
Peninsular Malaysia: Johor, Negeri Sembilan, Pahang, Selangor and Terengganu. **Sabah:** Beaufort, Beluran, Keningau, Kinabatangan, Kota Belud, Kota Kinabalu, Lahad Datu, Ranau, Sandakan, Sipitang, Tambunan, Tawau and Tenom. **Sarawak:** Bau, Belaga, Bintulu, Kapit, Kuching, Lawas, Lundu, Marudi and Tatau.

Habitat: Lowland to upper hill forests at altitudes to 1,000 m.

Conservation status: VU B2ab(iii) for Malaysia; VU B2ab(iii) for Peninsular Malaysia; LC for Sabah and Sarawak.

Conservation notes: It occurs in the network of Protected Areas in Sabah and Sarawak. The species in Peninsular Malaysia has a more restricted and fragmented distribution.

Other assessments: CR A1cd (Oldfield *et al.*, 1998); CR with threats from habitat conversion (Symington, 2004); EN (Ashton, 2004).



Shorea glauca King

Vernacular name: Peninsular Malaysia: damar laut daun besar.

Distribution: Peninsular Thailand, Peninsular Malaysia and Sumatra.

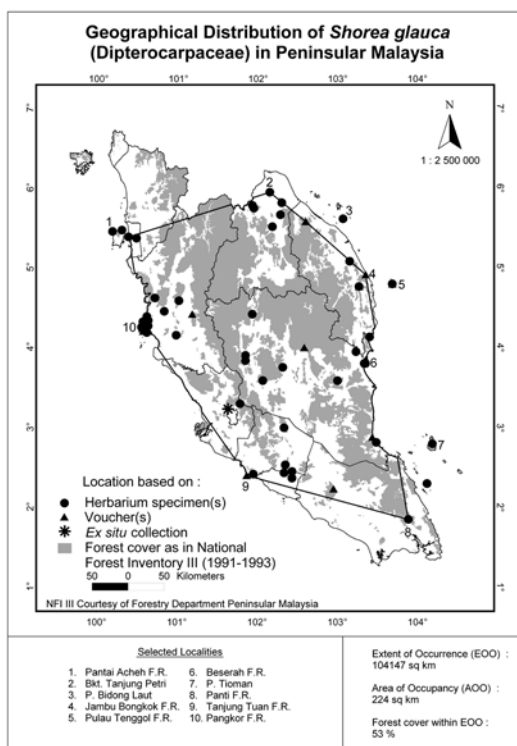
Peninsular Malaysia: Johor, Kelantan, Malacca, Negeri Sembilan, Pahang, Penang, Perak, Selangor and Terengganu.

Habitat: Lowland to hill dipterocarp forests up to 600 m altitude, on rocky promontories or steep hill slopes and ridges from the coast.

Conservation status: LC for Malaysia.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 361,000 stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: EN A1cd (IUCN, 2010); VU (Symington, 2004).



Shorea gratissima (Wall. ex Kurz) Dyer

Vernacular names: Peninsular Malaysia: meranti laut; Sabah: melapi laut.

Distribution: Myanmar, Sumatra, Peninsular Thailand, Peninsular Malaysia, Singapore and Borneo (Sabah and Kalimantan).

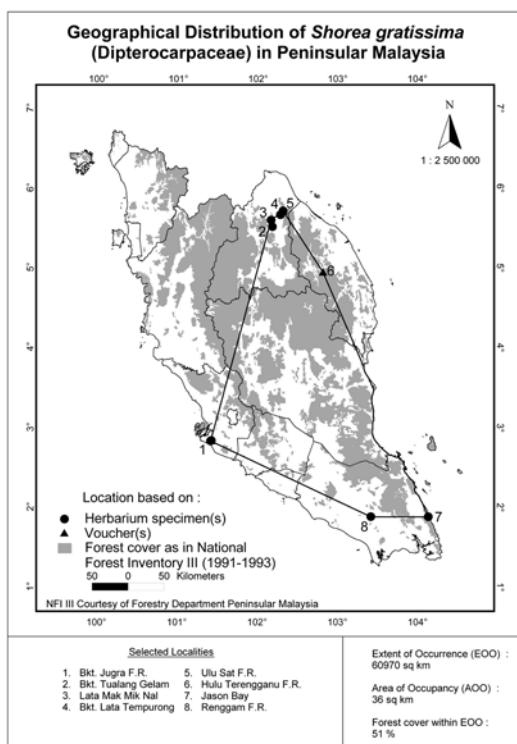
Peninsular Malaysia: Johor, Kelantan, Selangor and Terengganu. **Sabah:** Beluran, Kudat, Lahad Datu and Tawau.

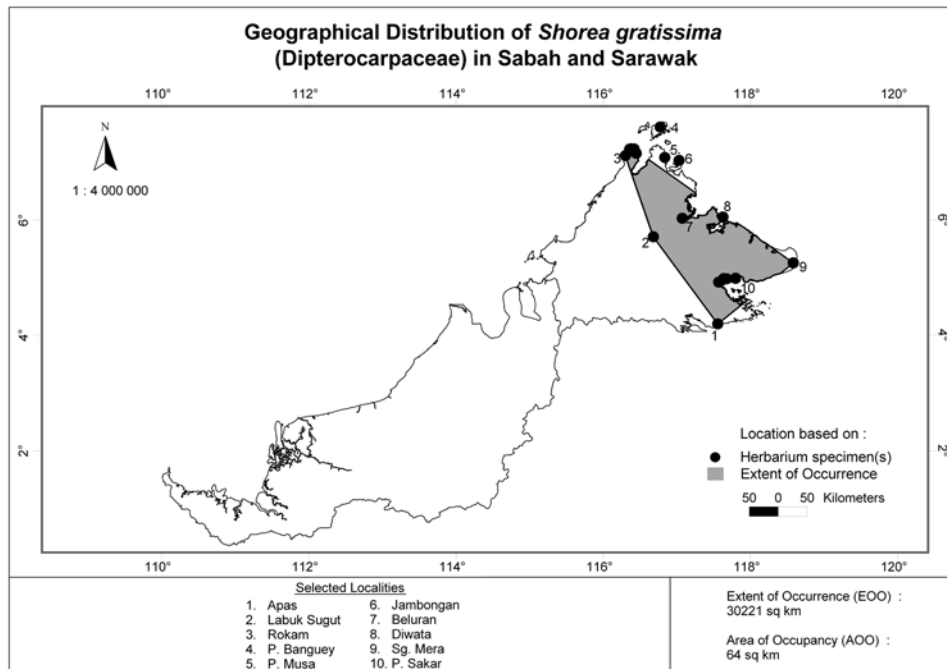
Habitat: Lowland to hill forests at altitudes to 500 m, on hills near the coast.

Conservation status: VU B2ab(iii) for Malaysia.

Conservation notes: Many of the forested areas are small fragments. About 720 trees from two populations are known from 5 compartments in Ulu Sat FR, Kelantan. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 21,000 stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: EN A1cd, C2a (IUCN, 2010); EN (Ashton, 2004; Symington, 2004).





Shorea guiso (Blanco) Blume

Plates 23A–B

Vernacular names: Peninsular Malaysia: membatu; Sabah and Sarawak: selangan batu merah.

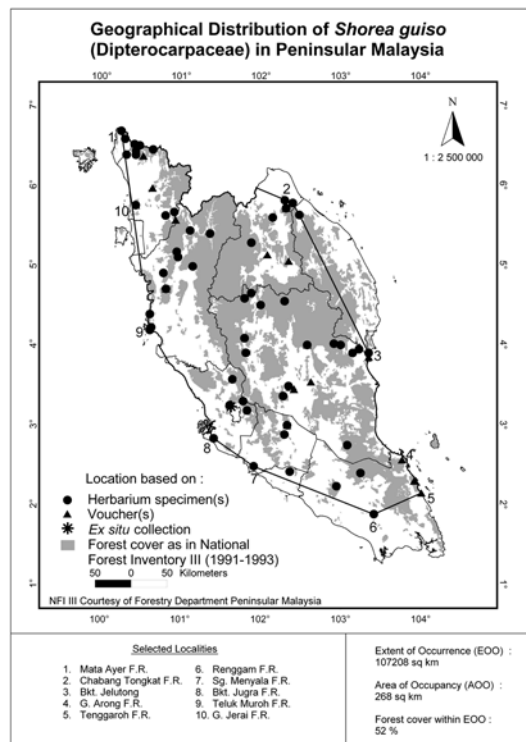
Distribution: Indo-China, Thailand, Sumatra, Peninsular Malaysia, Borneo (Sabah, Sarawak and Kalimantan) and the Philippines.

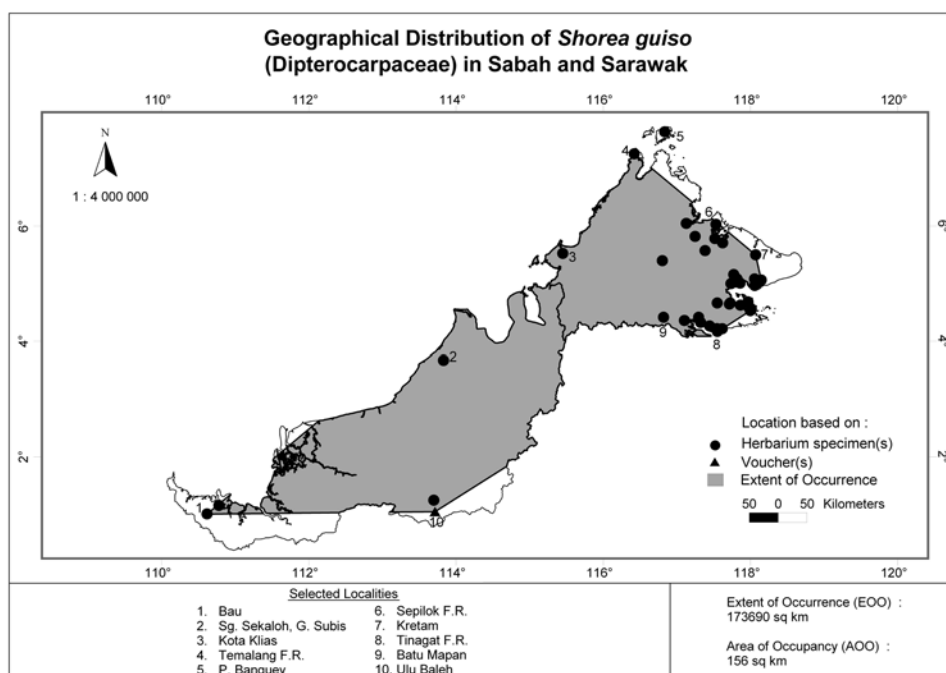
Peninsular Malaysia: Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Perak, Perlis, Selangor and Terengganu. **Sabah:** Beaufort, Kinabatangan, Kudat, Lahad Datu, Sandakan, Semporna and Tawau. **Sarawak:** Bau, Kapit, Kuching and Miri.

Habitat: Lowland to hill forests at altitudes to 600 m especially on coastal hills.

Conservation status: NT for Malaysia; LC for Peninsular Malaysia; NT for Sabah and Sarawak.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 473,000 stems above 30 cm dbh in the Permanent Reserved Forests. In 1985, at least 720 trees above 1 cm diameter were recorded from Pasoh 50-ha research plot with 93.8% having diameters less than 5 cm. Other assessments: CR A1cd (IUCN, 2010); EN (Symington, 2004); VU (Ashton, 2004).





Shorea hemsleyana* (King) King ex Foxw. ssp. *hemsleyana

Plates 23C–E

Vernacular name: Peninsular Malaysia: cengal pasir daun besar.

Distribution: Sumatra, Peninsular Thailand and Peninsular Malaysia.

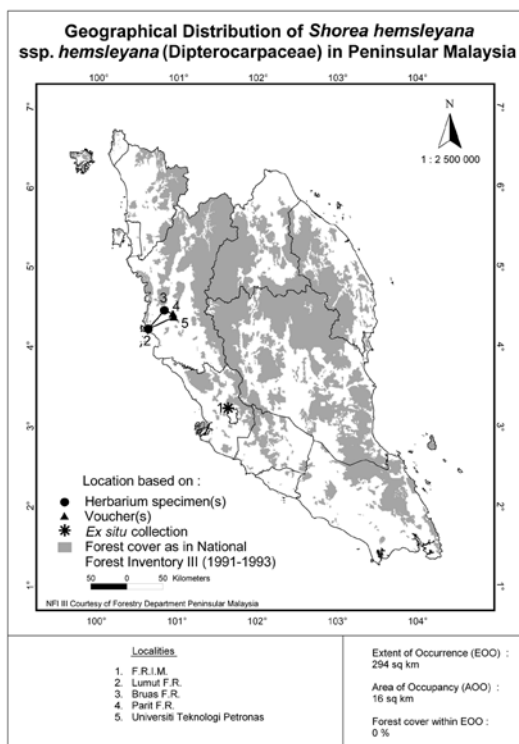
Peninsular Malaysia: Perak.

Habitat: Lowland dipterocarp forests in swamp areas.

Conservation status: CR A4c, D2 for Malaysia.

Conservation notes: To date, 65 and 77 trees have been located respectively in a 55-ha swamp forest in Universiti Teknologi MARA and in the 400-ha campus of Universiti Teknologi Petronas, in the district of Perak Tengah. Trees are also present at the Parit FR fragment. All the existing areas where the species occurs are small fragments and none are in the Protected Areas network. Conservation recommendations have been forwarded and the respective universities are taking steps to conserve the populations.

Other assessments: CR A1cd, C2a (Oldfield *et al.*, 1998); CR with threats arising from logging and land conversion (Symington, 2004).



Shorea henryana Pierre

Vernacular name: Peninsular Malaysia: meranti jerit.

Distribution: Myanmar, Thailand and Peninsular Malaysia.

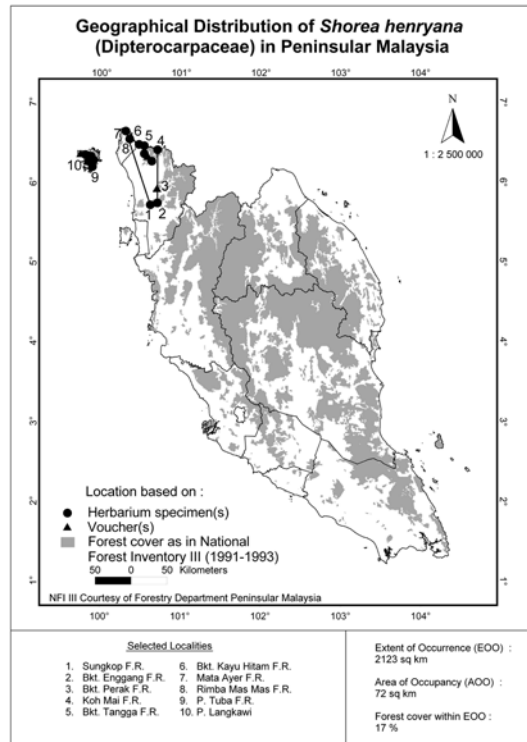
Peninsular Malaysia: Kedah and Perlis.

Habitat: Seasonally dry tropical rain forests on granite and quartzite soils and deep limestone soils.

Conservation status: EN B1b(iii)+c(iii) for Malaysia.

Conservation notes: Many of the Forest Reserves in the Langkawi Islands are intact.

Other assessments: EN A1cd (IUCN, 2010); NT, it is not at serious risk of extinction or genetic erosion (Symington, 2004).



Shorea hopeifolia (F.Heim) Symington

Vernacular names: Peninsular Malaysia: damar siput jantan; Sabah: seraya kuning jantan; Sarawak: lun siput jantan.

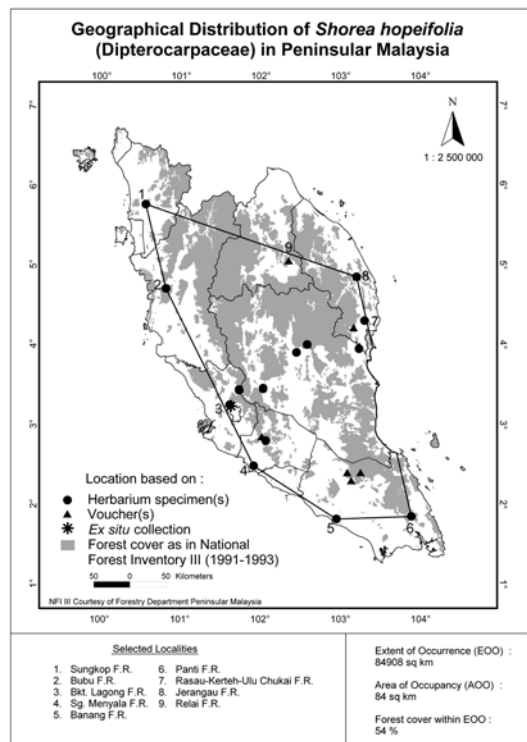
Distribution: Sumatra, Peninsular Malaysia, Borneo and the Philippines.

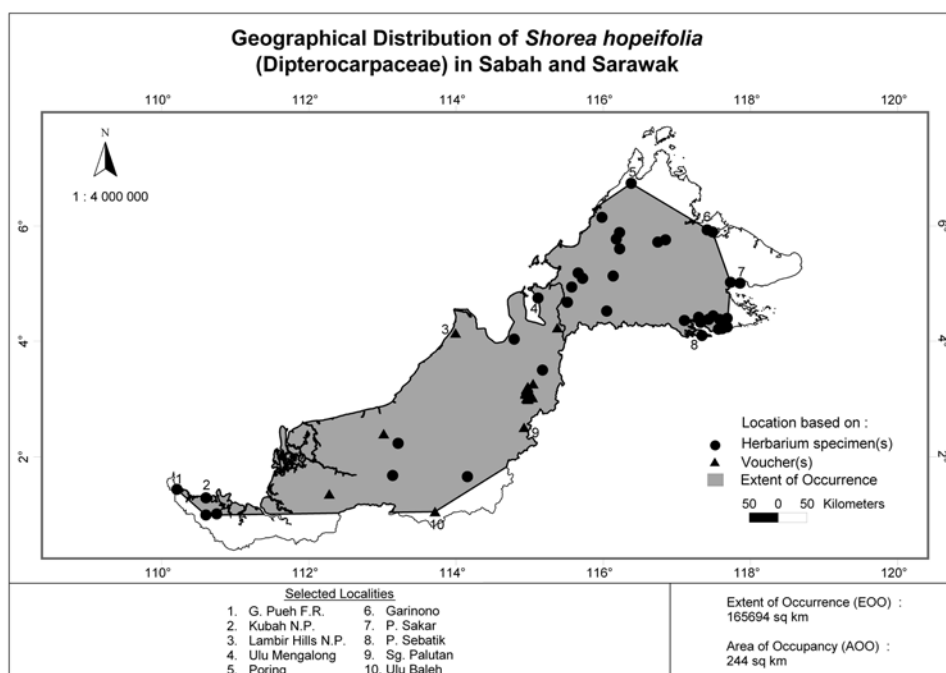
Peninsular Malaysia: Johor, Kedah, Kelantan, Negeri Sembilan, Pahang, Perak, Selangor and Terengganu. **Sabah:** Beaufort, Keningau, Ranau, Sandakan, Sipitang, Tambunan, Tawau and Tenom. **Sarawak:** Bau, Bintulu, Kuching, Kapit, Lawas, Lundu, Marudi, Miri and Tatau.

Habitat: Lowland to upper hill forests at altitudes to 1,200 m, showing a preference for the vicinity of streams.

Conservation status: NT for Malaysia.

Other assessments: CRA1cd (IUCN, 2010); CR from habitat conversion (Symington, 2004); EN (Ashton, 2004).





Shorea hypochra Hance

Vernacular name: Peninsular Malaysia: meranti temak.

Distribution: Indo-China, Thailand, Sumatra and Peninsular Malaysia.

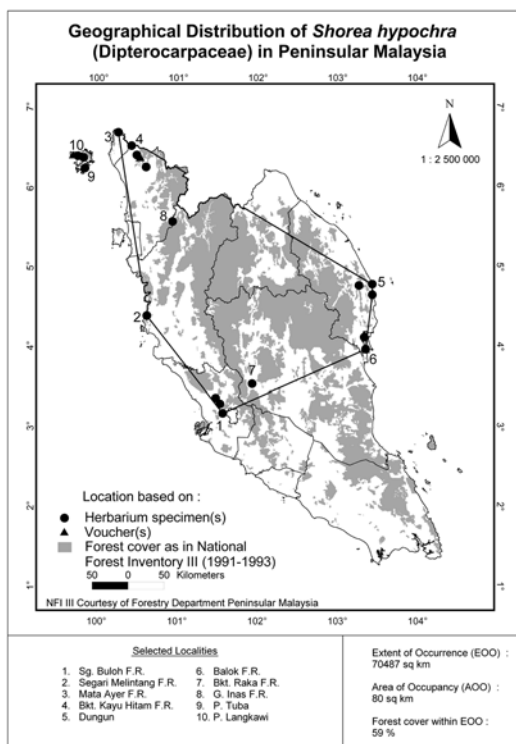
Peninsular Malaysia: Kedah, Pahang, Perak, Perlis, Selangor and Terengganu.

Habitat: Lowland to hill dipterocarp forests and seasonally dry tropical rain forests, sometimes in swamp forests.

Conservation status: NT for Malaysia.

Conservation notes: Populations occur in the Bukit Perangin and Gunung Machinchang Virgin Jungle Reserves, Kedah.

Other assessments: CR A1cd (IUCN, 2010); EN (Symington, 2004).



Shorea inappendiculata Burck

Plates 24A–B

Distribution: Sumatra, Peninsular Malaysia and Borneo.

Peninsular Malaysia: Johor. **Sabah:** Beluran, Kinabatangan, Lahad Datu, Sandakan and Tawau.

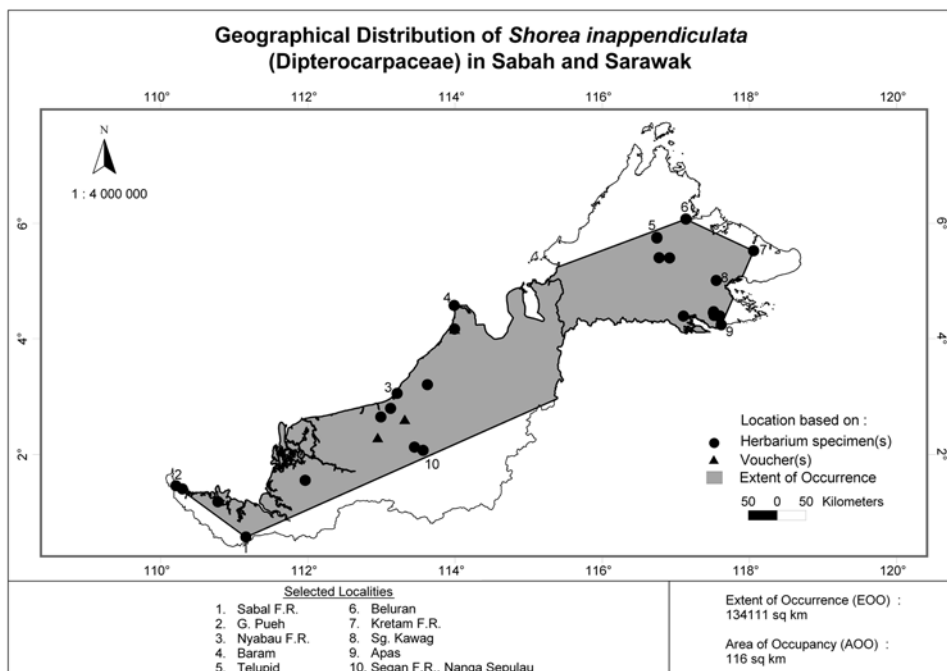
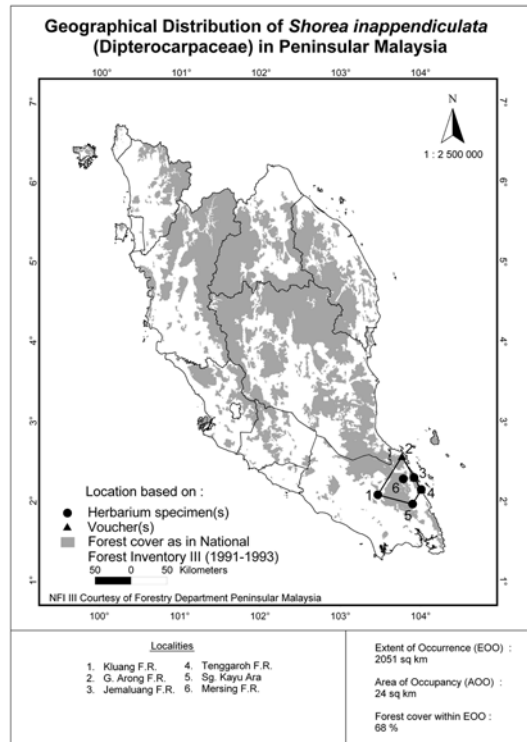
Sarawak: Bintulu, Kapit, Kuching, Limbang, Lundu, Miri, Samarahan, Sibu and Tatau.

Habitat: Lowland to hill forests at altitudes to 400 m, mostly in coastal hills.

Conservation status: EN B1b(iii)+c(iii) for Malaysia; EN B1b(iii)+c(iii) for Peninsular Malaysia; VU A4c for Sabah and Sarawak.

Conservation notes: No populations in Peninsular Malaysia are known in the network of Protected Areas.

Other assessments: CR A1cd, C2a (IUCN, 2010); possibly EX (Symington, 2004); EN (Ashton, 2004).



Shorea johorensis Foxw.

Vernacular names: Peninsular Malaysia: meranti pepijat; Sabah: seraya majau; Sarawak: meranti majau.

Distribution: Sumatra, Peninsular Malaysia and Borneo.

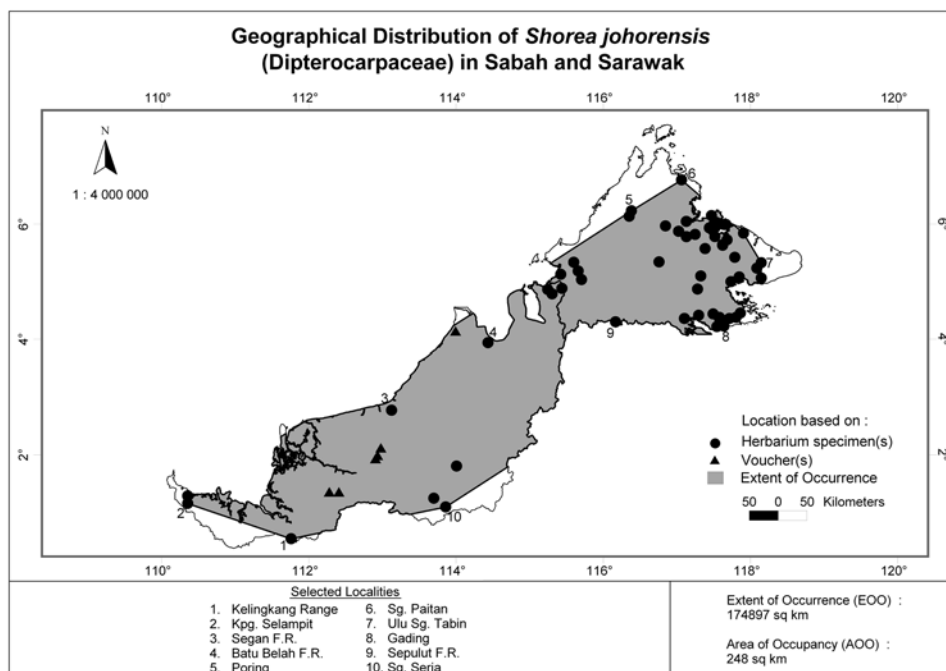
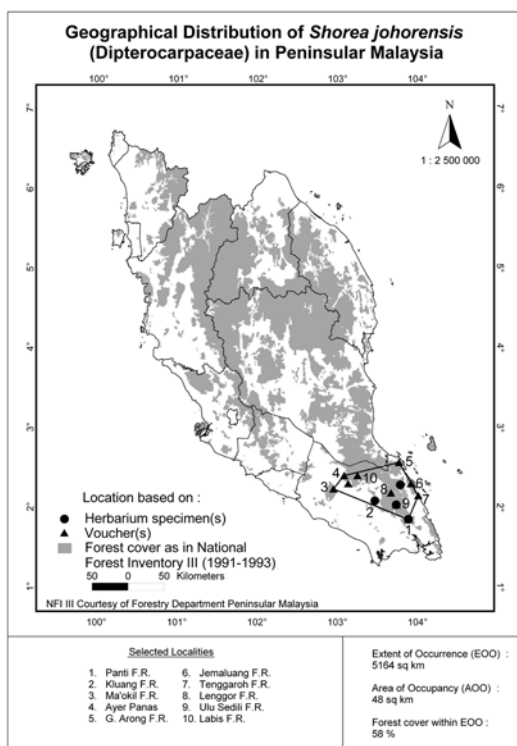
Peninsular Malaysia: Johor. **Sabah:** Beaufort, Beluran, Keningau, Kinabatangan, Lahad Datu, Ranau, Sandakan, Sipitang, Tawau and Tenom. **Sarawak:** Bintulu, Kanowit, Kapit, Lawas, Limbang, Lundu, Marudi, Miri, Song and Tatau.

Habitat: Lowland to hill forests occasionally to 800 m altitude.

Conservation status: VU B1ab(iii) for Malaysia; VU B1ab(iii) for Peninsular Malaysia; NT for Sabah and Sarawak.

Conservation notes: In Sabah and Sarawak, the species is represented in the network of Totally Protected Areas. It is widespread in Sabah.

Other assessments: CR A1cd (IUCN, 2010); CR by logging (Symington, 2004); VU with its natural habitat greatly reduced by forest conversion (Ashton, 2004).



Shorea kuantanensis P.S.Ashton

Vernacular name: Peninsular Malaysia: damar hitam.

Distribution: Peninsular Malaysia.

Peninsular Malaysia: Pahang.

Habitat: Lowland dipterocarp forests.

Conservation status: EX for Malaysia.

Conservation notes: The forest reserve where it is known is now an oil palm plantation. Attempts to locate the species in the adjacent forest fragments have so far been unsuccessful.

Other assessments: CR A1cd, C2a (IUCN, 2010); may now be EX (Symington, 2004).

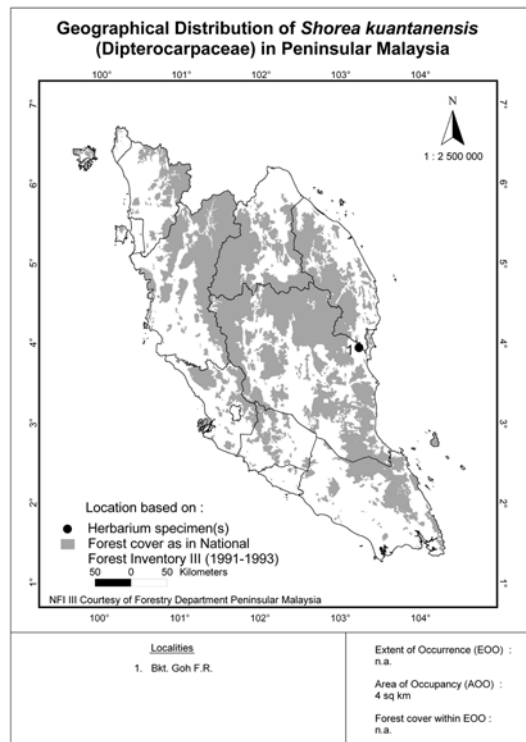
*Shorea kunstleri* King

Plate 24C

Vernacular names: Peninsular Malaysia: damar laut merah; Sabah: seraya sirap; Sarawak: selangan merah.

Distribution: Sumatra, Peninsular Malaysia and Borneo.

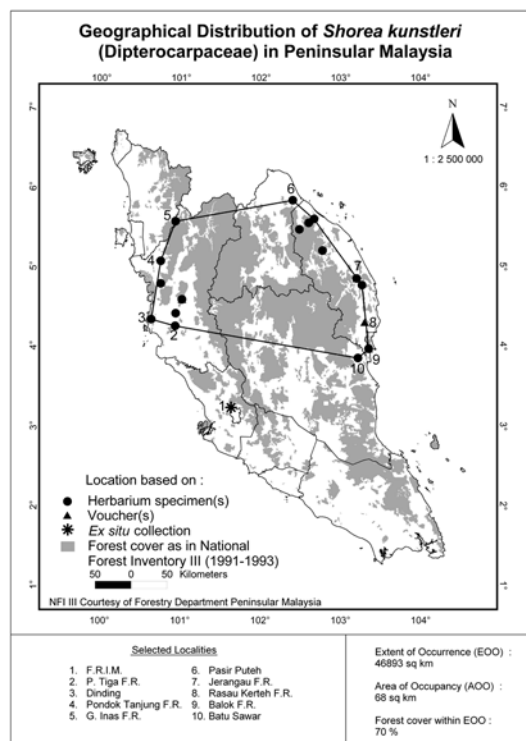
Peninsular Malaysia: Kedah, Kelantan, Pahang, Perak and Terengganu. **Sabah:** Beluran, Kinabatangan, Lahad Datu, Sandakan, Sipitang and Tawau. **Sarawak:** Bintulu, Kuching, Lawas, Marudi, Miri, Simunjan and Tatau.

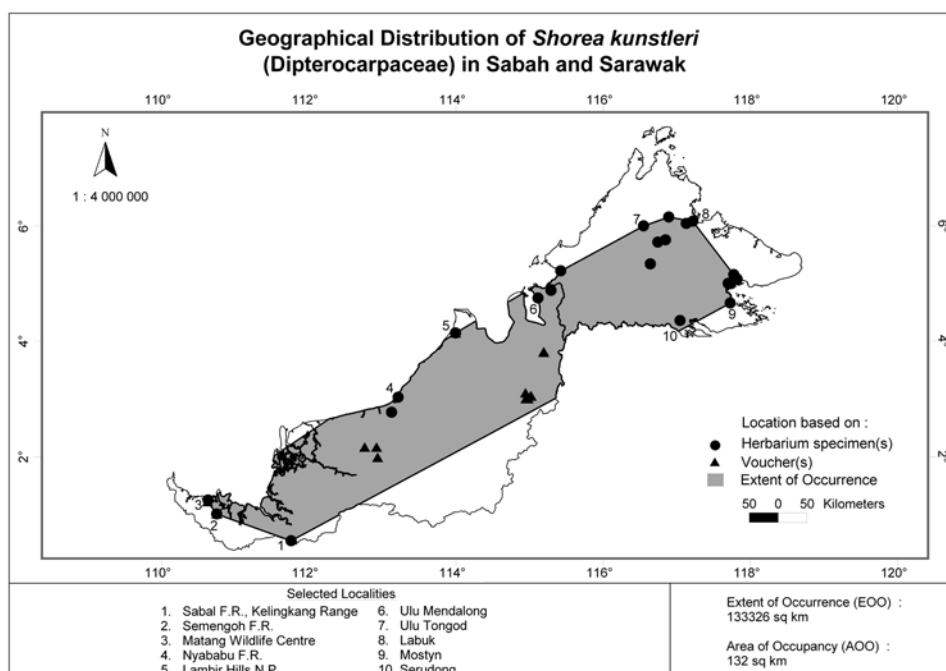
Habitat: Lowland to hill forests at altitudes to 800 m, over sandstone and ultrabasic substrates.

Conservation status: NT for Malaysia.

Conservation notes: In Peninsular Malaysia, the species is not known in the network of Totally Protected Areas. In Peninsular Malaysia, the species does not occur in the network of Totally Protected Areas. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 189,000 adult stems (above 30 cm dbh) in the Permanent Reserved Forests.

Other assessments: CRA1cd (IUCN, 2010); probably EN with threats from land conversion (Symington, 2004); EN (Ashton, 2004).





Shorea laevis Ridl.

Plate 25A

Vernacular names: Peninsular Malaysia and Sarawak: kumus; Sabah: selangan batu kumus.

Distribution: Myanmar, Peninsular Thailand, Peninsular Malaysia, Sumatra and Borneo.

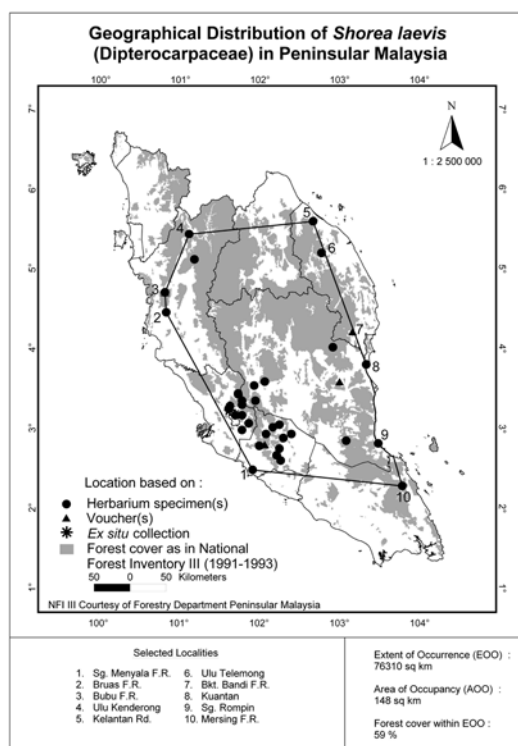
Peninsular Malaysia: Johor, Negeri Sembilan, Pahang, Perak, Selangor and Terengganu. **Sabah:** Beaufort, Beluran, Keningau, Kinabatangan, Kota Marudu, Kudat, Lahad Datu, Ranau, Sipitang, Tawau and Tenom. **Sarawak:** Belaga, Bintulu, Kapit, Lawas, Limbang, Lubok Antu, Miri and Sri Aman.

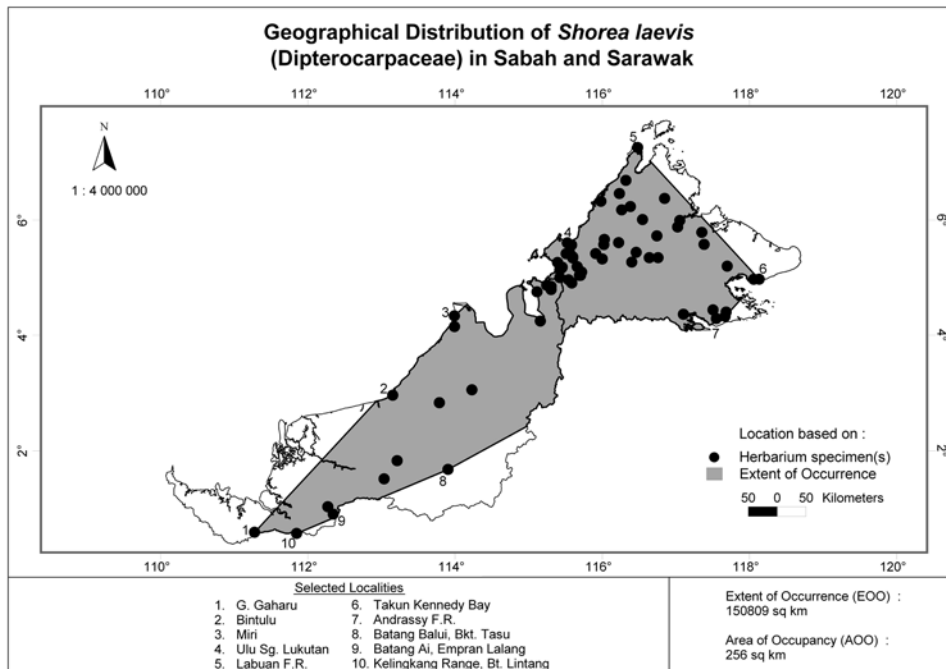
Habitat: Lowland to hill forests to 1,000 m altitude. In Borneo, it occurs along shale ridges, usually on leached skeletal clay and sandy clay soils.

Conservation status: NT for Malaysia; LC for Peninsular Malaysia; NT for Sabah and Sarawak.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 654,000 stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: LR/lc (IUCN, 2010); NT (Symington, 2004); VU, threats from logging (Ashton, 2004).





Shorea lamellata Foxw.

Plates 25B–C

Vernacular name: Peninsular Malaysia and Sarawak: meranti lapis.

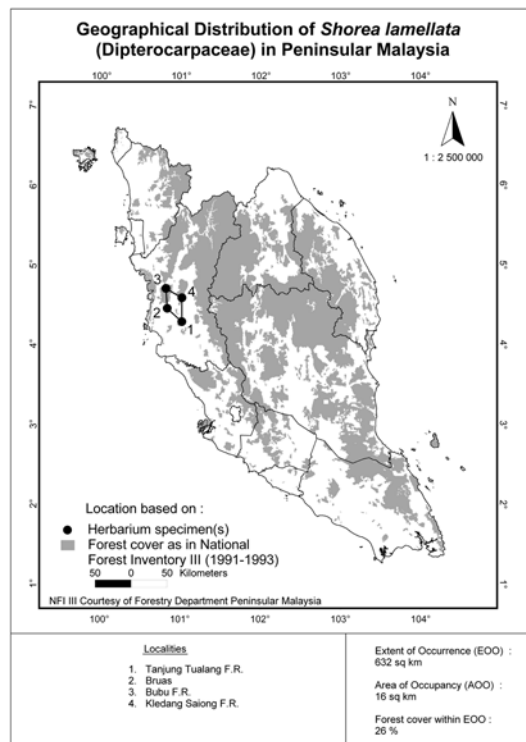
Distribution: Sumatra, Peninsular Malaysia, Borneo (Sarawak and Kalimantan).

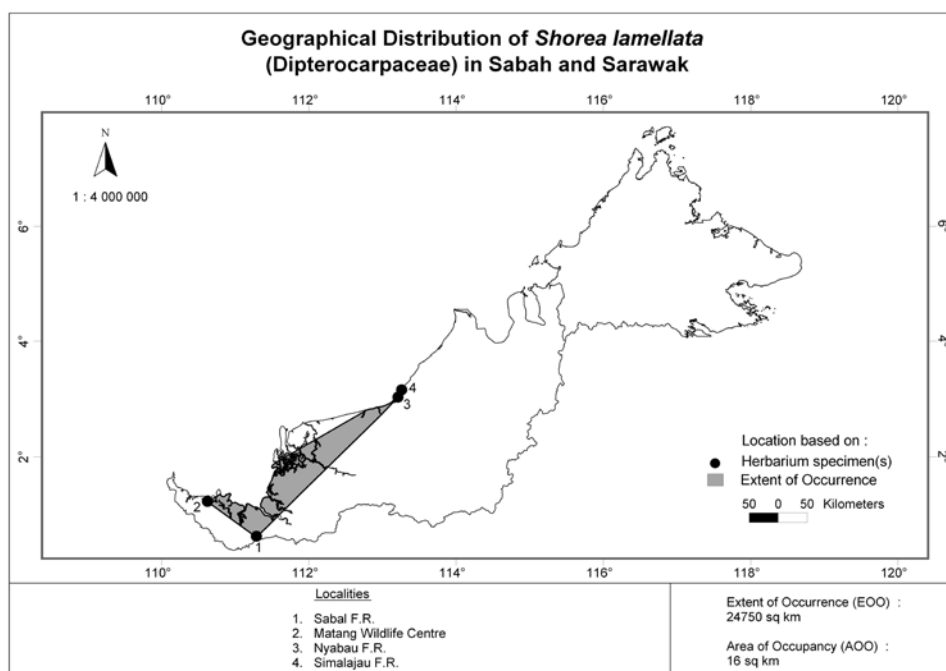
Peninsular Malaysia: Perak. **Sabah:** Tawau. **Sarawak:** Bintulu, Kuching, Mukah, Simunjan and Tatau.

Habitat: Lowland to hill forests to 900 m altitude. In Sarawak, it occurs on low hills on sandy clay soils on sedimentary substrates and also on Arip rhyolite at altitudes to 500 m.

Conservation status: CR A4c for Malaysia; CR A4c for Peninsular Malaysia; EN B2ab(iii) for Sarawak.

Conservation notes: In Peninsular Malaysia, some sites are no longer forested and there are no populations known in the network of Protected Areas. In Sarawak, it is reported to occur in Kubah National Park. The distribution in Sabah is known from only one collection from Tawau (Wood & Meijer, 1964). Other assessments: CR A1cd (IUCN, 2010); CR by logging and habitat conversion (Symington, 2004); EN, threats from land conversion (Ashton, 2004).





Shorea lepidota (Korth.) Blume

Vernacular name: Peninsular Malaysia: meranti langgong.

Distribution: Sumatra and Peninsular Malaysia.

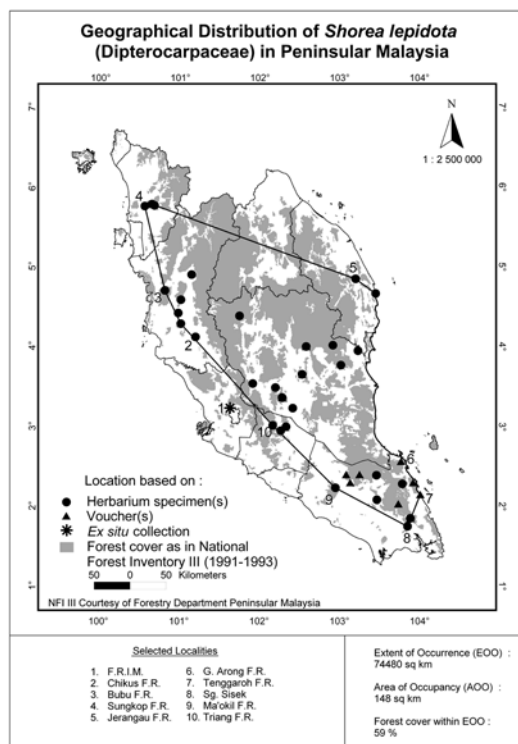
Peninsular Malaysia: Johor, Kedah, Negeri Sembilan, Pahang, Perak and Terengganu.

Habitat: Lowland dipterocarp forests up to 300 m altitude.

Conservation status: LC for Malaysia.

Conservation notes: In 1985, at least 1,172 trees above 1 cm diameter were recorded from the Pasoh 50-ha research plot. 73.9% of this had diameters less than 5 cm. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 244,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: CRA1cd (IUCN, 2010); EN with threats from habitat conversion (Symington, 2004).



Shorea leprosula Miq.

Plates 26A–C

Vernacular names: Peninsular Malaysia and Sarawak: meranti tembaga; Sabah: seraya tembaga.

Distribution: Peninsular Thailand, Sumatra, Peninsular Malaysia and Borneo.

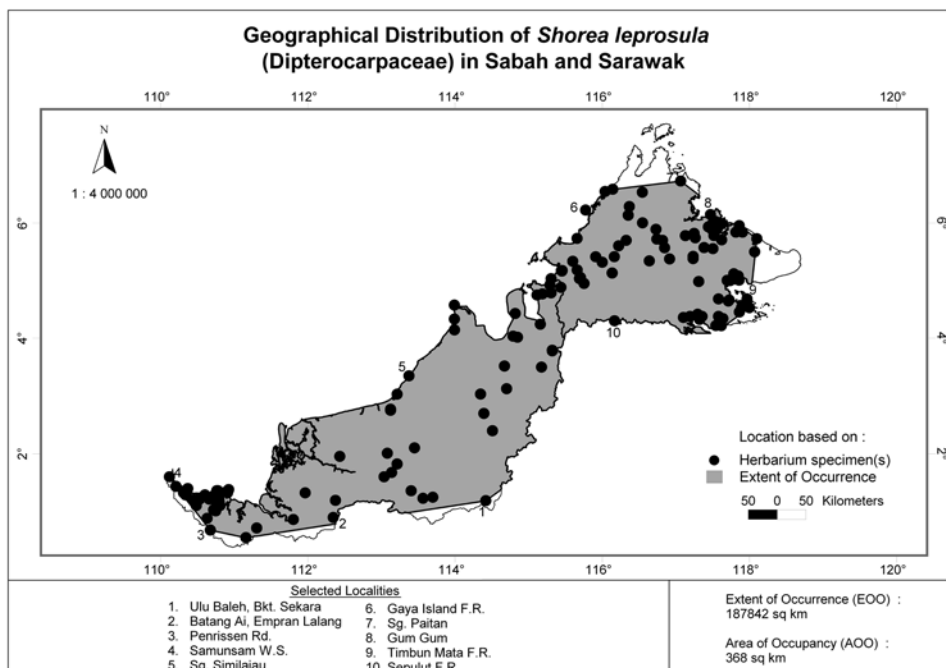
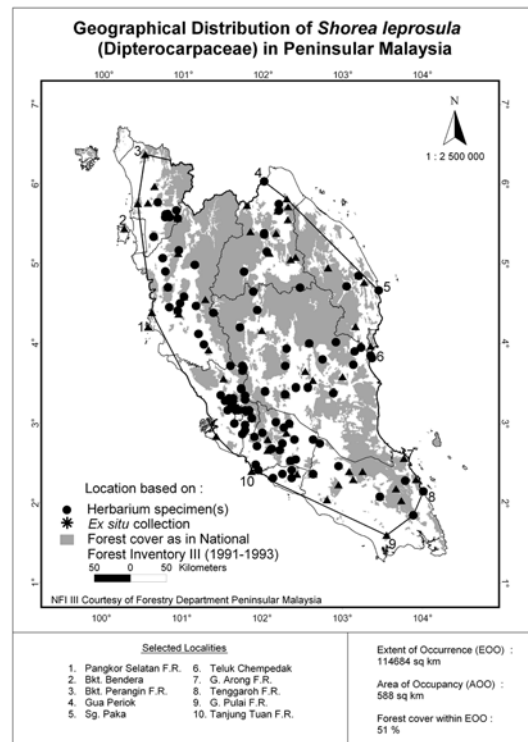
Peninsular Malaysia: Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Penang, Perak, Selangor and Terengganu. **Sabah:** Beaufort, Keningau, Kinabatangan, Kota Marudu, Kota Belud, Lahad Datu, Ranau, Sandakan, Semporna, Sipitang, Tawau and Tenom. **Sarawak:** Belaga, Bintulu, Kapit, Kuching, Lawas, Limbang, Lubok Antu, Lundu, Marudi, Miri and Song.

Habitat: Lowland to hill forests occurring on well-drained soils in forests up to 600 m altitude. In Borneo, it occurs on clay soils on shales and clays, also acid and intermediate igneous rocks and periodically flooded alluvium at altitudes to 600 m.

Conservation status: LC for Malaysia.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 7.4 million stems above 30 cm dbh in the Permanent Reserved Forests. In 1985, at least 3,017 trees above 1 cm diameter were recorded from the Pasoh 50-ha research plot. 83.1% of this had diameters less than 5 cm. In 1991, at least 22 trees above 1 cm diameter were recorded from Lambir Hills 52-ha research plot. 68.2% of this had diameters less than 5 cm.

Other assessments: EN A1cd (IUCN, 2010); not VU (Ashton, 2004).



Shorea longisperma Roxb.

Vernacular names: Peninsular Malaysia: meranti damar hitam; Sarawak: lun meranti.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sarawak, Brunei and Kalimantan).

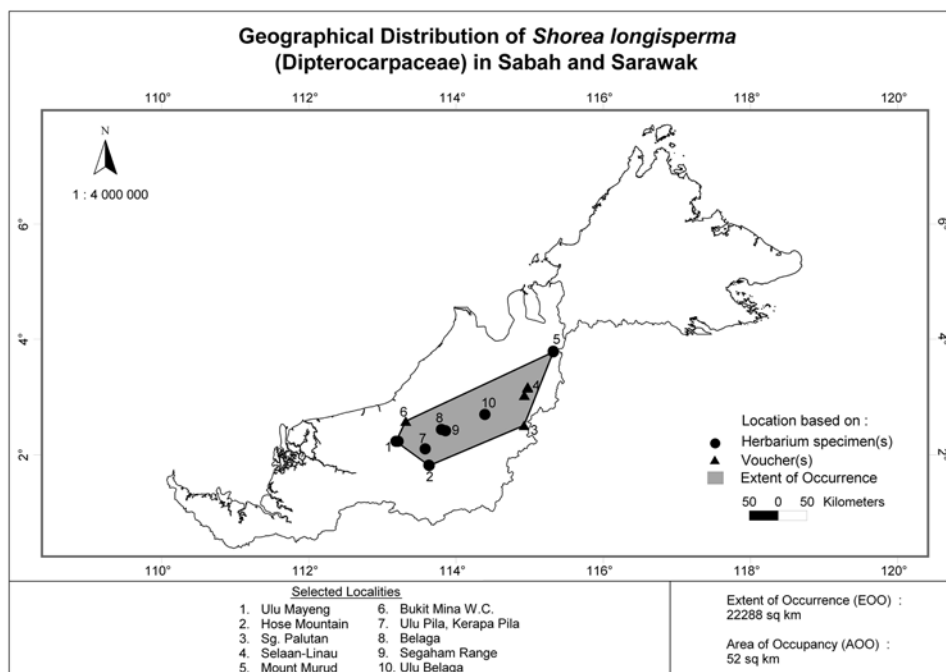
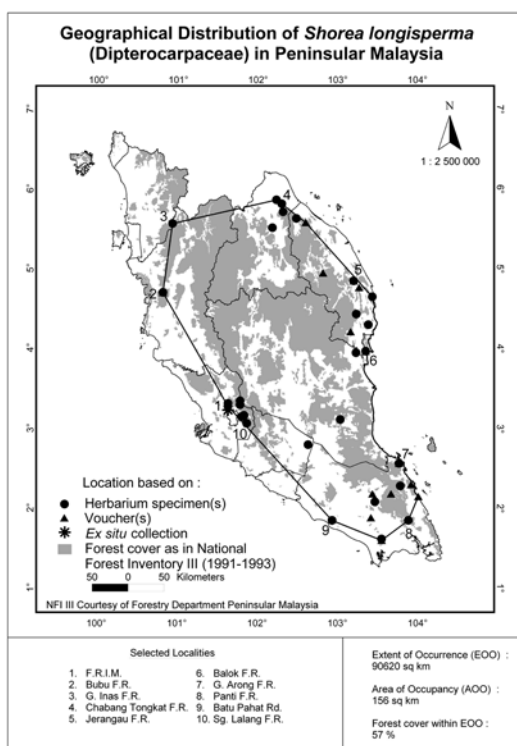
Peninsular Malaysia: Johor, Kedah, Kelantan, Negeri Sembilan, Pahang, Perak, Selangor and Terengganu. **Sarawak:** Belaga, Kapit, Lawas, Limbang, Marudi, Miri and Tatau.

Habitat: Lowland to upper hill forests. In Peninsular Malaysia, the species occurs in low-lying or undulating forest up to 300 m altitude in the valley of mountain ranges. In Borneo, it occurs on well-structured deep clay soils over shale, dacite and basalt on low coastal hills and uplands at altitudes to 1,100 m.

Conservation status: VUB2b(iii)+c(ii) for Malaysia; NT for Peninsular Malaysia; VU B2b(iii)+c(ii) for Sarawak.

Conservation notes: The species is reported absent from Sabah although sterile collections of what maybe the species had been made in the districts of Keningau, Kinabatangan and Kota Belud.

Other assessments: CR A1cd, C2a (IUCN, 2010); CR, threats from habitat conversion (Symington, 2004); VU, becoming EN with harvesting threats at higher altitudes (Ashton, 2004).



Shorea lumutensis Symington

Vernacular name: Peninsular Malaysia: balau putih.

Distribution: Peninsular Malaysia.

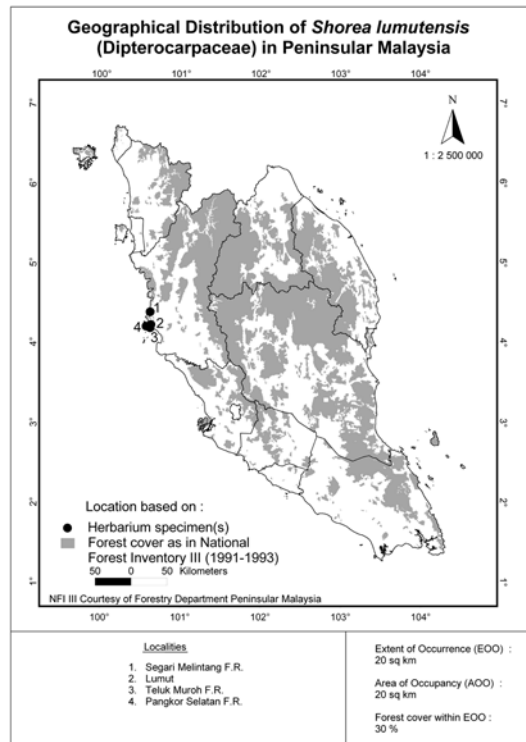
Peninsular Malaysia: Perak.

Habitat: Coastal hill dipterocarp forests above 100 m altitude.

Conservation status: CR A4cd, B1b(iii)+c(iv) for Malaysia.

Conservation notes: Herbarium collections had been made from Johor but the identity of these specimens are not known with certainty. The approximate number of mature individuals was derived from the presence of 416 individuals in a 8 ha plot. The population density of *S. lumutensis* > 30 cm diameter in the plot was 4.4 trees per ha (Lee *et al.*, 2006). Many populations are found in the network of Virgin Jungle Reserves.

Other assessments: CR A1cd, C2a (IUCN, 2010); CR (Symington, 2004).



Shorea macrantha Brandis

Plates 27A–D

Vernacular names: Peninsular Malaysia: kepong hantu; Sarawak: engkabang bungkus.

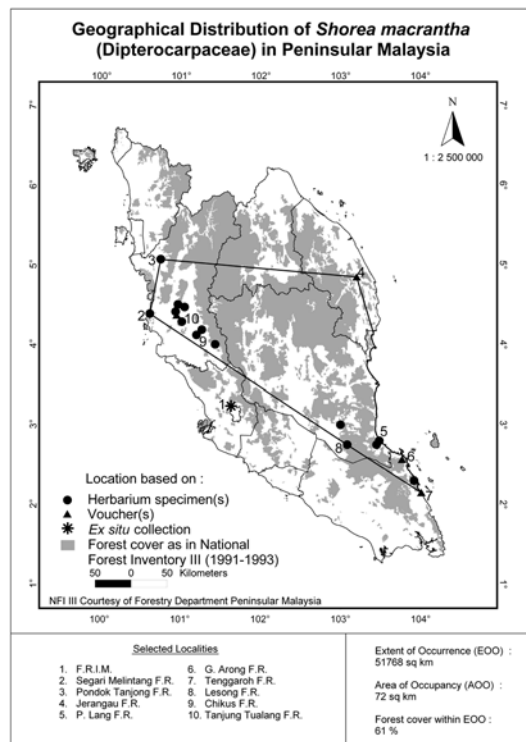
Distribution: Sumatra, Peninsular Malaysia and Borneo (Sarawak).

Peninsular Malaysia: Johor, Pahang, Perak and Terengganu. **Sarawak:** Kuching, Serian, Sibuan, Simunjan and Tatau.

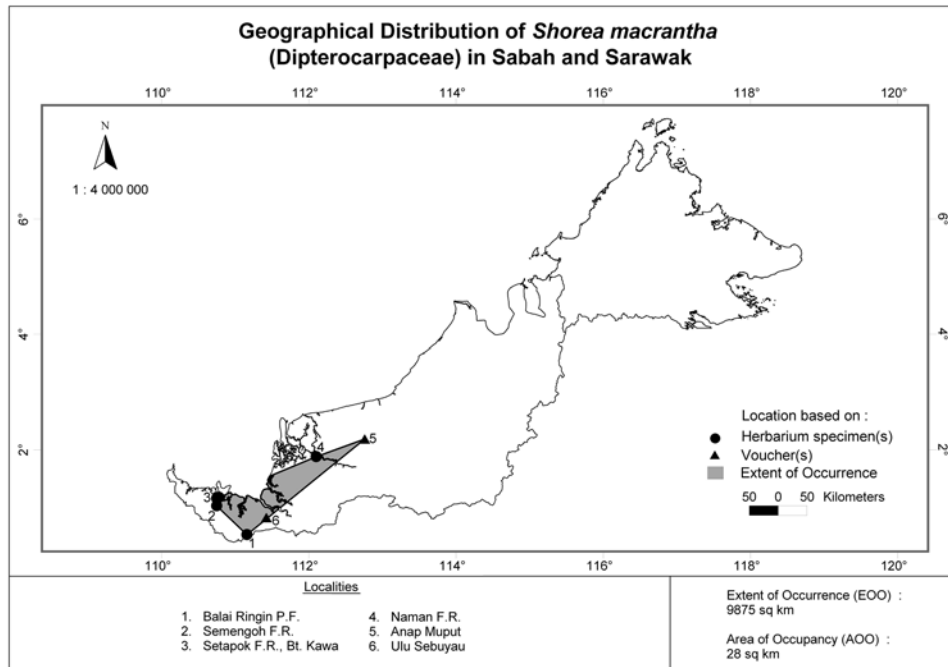
Habitat: Lowland swamp and semi-swamp forests and in the vicinity of rivers. In Sarawak, it occurs in inland margins of mixed peat swamp forests and on poorly drained podsols on terraces in kerangas.

Conservation status: EN B2ab(iii) for Malaysia; VU A4c for Peninsular Malaysia; EN B2ab(iii) for Sarawak.

Conservation notes: In Peninsular Malaysia, many of Perak's Forest Reserves where the taxon occurs had been converted to other land uses. To date, 18 and 11 trees have been located respectively in a 55-ha swamp forest in Universiti Teknologi MARA and in the 400-ha campus of Universiti Teknologi PETRONAS, in the district of Perak Tengah.



Other assessments: CR A1cd, C2a (IUCN, 2010); CR, threats from land conversion (Symington, 2004); EN (Ashton, 2004).



Shorea macroptera Dyer ssp. *macroptera*

Vernacular names: Peninsular Malaysia: melantai.

Distribution: Peninsular Thailand, Peninsular Malaysia, Singapore and Sumatra.

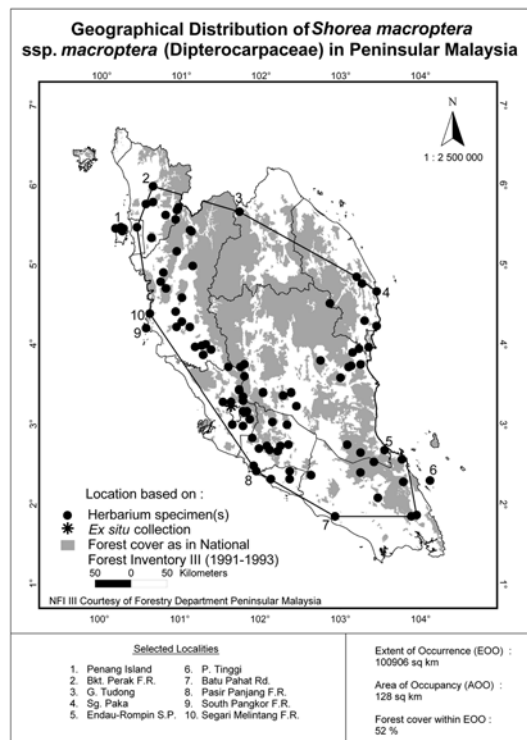
Peninsular Malaysia: Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Penang, Perak, Selangor and Terengganu.

Habitat: Lowland to upper hill dipterocarp forests, on low-lying, well-drained forest areas up to 900 m altitude.

Conservation status: LC for Malaysia.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 2.77 million adult stems above 30 cm dbh in the Permanent Reserved Forests. In 1985, at least 1,597 trees above 1 cm diameter were recorded from the Pasoh 50-ha research plot. 79.7% of this had diameters less than 5 cm.

Other assessments: CR A1cd (Oldfield *et al.*, 1998); NT (Symington, 2004).



Shorea materialis Ridl.

Vernacular names: Peninsular Malaysia: balau pasir; Sarawak: selangan batu pasir.

Distribution: Peninsular Malaysia and Borneo (Sarawak and Brunei).

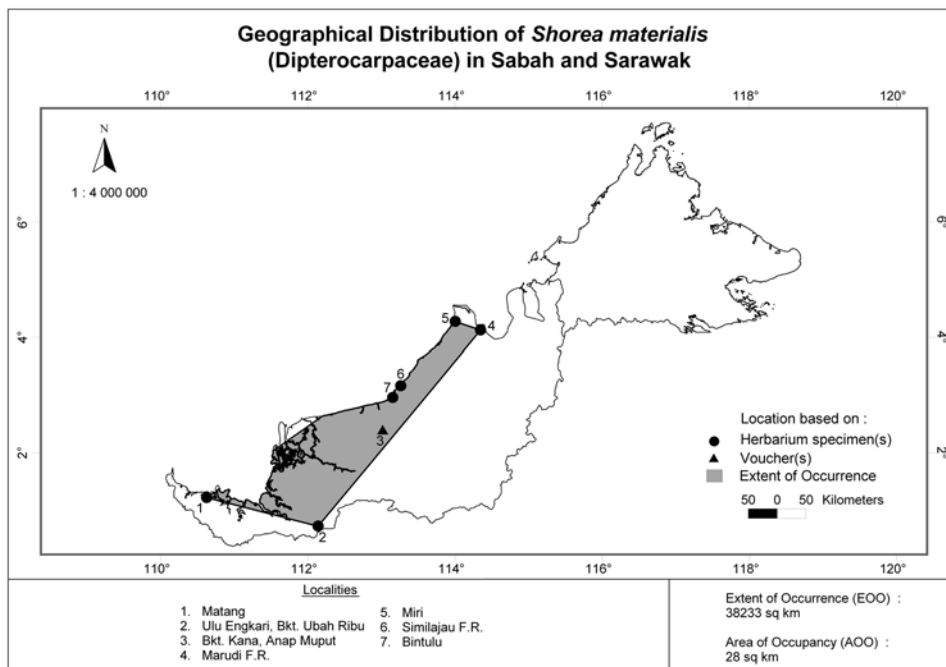
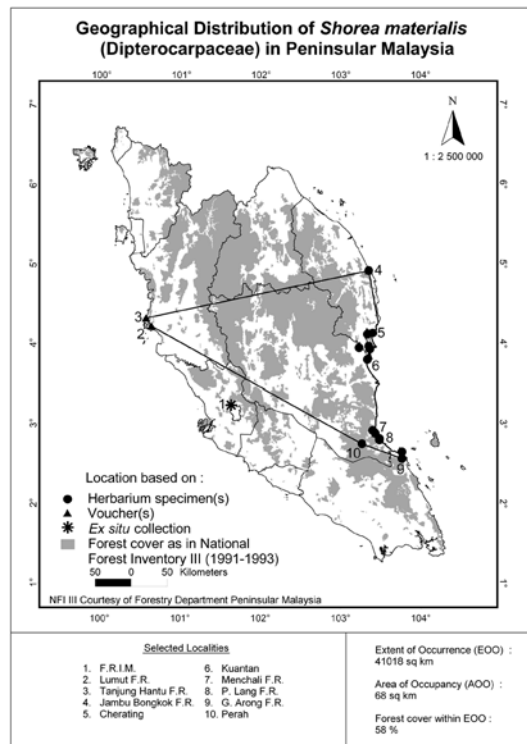
Peninsular Malaysia: Johor, Pahang, Perak and Terengganu. **Sarawak:** Bintulu, Kapit, Kuching, Lubok Antu and Miri.

Habitat: Lowland to hill forests. In Peninsular Malaysia, the species occurs usually on sandy, occasionally swampy soil, near coasts or tidal reaches of rivers. In Borneo, it occurs in kerangas forest on white sand terraces and on leached greyish-yellow sands on narrow ridges at altitudes to 800 m.

Conservation status: VU B2ab(iii) for Malaysia.

Conservation notes: In Sarawak, the species is reported to occur in Lambir Hills National Park. In Peninsular Malaysia, no populations are known to occur in the network of Totally Protected Areas. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 210,000 adult stems (above 30 cm dbh) in the Permanent Reserved Forests.

Other assessments: CR A1cd, C2a (IUCN, 2010); CR by habitat conversion (Symington, 2004); EN (Ashton, 2004).



Shorea maxima (King) Symington

Vernacular name: Peninsular Malaysia: damar hitam sengkawang putih.

Distribution: Peninsular Malaysia.

Peninsular Malaysia: Johor, Kelantan, Negeri Sembilan, Pahang, Perak, Selangor and Terengganu.

Habitat: Lowland to upper hill dipterocarp forests up to 1,300 m altitude.

Conservation status: NT for Malaysia.

Conservation notes: Populations occur in at least two Protected Areas. Many of the Forest Reserves where it occurs are under forest cover. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 5,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: EN A1c (IUCN, 2010); EN, threats from logging (Symington, 2004).

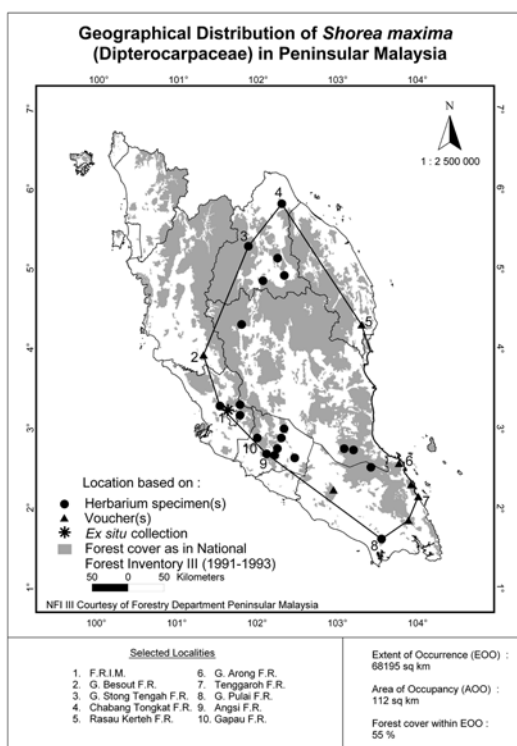
*Shorea maxwelliana* King

Plate 28A

Vernacular names: Peninsular Malaysia: damar laut daun kecil; Sabah: selangan batu asam; Sarawak: kumus hitam.

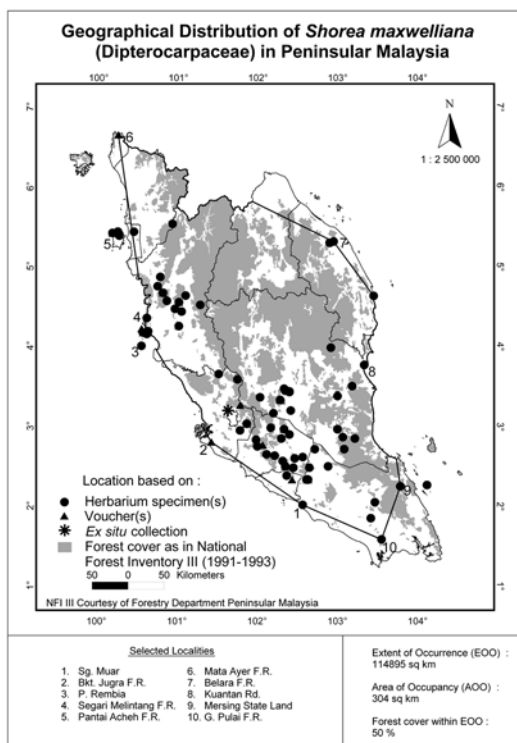
Distribution: Sumatra, Peninsular Malaysia and Borneo.

Peninsular Malaysia: Johor, Kedah, Malacca, Negeri Sembilan, Pahang, Penang, Perak, Perlis, Selangor and Terengganu. **Sabah:** Beaufort, Keningau, Kinabatangan, Kota Belud, Kudat, Lahad Datu, Sandakan, Sipitang, Tawau and Tenom. **Sarawak:** Bau, Belaga, Kapit, Kuching, Lawas, Limbang, Lundu, Marudi, Miri and Tatau.

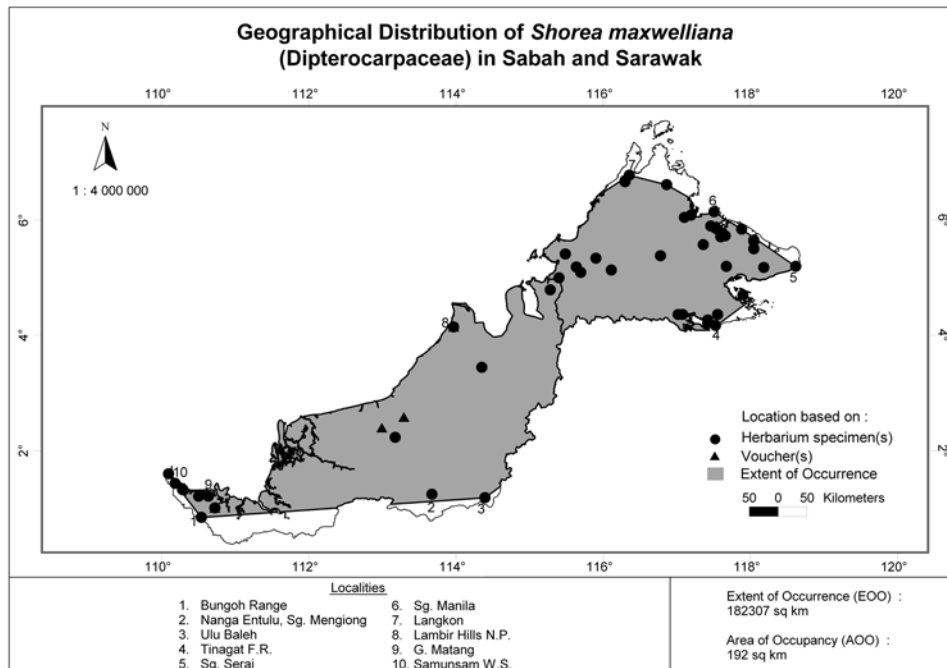
Habitat: Lowland to hill forests up to about 600 m altitude, including ultrabasic and sandstone and in regenerated logged-over forests.

Conservation status: LC for Malaysia.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 787,000 adult stems (above 30 cm dbh) in the Permanent Reserved Forests. In 1985, at least 5,682 trees above 1 cm diameter were recorded from the Pasoh 50-ha research plot with 83.0% having diameters less than 5 cm.



Other assessments: EN A1c (IUCN, 2010); NT (Symington, 2004); not VU (Ashton, 2004).



Shorea multiflora (Burck) Symington

Plates 28B–C

Vernacular names: Peninsular Malaysia: damar hitam; Sabah: banjutan; Sarawak: lun jantan.

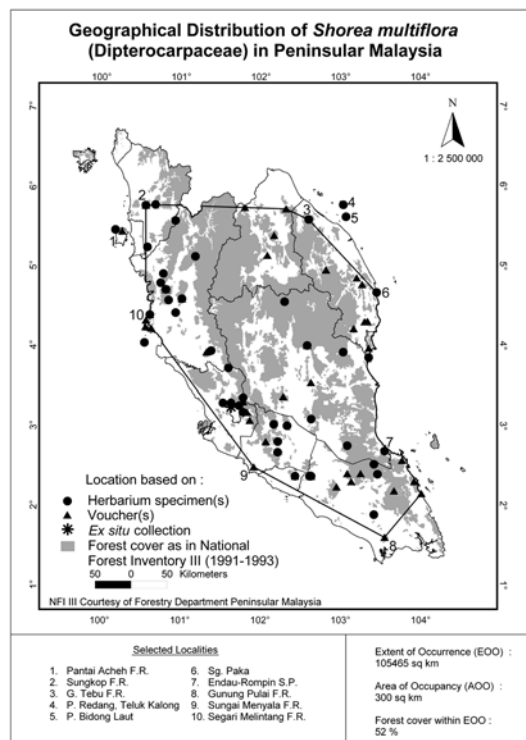
Distribution: Sumatra, Peninsular Malaysia and Borneo.

Peninsular Malaysia: Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Penang, Perak, Selangor and Terengganu. **Sabah:** Beaufort, Beluran, Kinabatangan, Kota Kinabalu, Lahad Datu, Sandakan, Semporna, Sipitang and Tawau. **Sarawak:** Belaga, Bintulu, Kapit, Kuching, Lawas, Limbang, Lubok Antu, Lundu, Marudi, Miri, Samarahan and Tatau.

Habitat: Lowland to upper hill forests to 900 m altitude. In Peninsular Malaysia, it occurs on coastal hills and in low-lying semi-swampy localities and on ridges. In Borneo, it occurs on yellow sands of coastal hills and inland shale ridges and on organic soil over karst limestone.

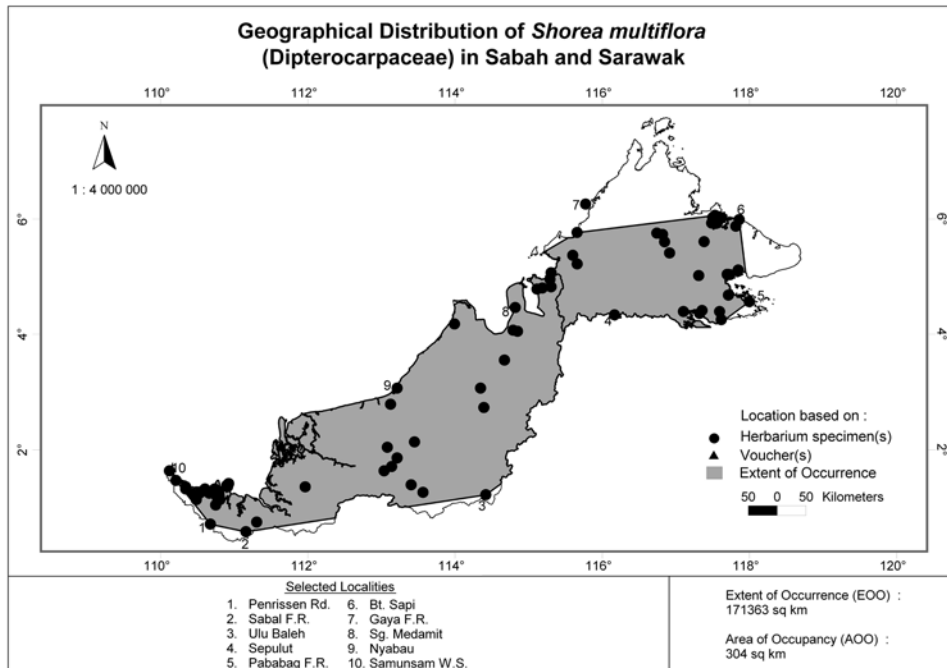
Conservation status: LC for Malaysia.

Conservation notes: The species occurs in the network of Totally Protected Areas. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated



64,000 adult stems above 30 cm dbh in the Permanent Reserved Forests. In 1991, at least 291 trees above 1 cm diameter were recorded from Lambir Hills 52-ha research plot. 75.9% of this had diameters less than 5 cm. In 1985, at least 3 trees above 1 cm diameter were recorded from the Pasoh 50-ha research plot. All trees had diameters less than 5 cm.

Other assessments: LR/lc (IUCN, 2010); NT (Symington, 2004); not VU (Ashton, 2004).



Shorea ochrophloia E.J. Strugnell ex Symington

Vernacular name: Peninsular Malaysia: seraya batu.

Distribution: Peninsular Malaysia.

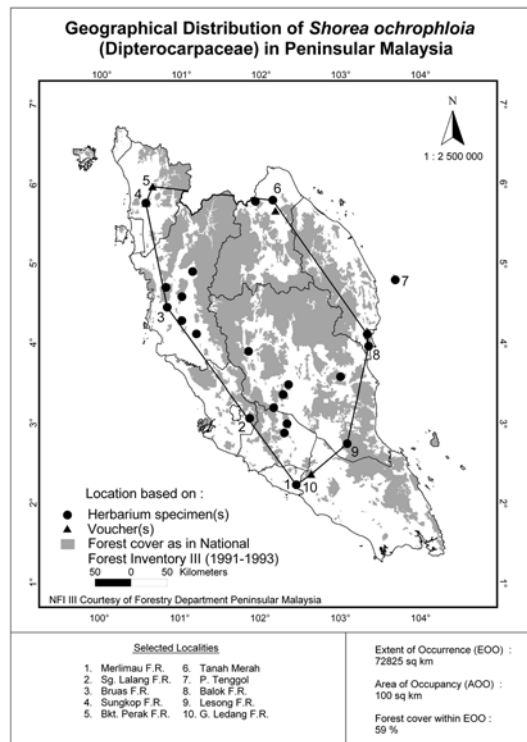
Peninsular Malaysia: Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Perak, Selangor and Terengganu.

Habitat: Lowland dipterocarp forest up to 300 m altitude.

Conservation status: VU B2b(iii)+c(iii) for Malaysia.

Conservation notes: One population occurs in the network of Totally Protected Areas.

Other assessments: CR A1cd (IUCN, 2010); CR, threats from habitat conversion (Symington, 2004).



Shorea ovalis (Korth.) Blume ssp. *ovalis*

Plates 29A–B

Vernacular names: Peninsular Malaysia: meranti kepong; Sabah: seraya kepong.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sabah and Kalimantan).

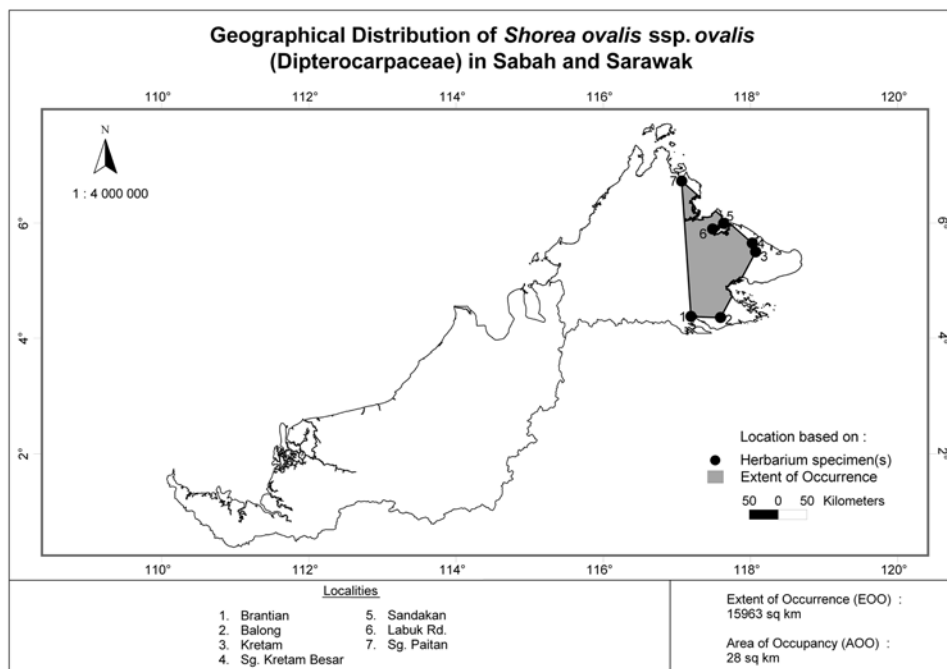
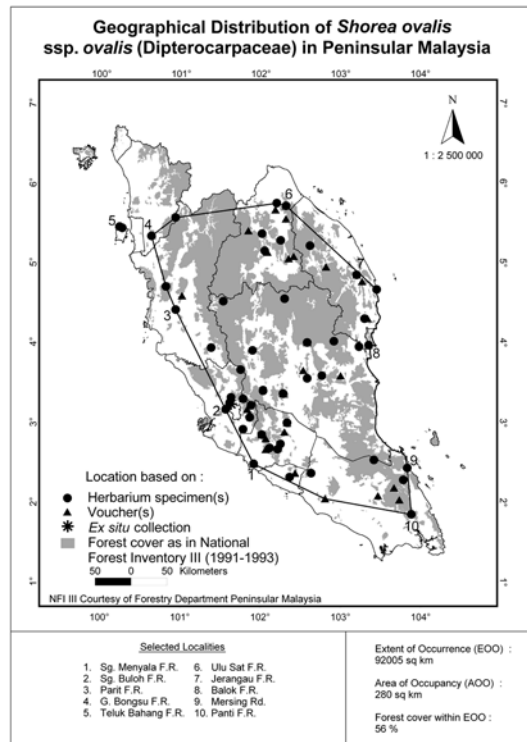
Peninsular Malaysia: Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Penang, Perak, Selangor and Terengganu. **Sabah:** Beluran, Kinabatangan, Sandakan and Tawau.

Habitat: Lowland and hill forests. In the peninsula, it occurs in low-lying areas and stream valleys. In Sabah, it occurs on fertile well-structured clay soils, on low hills at altitudes to 500 m.

Conservation status: NT for Malaysia; LC for Peninsular Malaysia; NT for Sabah.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 2.7 million adult stems above 30 cm dbh in the Permanent Reserved Forests. In 1985, at least 1,308 trees above 1 cm diameter were recorded from the Pasoh 50-ha research plot. 82.6% of this had diameters less than 5 cm.

Other assessments: EN A1cd (IUCN, 2010); EN by forest conversion (Symington, 2004); VU from land conversion threats (Ashton, 2004).



Shorea ovata Dyer ex Brandis

Vernacular names: Peninsular Malaysia: meranti sarang punai bukit; Sabah: seraya punai bukit; Sarawak: meranti pitis.

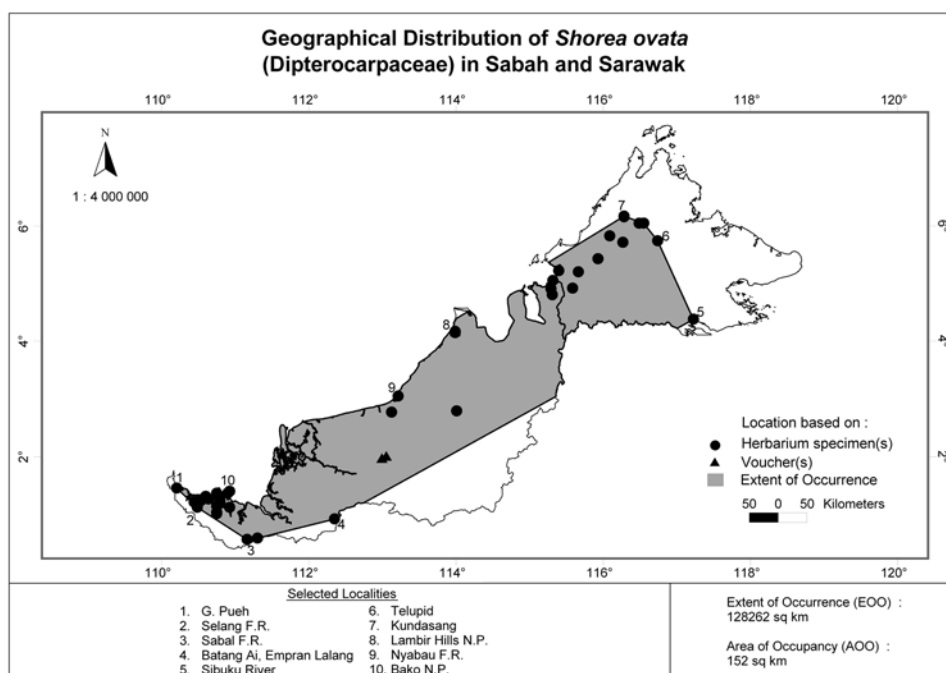
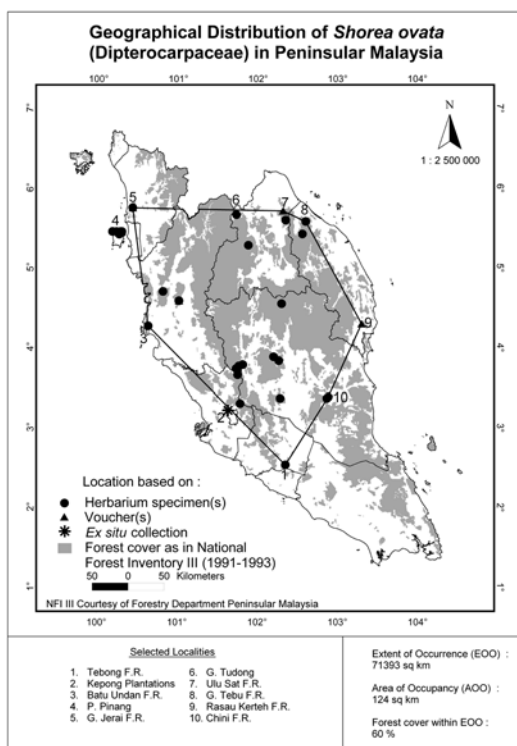
Distribution: Sumatra, Peninsular Malaysia, Borneo (Sabah, Sarawak and Brunei) and the Philippines.

Peninsular Malaysia: Kedah, Kelantan, Negeri Sembilan, Pahang, Penang, Perak, Selangor and Terengganu. **Sabah:** Beaufort, Beluran, Kota Belud, Ranau, Sipitang, Tambunan and Tawau. **Sarawak:** Bintulu, Kuching, Lawas, Limbang, Lubok Antu, Lundu, Miri, Samarahan, Simunjan and Tatau.

Habitat: Lowland to upper hill forests to 1,300 m altitude. In Peninsular Malaysia, the species occurs at altitudes of a few hundred feet above sea level in coastal ranges; in inland ranges, it occurs about 600–1,300 m. In Borneo, it occurs on yellow sandy soil in the lowlands, and in the ecotone to kerangas and at altitudes 600–1,000 m.

Conservation status: NT for Malaysia; LC for Peninsular Malaysia; NT for Sabah and Sarawak.

Other assessments: EN A1cd (IUCN, 2010); NT (Symington, 2004); VU in the lowlands with threats mainly from land conversion (Ashton, 2004).



Shorea palembanica Miq.

Vernacular names: Peninsular Malaysia: meranti tengkawang air; Sarawak: engkabang asu.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sabah, Sarawak and Kalimantan).

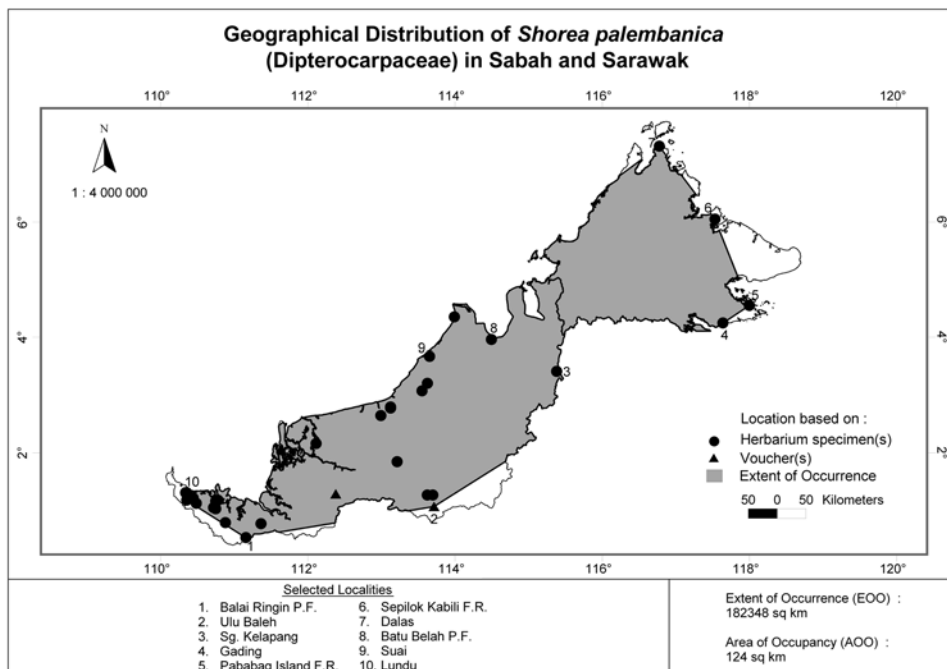
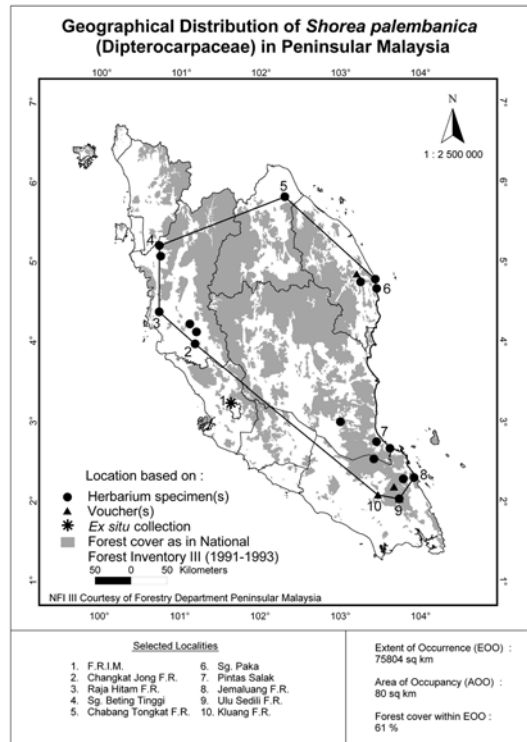
Peninsular Malaysia: Johor, Kelantan, Pahang, Perak and Terengganu. **Sabah:** Beluran, Pitas, Sandakan, Semporna and Tawau. **Sarawak:** Belaga, Bintulu, Kapit, Kuching, Lubok Antu, Lundu, Miri, Samarahan, Sibiu, Simunjan and Tatau.

Habitat: Lowland forests. In Peninsular Malaysia, the species occurs along banks of streams and in swamp areas. In Borneo, it occurs on silty floodplains and along banks of sluggish rivers.

Conservation status: VU A4c for Malaysia.

Conservation notes: Information on the habitat status for the localities in Sabah is required.

Other assessments: CR A1cd (IUCN, 2010); CR (Symington, 2004); VU from land conversion threats (Ashton, 2004).



Shorea parvifolia Dyer ssp. *parvifolia*

Plate 29C

Vernacular names: Peninsular Malaysia and Sarawak: meranti sarang punai; Sabah: seraya punai.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sabah and Sarawak).

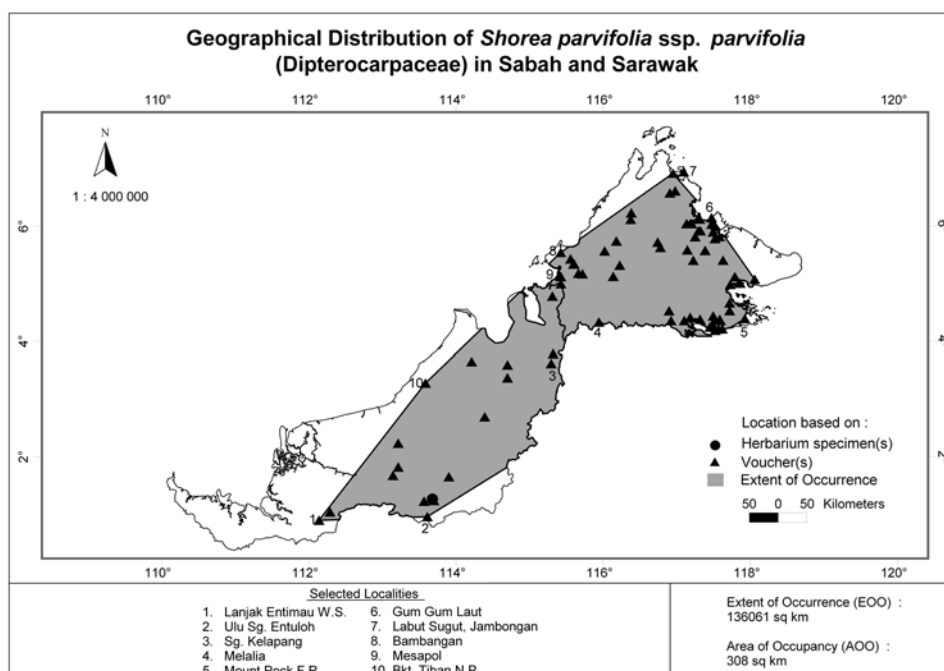
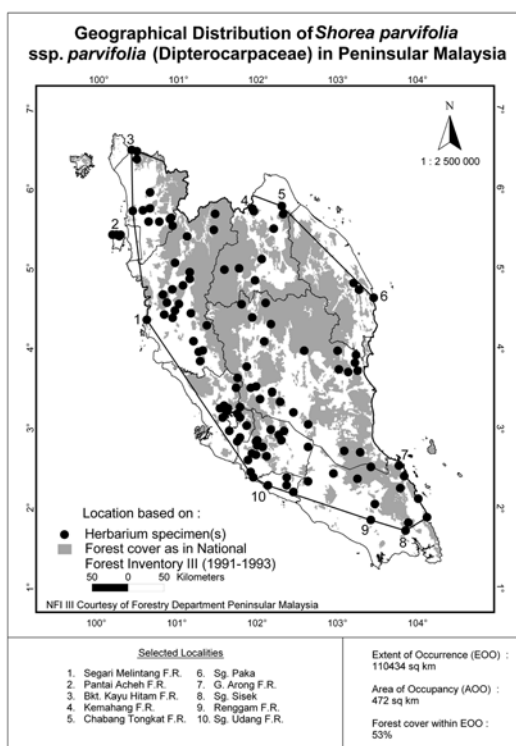
Peninsular Malaysia: Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Penang, Perak, Selangor and Terengganu. **Sabah:** Beaufort, Beluran, Keningau, Kinabatangan, Kuala Penyu, Lahad Datu, Nabawan, Pitas, Ranau, Sandakan, Semporna, Sipitang, Tambunan, Tawau and Tenom. **Sarawak:** Belaga, Bintulu, Kapit, Lawas, Limbang, Lubok Antu, Marudi, Miri, Song and Tatau.

Habitat: Lowland to hill forests and in seasonally dry tropical rain forest. In Peninsular Malaysia, the species occurs up to 800 m altitude. In Borneo, it occurs on yellow clay soils, usually well-drained, on shales and intermediate and acid volcanic rocks but rare on base rich rocks such as basalt.

Conservation status: LC for Malaysia.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 6.2 million adult stems (above 30 cm dbh) in the Permanent Reserved Forests. In 1985, at least 1,685 trees above 1 cm diameter were recorded from the Pasoh 50-ha research plot. 77.1% of this had diameters less than 5 cm.

Other assessments: EN A1cd (Oldfield *et al.*, 1998); NT (Symington, 2004); VU from land conversion threats (Ashton, 2004).



Shorea parvifolia Dyer ssp. *velutinata* P.S.Ashton

Vernacular names: Sarawak: meranti sarang punai; Sabah: seraya punai.

Distribution: Sumatra, Peninsular Malaysia and Borneo.

Peninsular Malaysia: Pahang (Temerluh). **Sabah:** Beaufort, Kinabatangan, Lahad Datu and Sandakan.

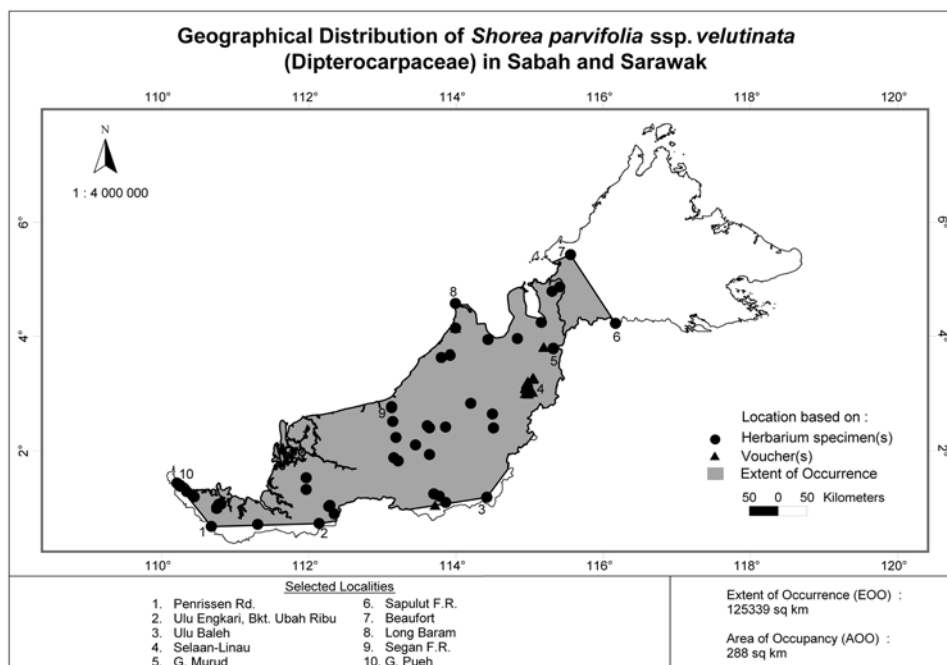
Sarawak: Belaga, Bintulu, Kapit, Kuching, Marudi, Miri, Lawas, Limbang, Lubok Antu, Lundu, Samarahan and Tatau.

Habitat: Lowland and hill forests.

Conservation status: LC for Malaysia; DD for Peninsular Malaysia; LC for Sabah and Sarawak.

Conservation notes: In Peninsular Malaysia, the species is represented by one collection and this collection is not available in the regional herbaria. Locality detail is dubious. In Sabah and Sarawak, it is reported to be widespread.

Other assessments: EN A1cd (Oldfield *et al.*, 1998); NT (Symington, 2004); not VU (Ashton, 2004).



Shorea pauciflora King

Vernacular names: Peninsular Malaysia and Sarawak: nemesu; Sabah: oba suluk.

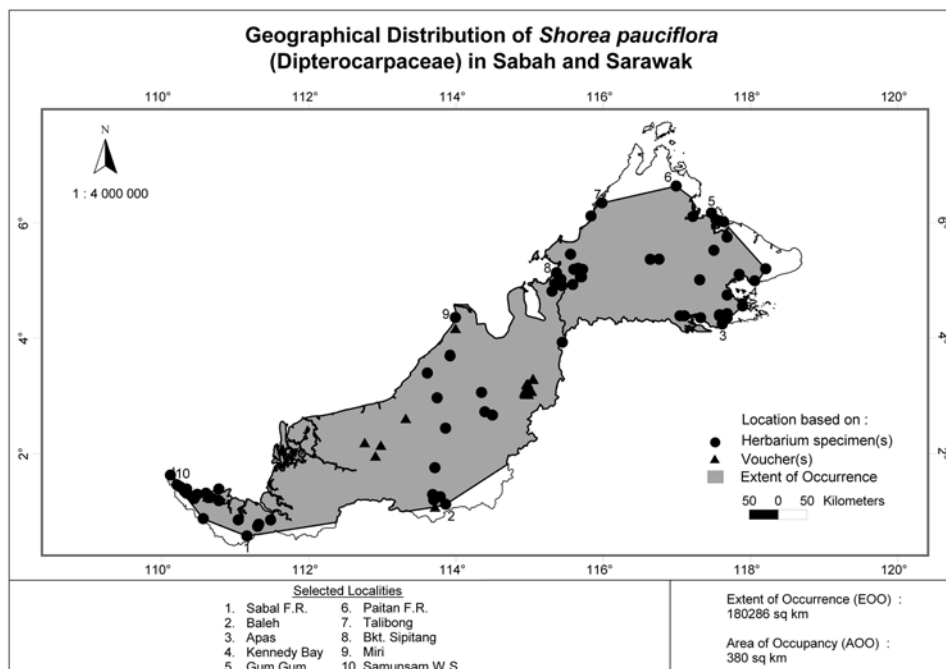
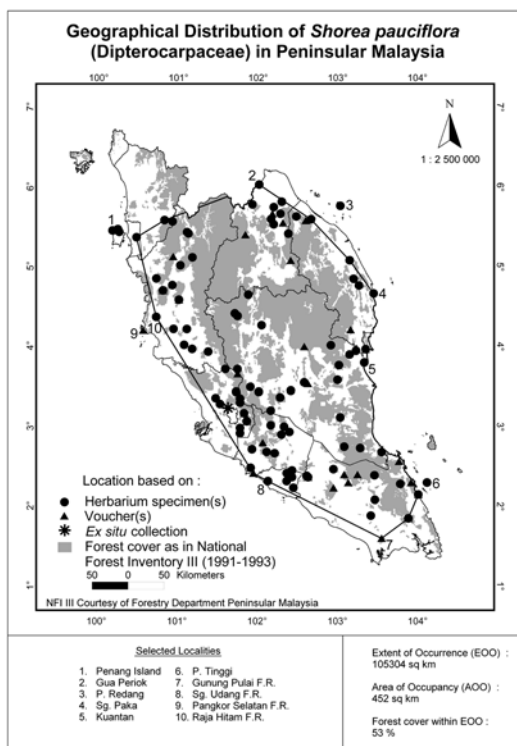
Distribution: Sumatra, Peninsular Malaysia and Borneo.

Peninsular Malaysia: Johor, Kedah, Kelantan, Malacca, Negeri Sembilan, Pahang, Penang, Perak, Selangor and Terengganu. **Sabah:** Beaufort, Beluran, Kinabatangan, Kota Belud, Kuala Penyu, Kudat, Lahad Datu, Sandakan, Sipitang, Tawau and Tenom. **Sarawak:** Bau, Belaga, Bintulu, Kapit, Kuching, Lawas, Lundu, Marudi, Miri, Samarahan, Sri Aman and Tatau.

Habitat: Lowland to hill forests. In Peninsular Malaysia, it occurs in well-drained soils at altitudes to 600 m or even higher in valleys. In Borneo, it occurs on yellow-red sandy, sandy clay and clay soils, including on plateau sandstone and granodiorite, the Arip rhyolite and inland sedimentaries.

Conservation status: LC for Malaysia.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 1.7 million adult stems above 30 cm dbh in the Permanent Reserved Forests. At least 2,370 trees above 1 cm diameter were recorded from the Pasoh 50-ha research plot in 1985; 84.8% had diameters less than 5 cm. In 1991, at least 50 trees above 1 cm diameter were recorded from Lambir Hills 52-ha research plot with 48.0% having diameters less than 5 cm. Other assessments: EN A1cd (IUCN, 2010); maybe EN by land conversion (Symington, 2004); not VU (Ashton, 2004).



Shorea peltata Symington

Plates 30A–B

Vernacular names: Peninsular Malaysia: meranti telepok; Sabah: seraya kuning keladi.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sabah).

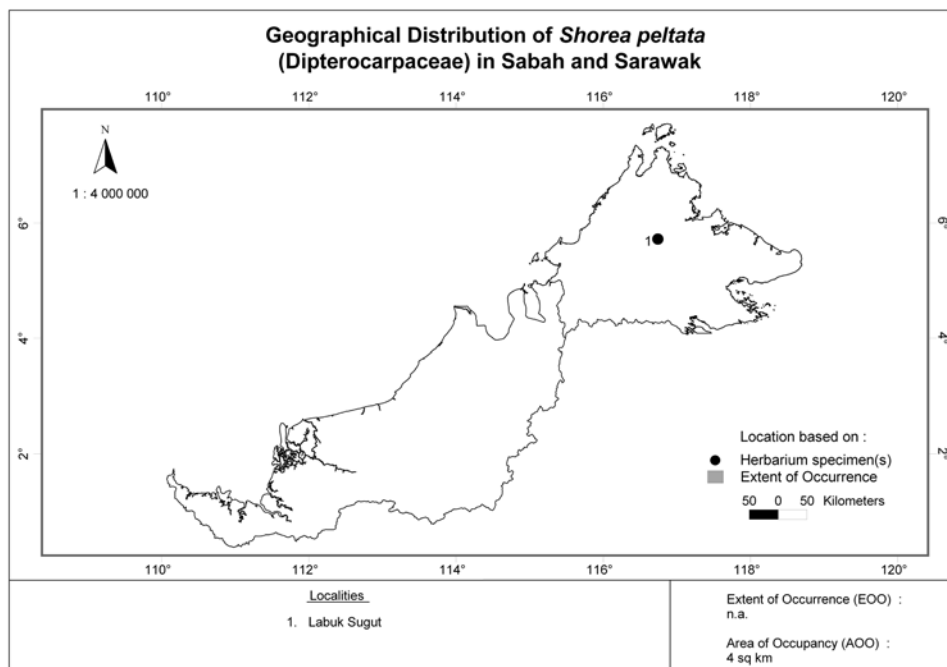
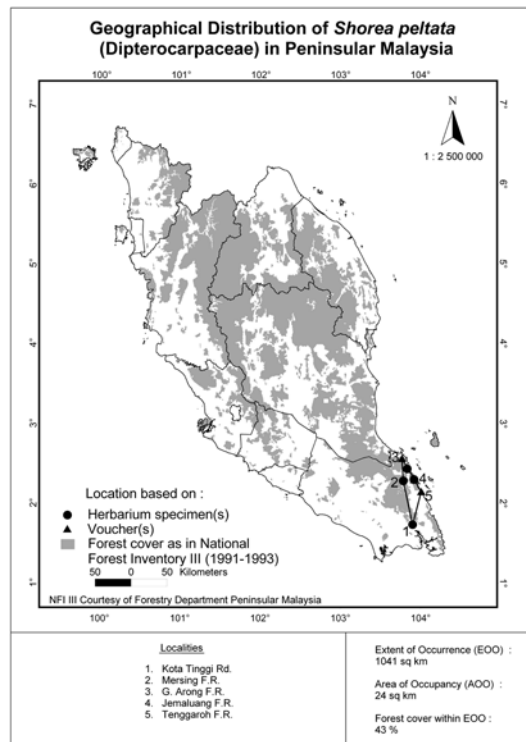
Peninsular Malaysia: Johor. **Sabah:** Beluran.

Habitat: Lowland forests. In Sabah, the species occurs on leached clay soil.

Conservation status: CR B2ab(iii) for Malaysia; EN B1ab(iii) for Peninsular Malaysia; CR B2ab(iii) for Sabah.

Conservation notes: In Peninsular Malaysia the species is common where found. 167 trees greater than 1 cm dbh were recorded from Compartments 5, 26 and 28 of Jemaluang FR in 2007. Trees also occur in Tenggaroh FR. In Sabah, the species is known from only one locality and is vulnerable to habitat change. Efforts are being made to class relevant compartments of Jemaluang and Tenggaroh FR as High Conservation Value Forest.

Other assessments: CR A1cd, C2a (IUCN, 2010); CR by habitat conversion (Symington, 2004); CR (Ashton, 2004).



Shorea platycarpa F.Heim

Plate 30C

Vernacular name: Peninsular Malaysia and Sarawak: meranti paya.

Distribution: Sumatra, Peninsular Malaysia and Borneo.

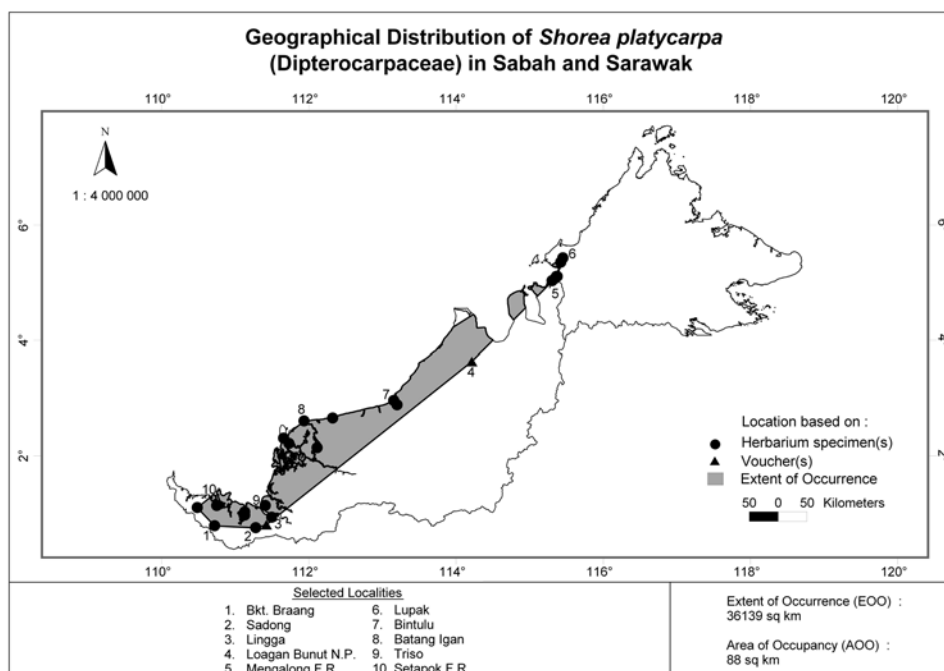
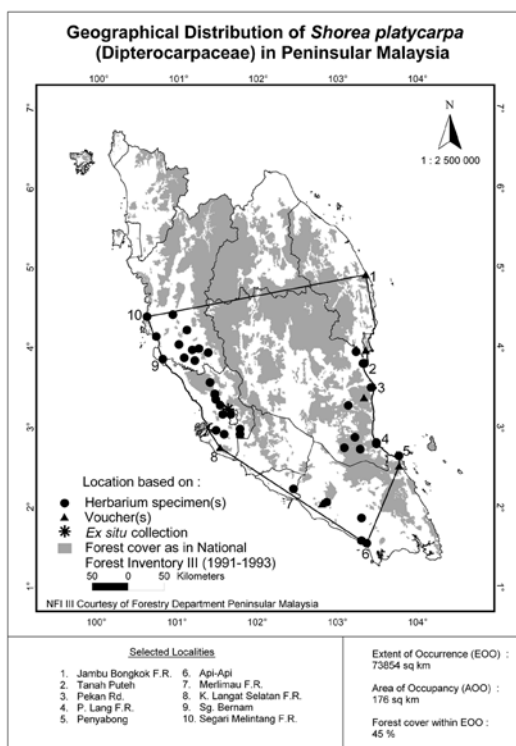
Peninsular Malaysia: Johor, Malacca, Pahang, Perak, Selangor and Terengganu. **Sabah:** Beaufort and Sipitang. **Sarawak:** Bintulu, Kuching, Marudi, Mukah, Sibiu, Simunjan and Sri Aman.

Habitat: Lowland forests often in swampy areas. In Borneo, the species also occurs on poorly drained podsols on the former beach terraces.

Conservation status: EN A4c for Malaysia; NT for Peninsular Malaysia; EN A4c for Sabah and Sarawak.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 271,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: CR A1cd (IUCN, 2010); EN by forest conversion (Ashton, 2004; Symington, 2004).



Shorea platyclados Slooten ex Foxw.

Vernacular names: Peninsular Malaysia and Sarawak: meranti bukit; Sabah: seraya bukit.

Distribution: Sumatra, Peninsular Malaysia and Borneo.

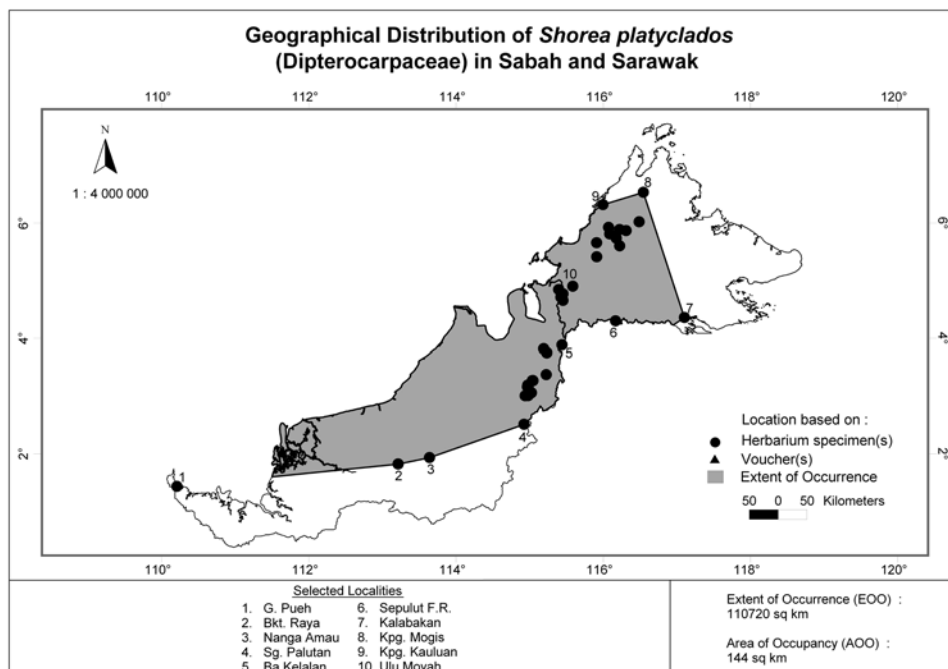
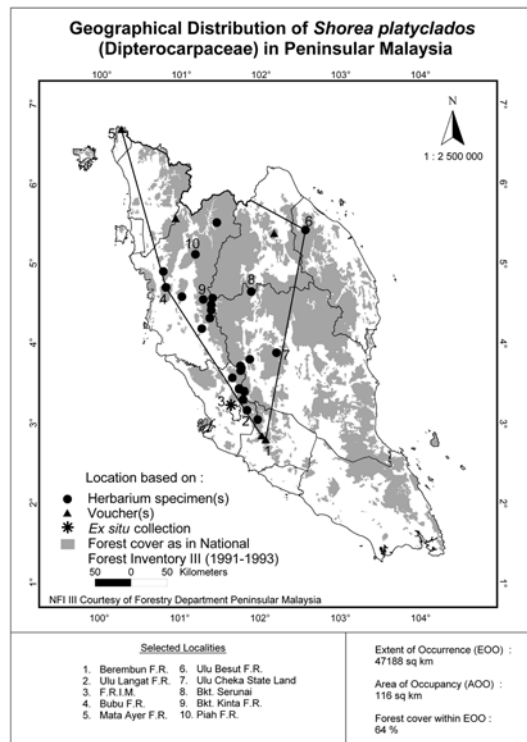
Peninsular Malaysia: Kedah, Kelantan, Negeri Sembilan, Pahang, Perak, Perlis, Selangor and Terengganu. **Sabah:** Keningau, Kota Marudu, Ranau, Sipitang, Tambunan and Tawau. **Sarawak:** Kapit, Lawas, Limbang, Lundu and Marudi.

Habitat: In Peninsular Malaysia, the species has been recorded from 300 m to 1,200 m on ridges, valleys, hill slopes and very steep slopes. In Borneo, it occurs on deep friable red-brown fertile clay soils, on shale and basalt at 700–1,300 m altitude, sometimes at base of mountains at altitudes as low as 150 m.

Conservation status: NT for Malaysia; LC for Peninsular Malaysia; NT for Sabah and Sarawak.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 1.28 million stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: may become EN as a result from logging (Symington, 2004); VU due to logging (Ashton, 2004).



Shorea resinosa Foxw.

Plate 31A

Vernacular name: Peninsular Malaysia and Sarawak: meranti belang.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sarawak).

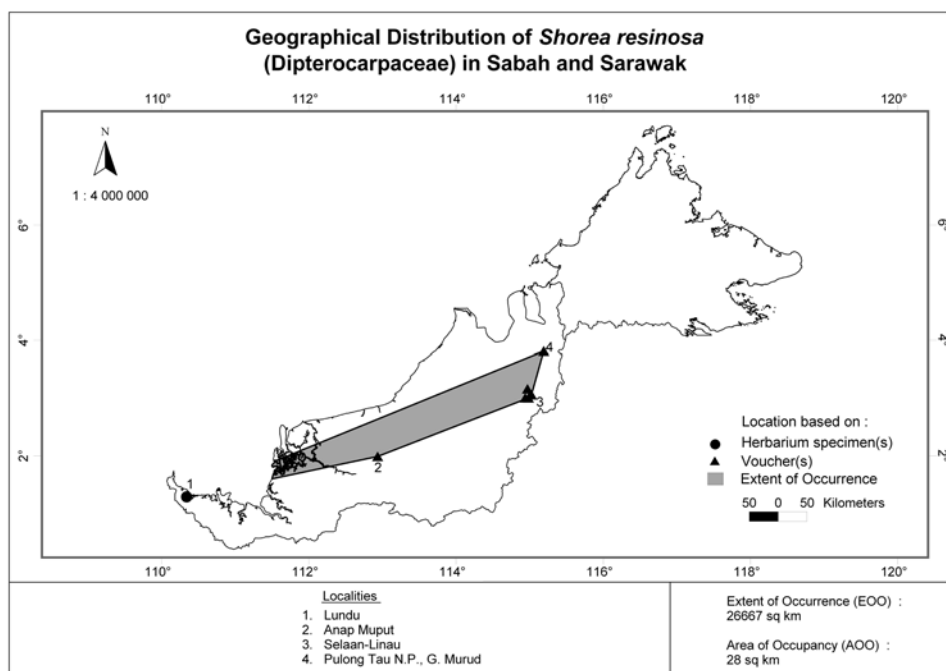
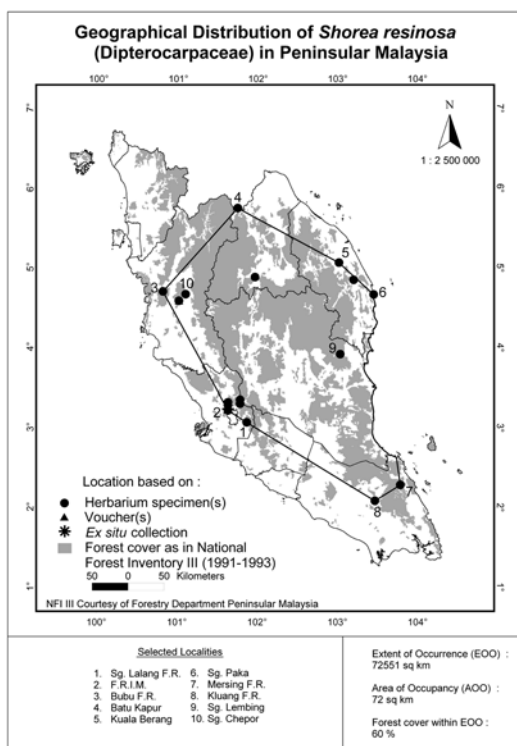
Peninsular Malaysia: Johor, Kelantan, Pahang, Perak, Selangor and Terengganu. **Sarawak:** Lundu, Marudi and Tatau.

Habitat: Undulating lowland to hill forests up to 500 m altitude. In Borneo, it is confined to forests on yellow sandy soils over sandstone.

Conservation status: VU B2ab(iii) for Malaysia; NT for Peninsular Malaysia; VU B2ab(iii) for Sarawak.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 113,000 adult stems (above 30 cm dbh) in the Permanent Reserved Forests. In Sarawak, the species occurs in the Pulong Tau National Park.

Other assessments: CR A1cd (IUCN, 2010); CR by habitat conversion (Symington, 2004); probably EN (Ashton, 2004).



Shorea roxburghii G.Don

Vernacular name: Peninsular Malaysia: temak.

Distribution: India, Myanmar, Thailand, Indo-China and Peninsular Malaysia.

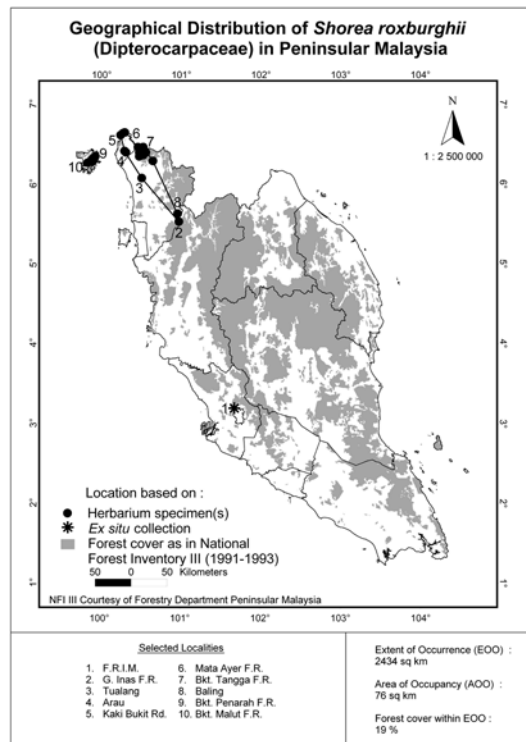
Peninsular Malaysia: Kedah (including Langkawi Islands) and Perlis.

Habitat: Lowland dipterocarp forest, seasonally dry tropical rain forests or semi-evergreen forests in *Schima*-bamboo forest and on limestone.

Conservation status: NT for Malaysia.

Conservation notes: Although the EOO allows an Endangered category with criterion B, it does not fully satisfy the requirements of the criterion. Although harvest has been recorded, the species is gregarious where it occurs and extreme fluctuation in locations and number of populations are not anticipated. Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 232,000 stems above 30 cm dbh in the Permanent Reserved Forests. The species is also widely planted as an ornamental plant in urban areas.

Other assessments: EN A1cd (IUCN, 2010); VU (Symington, 2004).



Shorea scrobiculata Burck

Vernacular names: Peninsular Malaysia: balau sengkawang; Sabah: selangan batu kurap; Sarawak: selangan batu zang.

Distribution: Peninsular Malaysia and Borneo.

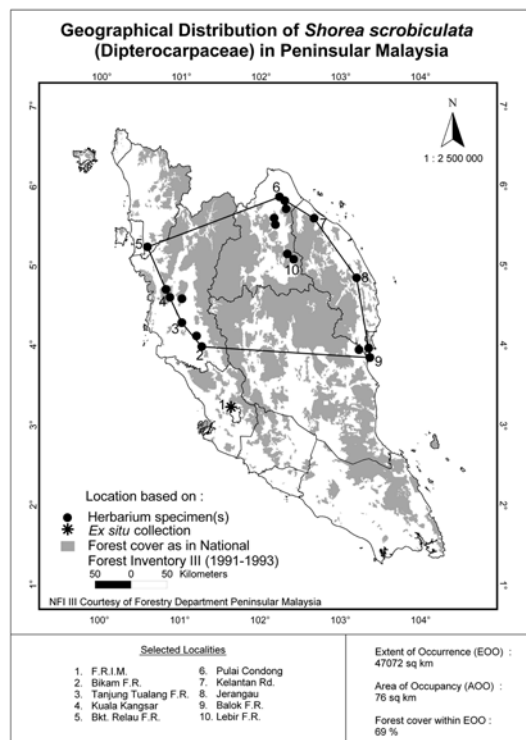
Peninsular Malaysia: Kedah, Kelantan, Pahang, Perak and Terengganu. **Sabah:** Beaufort, Keningau, Kinabatangan, Kunak, Lahad Datu, Pitas, Ranau, Sandakan and Tawau. **Sarawak:** Belaga, Bintulu, Kapit, Kuching, Lawas, Limbang, Lundu, Miri, Simunjan, Song and Tatau.

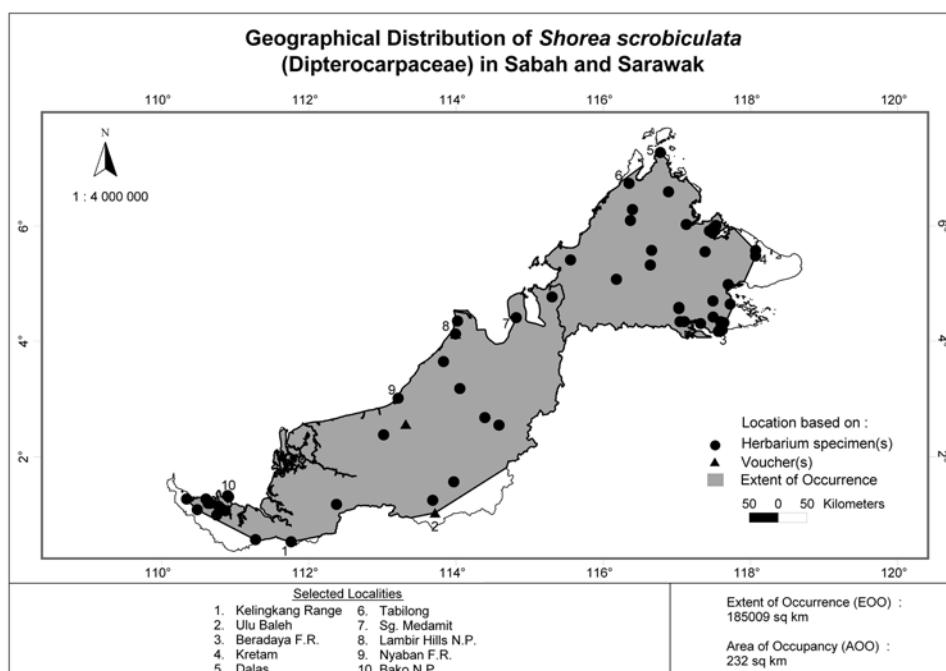
Habitat: Lowland and hill forests. In Peninsular Malaysia, the species occurs up to 500 m altitude while in Borneo, it occurs on leached, well-drained sandy and clay soils on low hills and along shale ridges at altitudes to 700 m.

Conservation status: NT for Malaysia; NT for Peninsular Malaysia; LC for Sabah and Sarawak.

Conservation notes: The species occurs in the network of Totally Protected Areas in Sabah and Sarawak.

Other assessments: CR by habitat conversion and logging (Symington, 2004); not VU (Ashton, 2004).





Shorea siamensis Miq.

Vernacular name: Peninsular Malaysia: temak batu.

Distribution: Myanmar, Indo-China, Thailand and Peninsular Malaysia.

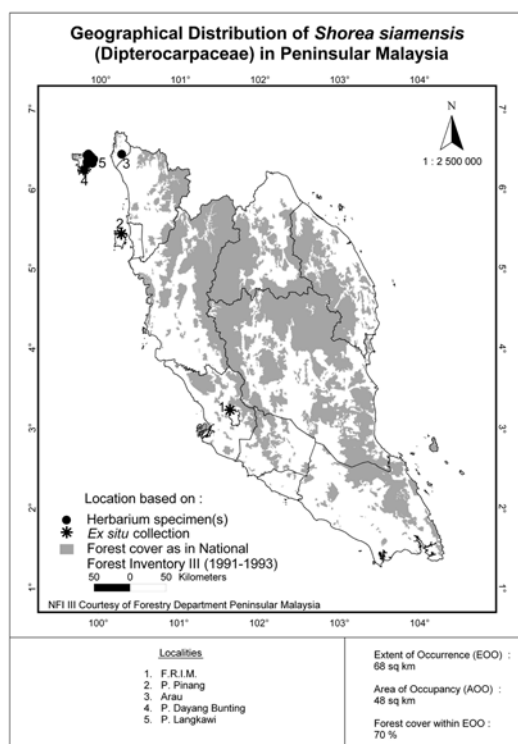
Peninsular Malaysia: Kedah and Perlis.

Habitat: Seasonally dry tropical rain forests or semi-evergreen forest in rocky headlands of islands and on limestone.

Conservation status: LC for Malaysia.

Conservation notes: Although the EOO allows a Critically Endangered category under criterion B, it does not fully satisfy the requirements for the criterion. Furthermore, much of its habitat in the rocky headlands of islands is still primary.

Other assessments: LR/lc (IUCN, 2010).



***Shorea singkawang* (Miq.) Burck ssp. *scabrosa* P.S.Ashton**

Vernacular name: Peninsular Malaysia: meranti sengkawang merah.

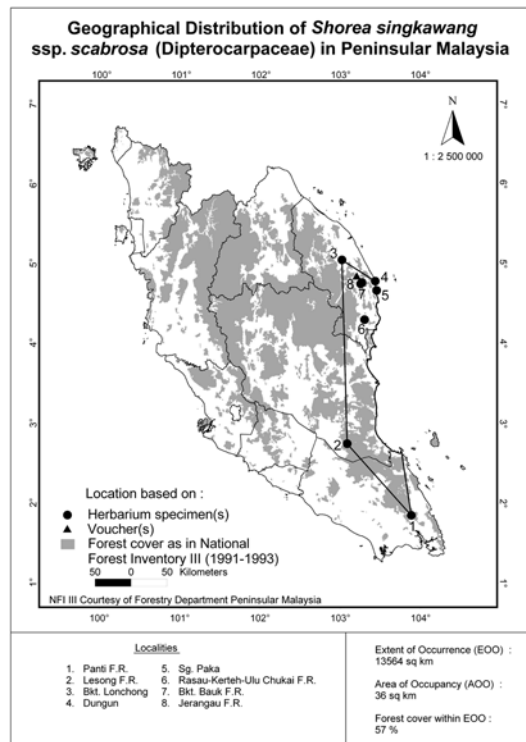
Distribution: Peninsular Malaysia.

Peninsular Malaysia: Johor, Pahang and Terengganu.

Habitat: Lowland and hill dipterocarp forests, on low hills, near coast, sometimes occurring in soils with impeded drainage.

Conservation status: EN B2b(iii)+c(ii) for Malaysia.

Conservation notes: No populations are known to occur in the network of Protected Areas. Some of the Forest Reserves where it occurs are small fragments. Other assessments: CR A1cd (IUCN, 2010); CR by land conversion (Symington, 2004).



Shorea singkawang* (Miq.) Burck ssp. *singkawang

Plates 31B–C

Vernacular name: Peninsular Malaysia: meranti sengkawang merah.

Distribution: Peninsular Thailand, Peninsular Malaysia and Sumatra.

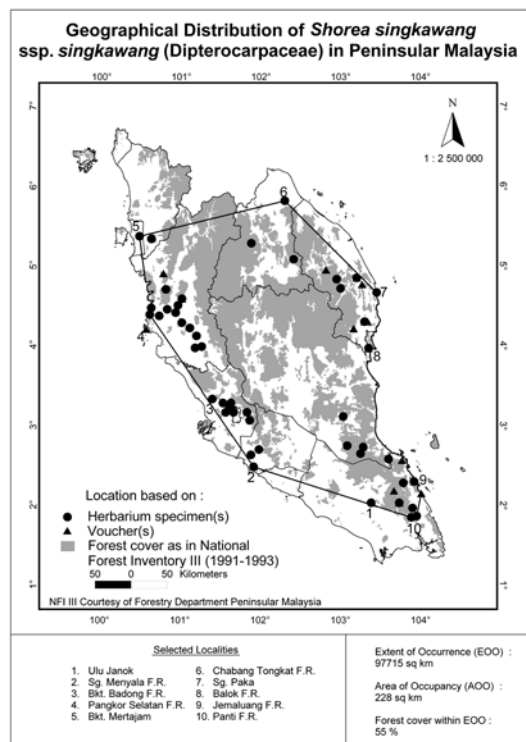
Peninsular Malaysia: Johor, Kedah, Kelantan, Negeri Sembilan, Pahang, Penang, Perak, Selangor and Terengganu.

Habitat: Lowland dipterocarp forests, in well-drained undulating land up to 400 m altitude. It is sometimes found on damp soil near streams.

Conservation status: LC for Malaysia.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 438,000 adult stems above 30 cm dbh in the Permanent Reserved Forests.

Other assessments: CR A1cd (IUCN, 2010); CR by land conversion (Symington, 2004).

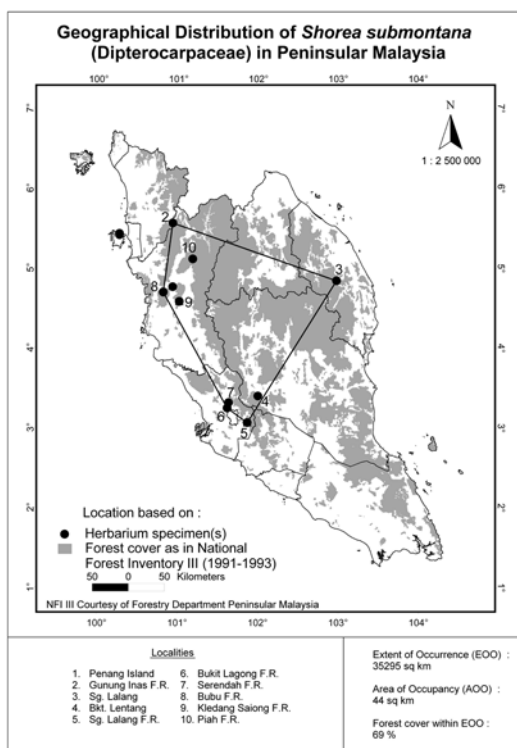


Shorea submontana Symington

Plates 32A–B

Vernacular name: Peninsular Malaysia: balau gajah.**Distribution:** Peninsular Malaysia.**Peninsular Malaysia:** Kedah, Pahang, Penang, Perak, Selangor and Terengganu.**Habitat:** Hill to upper hill dipterocarp forests from 300 m to 1,000 m altitude.**Conservation status:** NT for Malaysia.**Conservation notes:** Much of the inland ranges in Perak and Selangor are very steep and cannot be logged under current legislation. Some of the coastal ranges where the species occurs are still under forest cover.

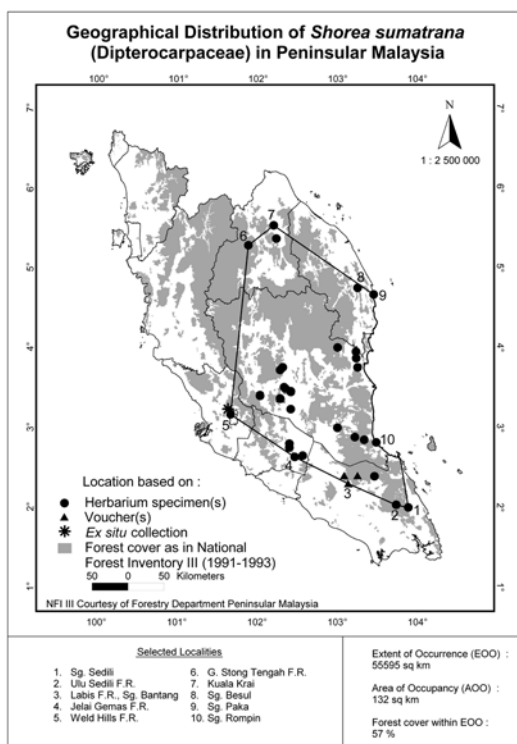
Other assessments: EN A1cd (IUCN, 2010); VU with threats from logging (Symington, 2004).

*Shorea sumatrana* (Slooten) Desch

Plates 32C–D

Vernacular name: Peninsular Malaysia: sengkawang.**Distribution:** Peninsular Thailand, Sumatra and Peninsular Malaysia.**Peninsular Malaysia:** Johor, Kelantan, Negeri Sembilan, Pahang and Terengganu.**Habitat:** Lowland dipterocarp forest in low-lying land frequently swampy habitats and land subject to inundation on banks of slow-flowing rivers.**Conservation status:** NT for Malaysia.**Conservation notes:** Several populations are known in the network of totally protected areas.

Other assessments: CR A1cd (IUCN, 2010); CR as a result of population fragmentation and habitat destruction (Symington, 2004).



Shorea teysmanniana Dyer ex Brandis

Vernacular names: Peninsular Malaysia: meranti bunga; Sabah: seraya bunga; Sarawak: meranti lilin.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sabah, Sarawak and Brunei).

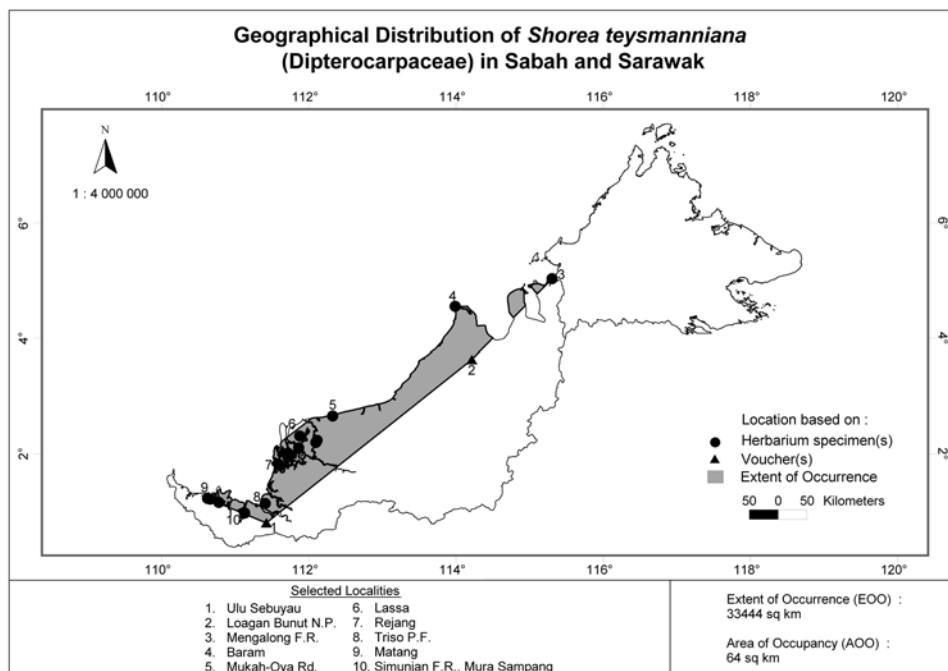
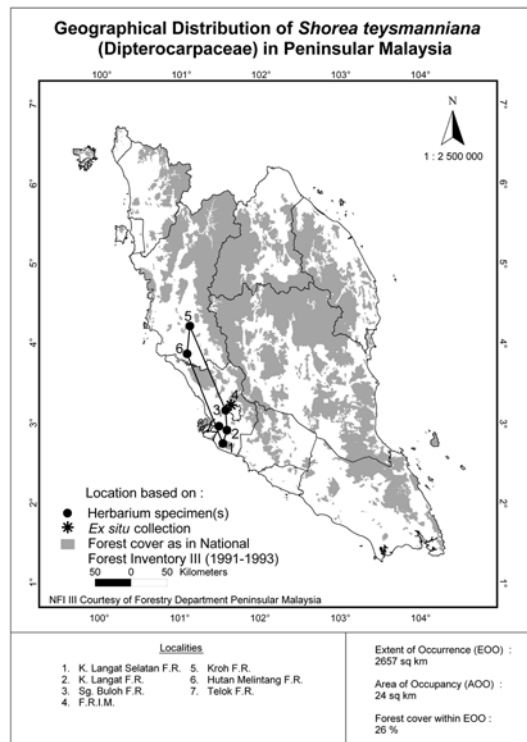
Peninsular Malaysia: Perak and Selangor. **Sabah:** Sipitang. **Sarawak:** Kuching, Marudi, Miri, Mukah, Sarikei, Sibu, Simunjan and Sri Aman.

Habitat: Lowland peat swamp forests, once recorded from sandstone plateau.

Conservation status: CR A4c for Malaysia.

Conservation notes: One population occurs in a Virgin Jungle Reserve.

Other assessments: EN A1cd (IUCN, 2010); CR (Symington, 2004); EN with threats from deforestation (Ashton, 2004).



Shorea uliginosa Foxw.

Vernacular names: Peninsular Malaysia: meranti bakau; Sarawak: meranti buaya.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sarawak and Kalimantan).

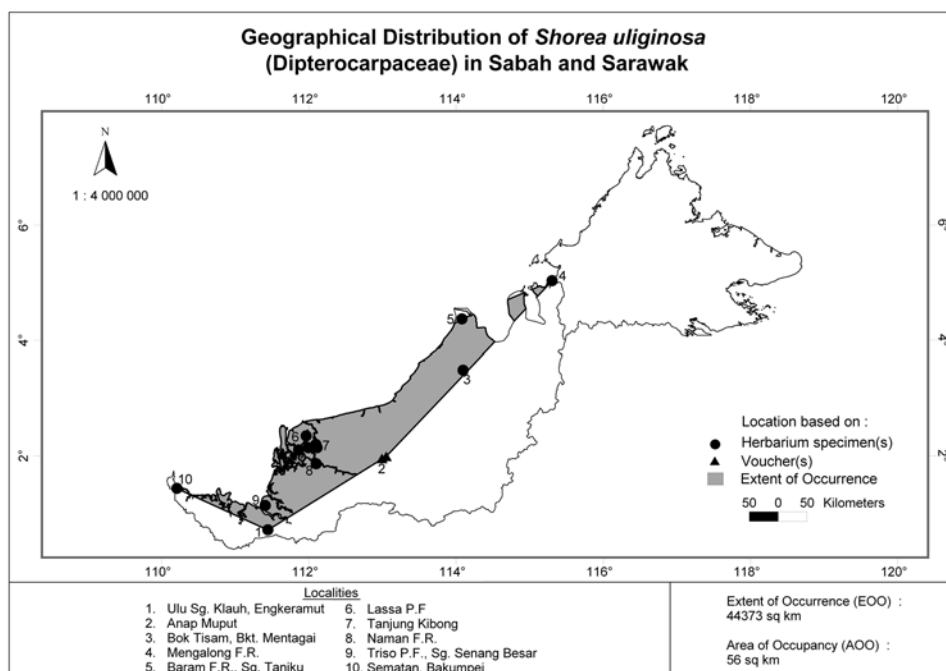
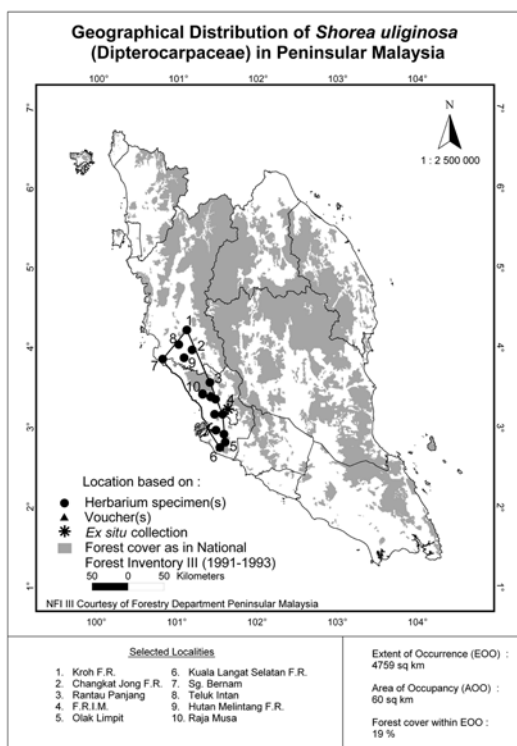
Peninsular Malaysia: Perak and Selangor. **Sabah:** Sipitang. **Sarawak:** Bintulu, Marudi, Miri, Mukah, Sarikei, Sibü, Sri Aman and Tatau.

Habitat: Peat swamp forests in the lowlands and heath forests. In Peninsular Malaysia, the species occurs in coastal swamp forests.

Conservation status: EN A4c for Malaysia; VU A4c for Peninsular Malaysia; EN A4c for Sabah and Sarawak.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 169,000 adult stems (above 30 cm dbh) in the Permanent Reserved Forests. Several populations occur in Virgin Jungle Reserves.

Other assessments: VU A1cd (IUCN, 2010); EN by habitat conversion (Ashton, 2004; Symington, 2004).



Vatica bella Slooten

Vernacular name: Peninsular Malaysia: resak keluang.

Distribution: Peninsular Malaysia.

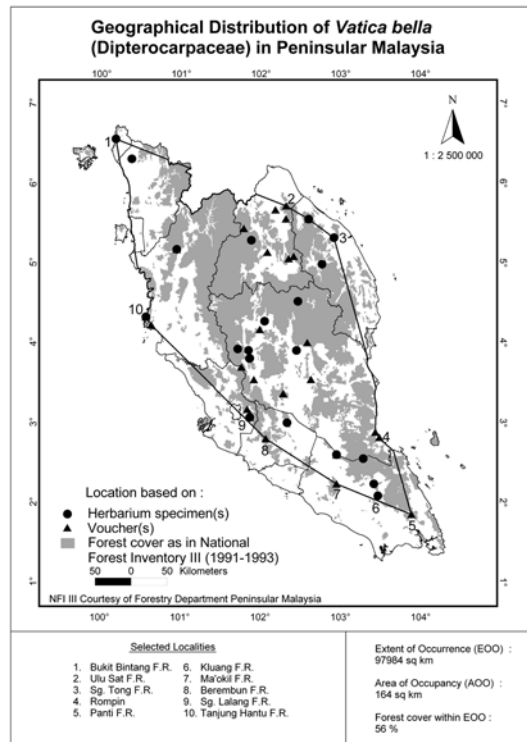
Peninsular Malaysia: Johor, Kedah, Kelantan, Negeri Sembilan, Pahang, Perlis, Perak, Selangor and Terengganu.

Habitat: Lowland dipterocarp forests on undulating land below 250 m altitude.

Conservation status: NT for Malaysia.

Conservation notes: Populations occur in the network of Totally Protected Areas.

Other assessments: CR A1cd (IUCN, 2010); EN, except in Pasoh FR, Negeri Sembilan (Symington, 2004).



Vatica cinerea King

Vernacular name: Peninsular Malaysia: resak laut.

Distribution: Myanmar, Indo-China, Peninsular Thailand and Peninsular Malaysia.

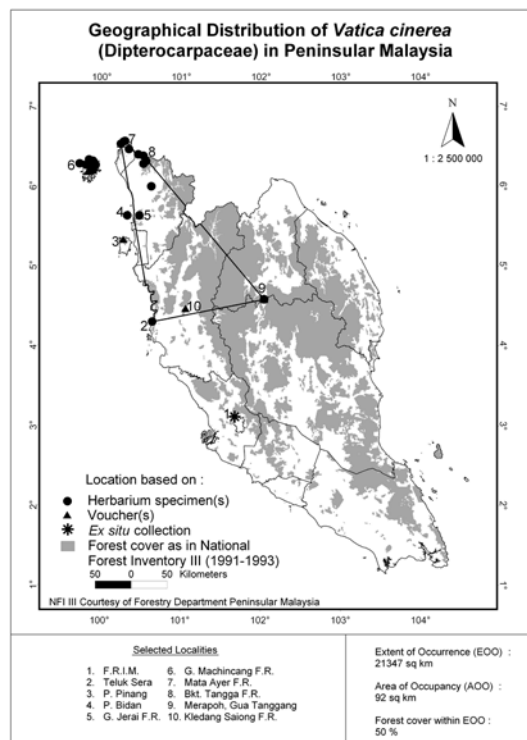
Peninsular Malaysia: Kedah, Pahang, Penang, Perak and Perlis.

Habitat: Occurs in exposed ridges, rocky headlands and limestone hills with an altitudinal range of up to 700 m. It thrives in exposed areas.

Conservation status: NT for Malaysia.

Conservation notes: The species adapts readily to unfavourable habitats.

Other assessments: EN A1cd (IUCN, 2010); VU with threats from habitat conversion (Symington, 2004).



Plates 33A–C

Vatica cuspidata (Ridl.) Symington

Plate 33D

Vernacular name: Peninsular Malaysia: resak daun runching.

Distribution: Peninsular Malaysia.

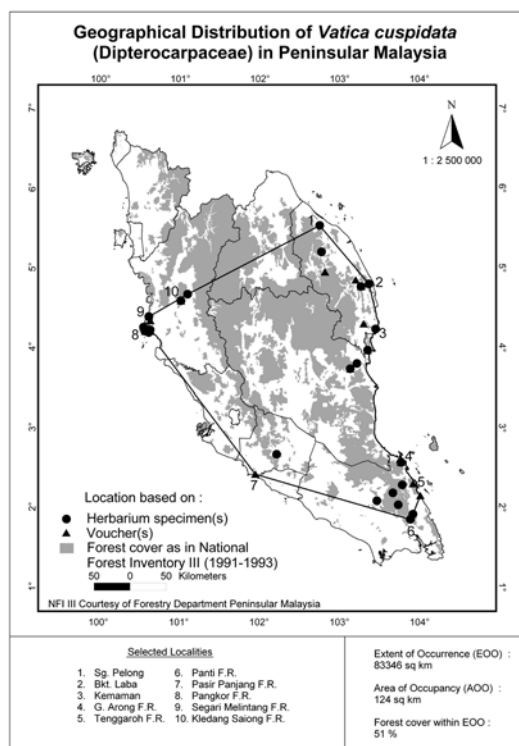
Peninsular Malaysia: Johor, Negeri Sembilan, Pahang, Perak and Terengganu.

Habitat: Hill dipterocarp forests, common on coastal hills (about 150 m altitude) and inland ridges (300–800 m altitude).

Conservation status: NT for Malaysia.

Conservation notes: Much of the inland ridges where it is recorded are under forest cover. Some of the coastal hills have been converted into other land uses.

Other assessments: CR A1cd (IUCN, 2010); VU from habitat conversion threats and placement of logging roads along ridges (Symington, 2004).

*Vatica flavida* Foxw.

Plates 34A–E

Vernacular name: Peninsular Malaysia: resak padi.

Distribution: Peninsular Malaysia.

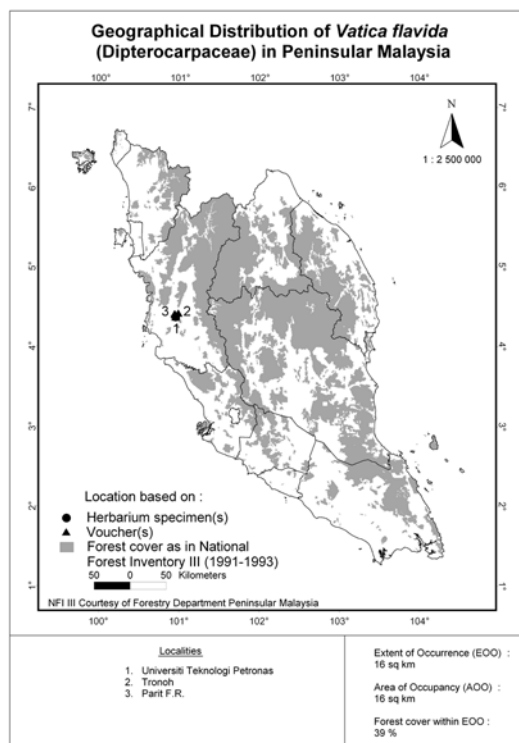
Peninsular Malaysia: Perak.

Habitat: Freshwater swamp forests in the lowland dipterocarp forests.

Conservation status: CR A4c, B2ab(iii) for Malaysia.

Conservation notes: To date, 17 and 232 trees have been located, respectively, in a 55-ha swamp forest in Universiti Teknologi MARA and in the 400-ha campus of Universiti Teknologi Petronas, in the district of Perak Tengah. Conservation efforts have been initiated by these universities.

Other assessments: CR A1cd, C2a (IUCN, 2010); may now be EX (Symington, 2004).



Vatica havilandii Brandis

Fig. 9, Plates 35A–F

Vernacular name: Peninsular Malaysia, Sabah and Sarawak: resak degung.

Distribution: Peninsular Malaysia and Borneo.

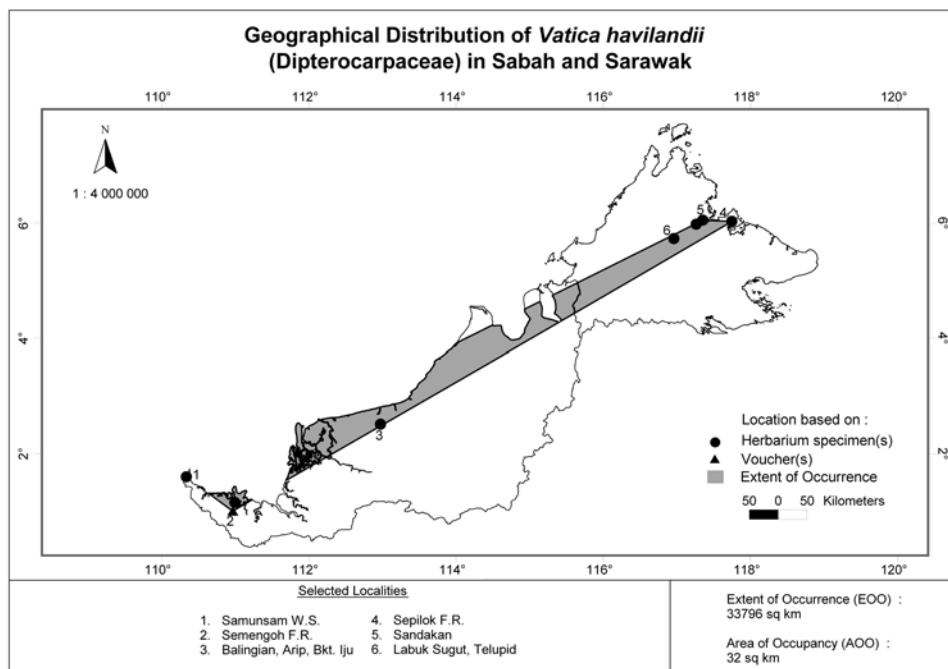
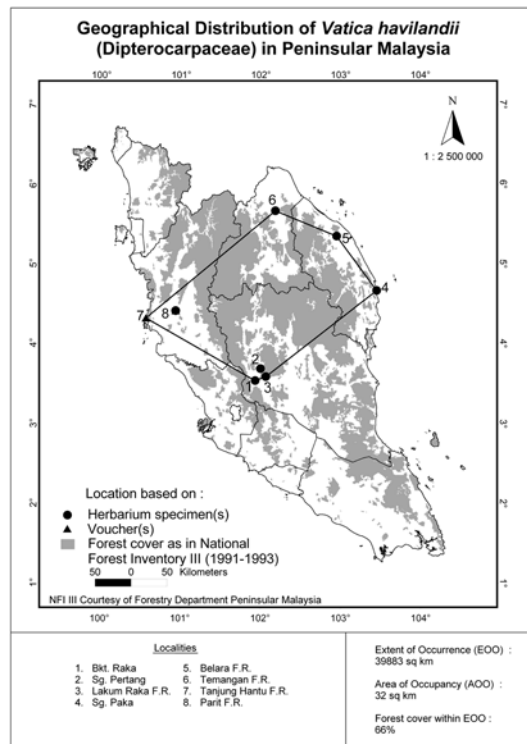
Peninsular Malaysia: Kelantan, Pahang, Perak and Terengganu. **Sabah:** Beluran and Sandakan. **Sarawak:** Kuching, Lundu and Mukah.

Habitat: Lowland forests. In Peninsular Malaysia, the species occurs in low-lying forest areas adjoining swamps and on low hills. In Borneo, it is found on sandy clay soil, usually near water, sometimes close to limestone.

Conservation status: EN A4c, B2b(iii)+c(ii) for Malaysia; EN A4c, B2b(iii)+c(ii) for Peninsular Malaysia; EN A4c for Sabah and Sarawak.

Conservation notes: The species occurs in Samunsam Wildlife Sanctuary, Sarawak and Kabil Sepilok FR, Sabah. In Peninsular Malaysia, no populations are known to occur in the network of Totally Protected Areas.

Other assessments: CR A1c, C2a (IUCN, 2010); CR or possibly EX from habitat conversion (Symington, 2004); probably CR (Ashton, 2004).



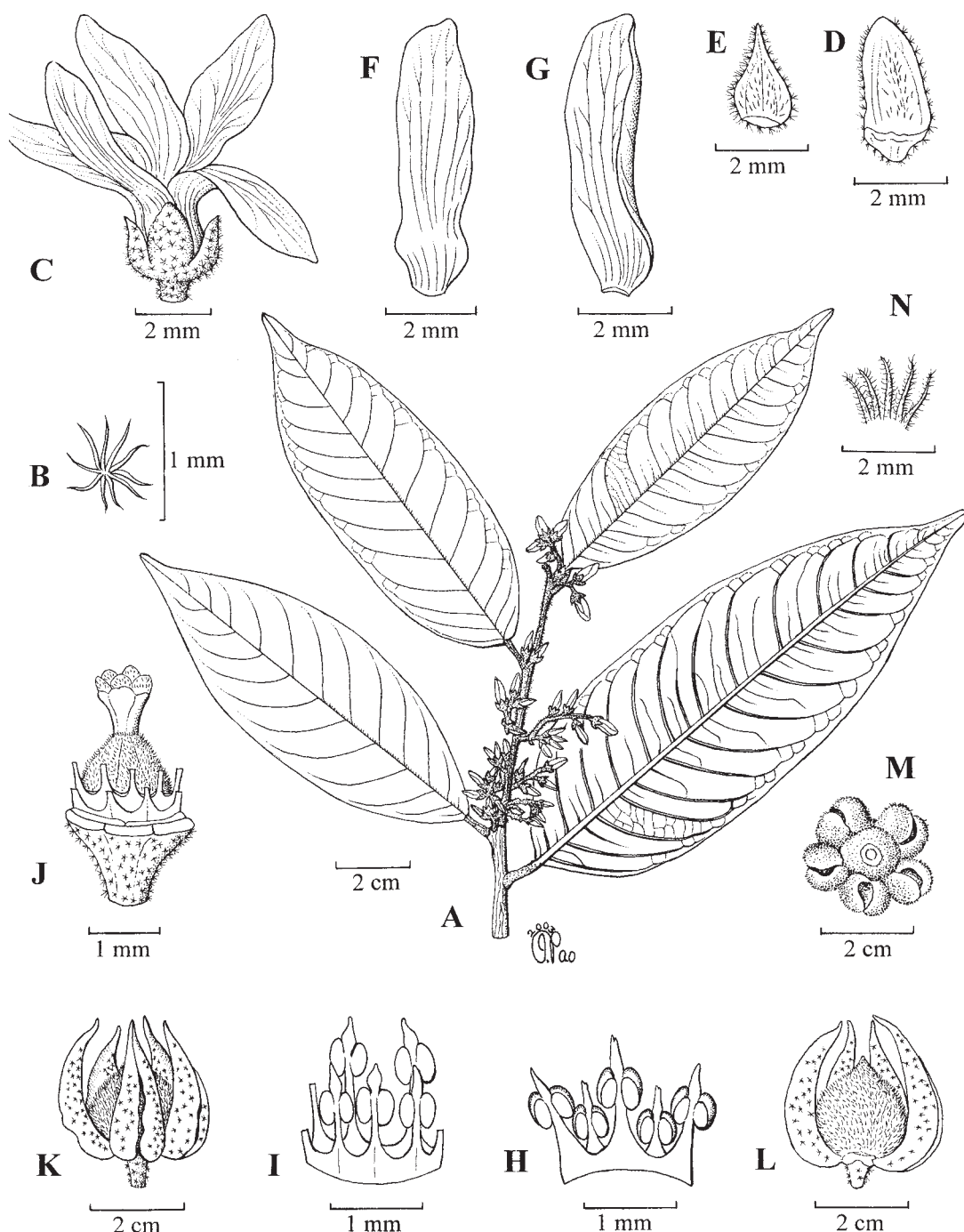


Fig. 9. *Vatica havilandii*. A, flowering leafy twig; B, tufted hairs; C, open flower; D, adaxial view of outer sepal; E, adaxial view of inner sepal; F, abaxial view of petal; G, adaxial view of petal; H, adaxial view of stamens; I, abaxial view of stamens; J, gynoecium; K, fruit; L, fruit with exposed nut; M, basal view of fruit; N, hairs on nut (A–J from *SN 36684*, K–N from *S 23244*) (Reproduced with permission from the Tree Flora of Sabah and Sarawak project).

Vatica heteroptera Symington

Vernacular name: Peninsular Malaysia: resak gunung.

Distribution: Peninsular Malaysia.

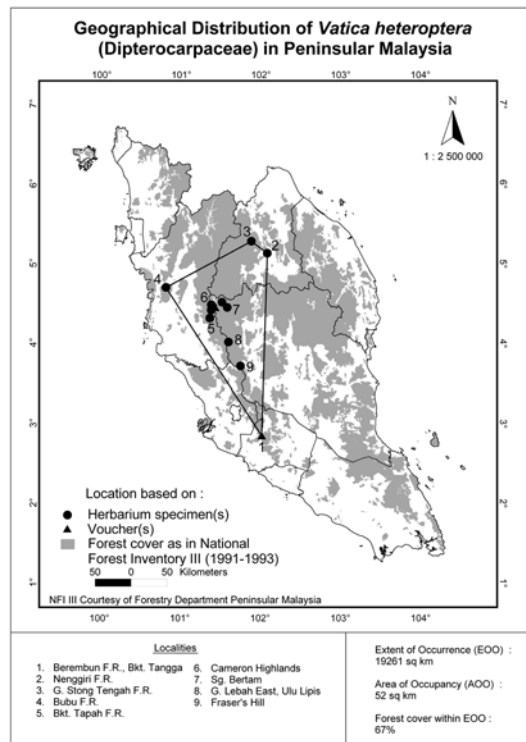
Peninsular Malaysia: Kelantan, Negeri Sembilan, Pahang and Perak.

Habitat: Inland ridges of upper hill dipterocarp forests between 900–1,200 m altitude. Commonly associated with *Shorea platyclados* in the habitat.

Conservation status: NT for Malaysia.

Conservation notes: Much of its occupied habitat cannot be logged under current legislation. In areas such as Cameron Highlands, threats from small scale agriculture encroachment exist.

Other assessments: CR A1c, C2a (IUCN, 2010); VU, threats from rapid development (Symington, 2004).



Vatica hullettii (Ridl.) P.S.Ashton

Vernacular name: Peninsular Malaysia: resak.

Distribution: Peninsular Malaysia.

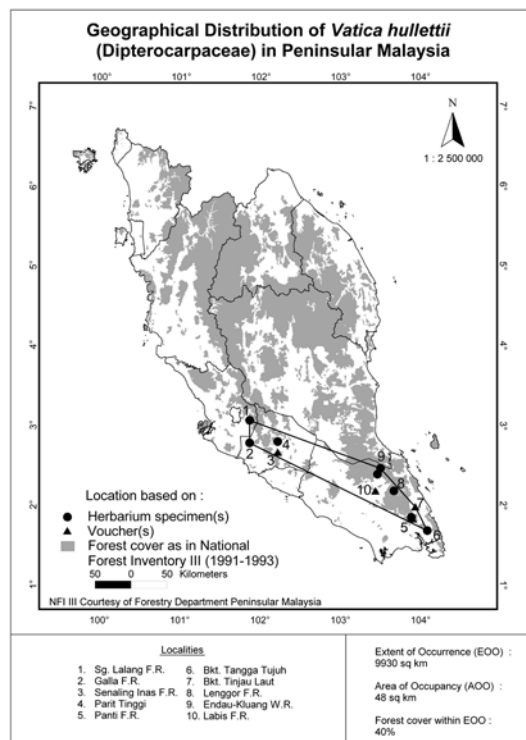
Peninsular Malaysia: Johor, Negeri Sembilan, Pahang and Selangor.

Habitat: Lowland dipterocarp forests.

Conservation status: VU B1ab(iii) for Malaysia.

Conservation notes: Populations occur in the Endau-Rompin State Park. The species is not harvested as it has a small diameter size (maximum diameter recorded was 19 cm). Much of its occupied areas are under forest cover.

Other assessments: CR A1c, C2a (IUCN, 2010); CR by habitat conversion (Symington, 2004).



Vatica lobata Foxw.

Vernacular name: Peninsular Malaysia: resak paya.

Distribution: Peninsular Malaysia.

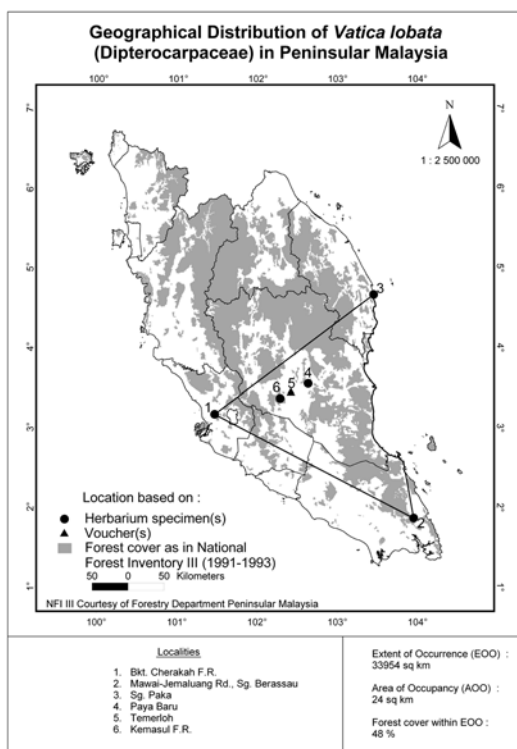
Peninsular Malaysia: Johor, Pahang, Selangor and Terengganu.

Habitat: Lowland dipterocarp forests in swampy localities near streams.

Conservation status: EN A4c, B2b(iii)+c(ii) for Malaysia.

Conservation notes: The species is not harvested as it has a maximum diameter of 33 cm. No populations are known in totally protected areas.

Other assessments: CR A1c, C2a (IUCN, 2010); CR, threats from agriculture (Symington, 2004).

*Vatica lowii* King

Vernacular name: Peninsular Malaysia: resak pipit.

Distribution: Peninsular Thailand and Peninsular Malaysia.

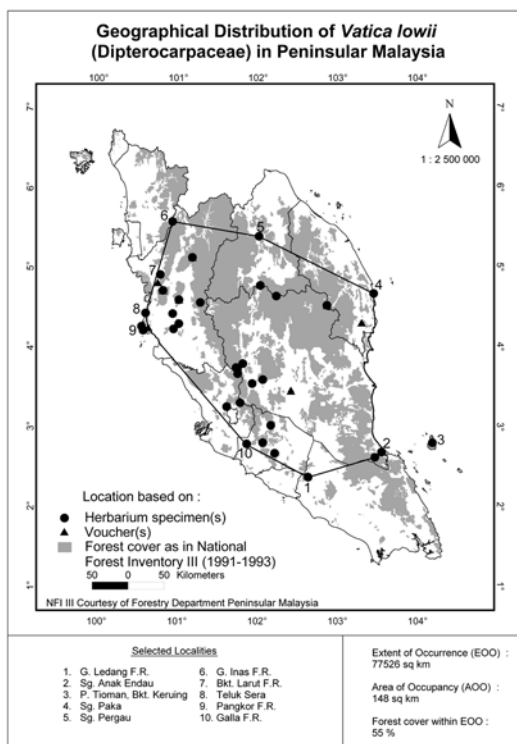
Peninsular Malaysia: Johor, Kedah, Kelantan, Negeri Sembilan, Pahang, Perak, Selangor and Terengganu.

Habitat: Lowland to hill dipterocarp forests up to 650 m altitude.

Conservation status: NT for Malaysia.

Conservation notes: Although this taxon has been widely collected, confirmatory material, i.e., fruits, is only available for Perak, Pahang and Selangor. Its extent of occurrence in the peninsula cannot be confirmed.

Other assessments: EN A1c (IUCN, 2010); NT (Symington, 2004).



Vatica maingayi Dyer

Vernacular names: Peninsular Malaysia and Sarawak: resak lidi; Sabah: resak daun merah.

Distribution: Peninsular Malaysia, Sumatra and Borneo (Sabah and Sarawak).

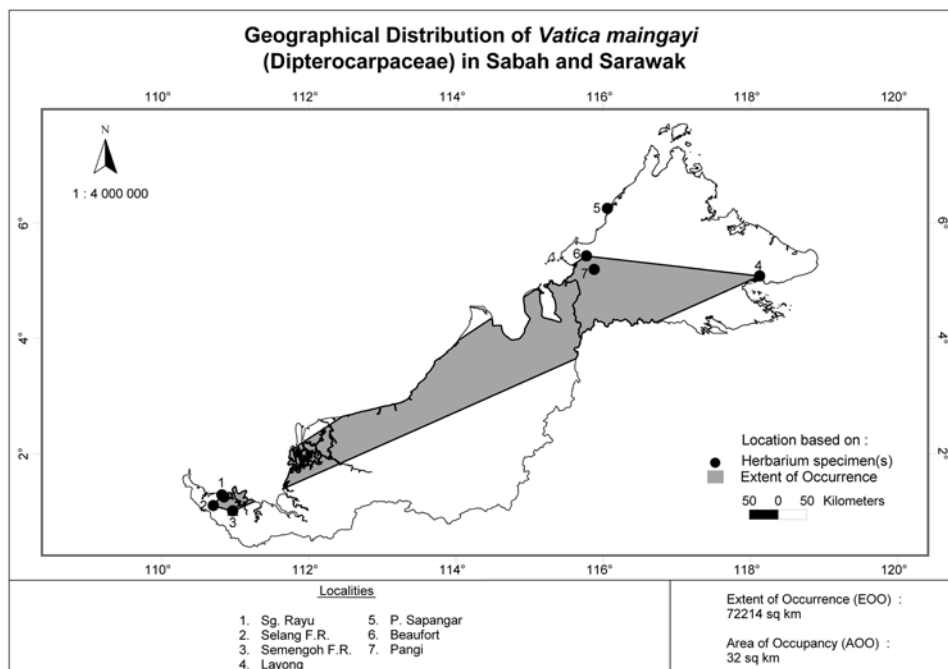
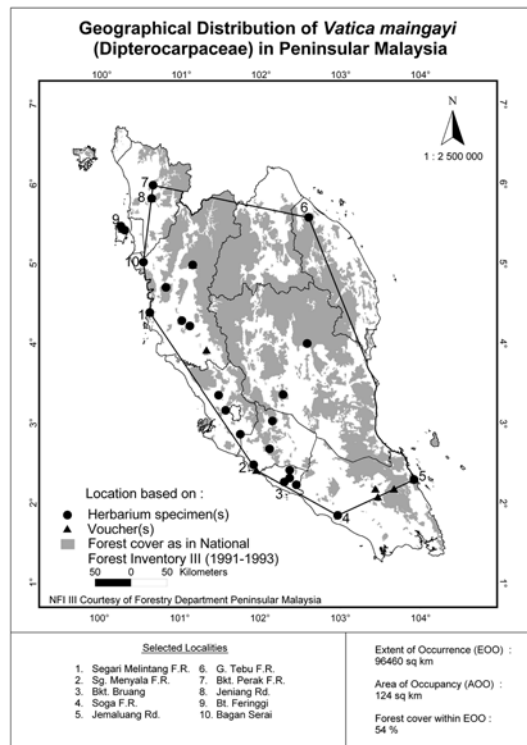
Peninsular Malaysia: Johor, Kedah, Malacca, Negeri Sembilan, Pahang, Penang, Perak, Selangor and Terengganu. **Sabah:** Beaufort, Kota Kinabalu, Lahad Datu and Tenom. **Sarawak:** Kuching.

Habitat: Lowland forests up to 200 m altitude. In Borneo, it occurs on yellow sandy clay soils.

Conservation status: VU A4c, B2b(iii)+c(ii) for Malaysia; VU A4c, B2b(iii)+c(ii) for Peninsular Malaysia; VU A4c for Sabah and Sarawak.

Conservation notes: Information on the habitat status in Sabah is required.

Other assessments: CR A1cd, C2a (IUCN, 2010); EN by forest conversion (Symington, 2004); rare and EN (Ashton, 2004).



Vatica mangachapoi Blanco ssp. *mangachapoi*

Fig. 10, Plates 36A–B

Vernacular names: Peninsular Malaysia: resak julung; Sabah: resak bajau; Sarawak: resak paya.

Distribution: Peninsular Thailand, Peninsular Malaysia, Borneo (Sabah, Sarawak and Brunei) and the Philippines.

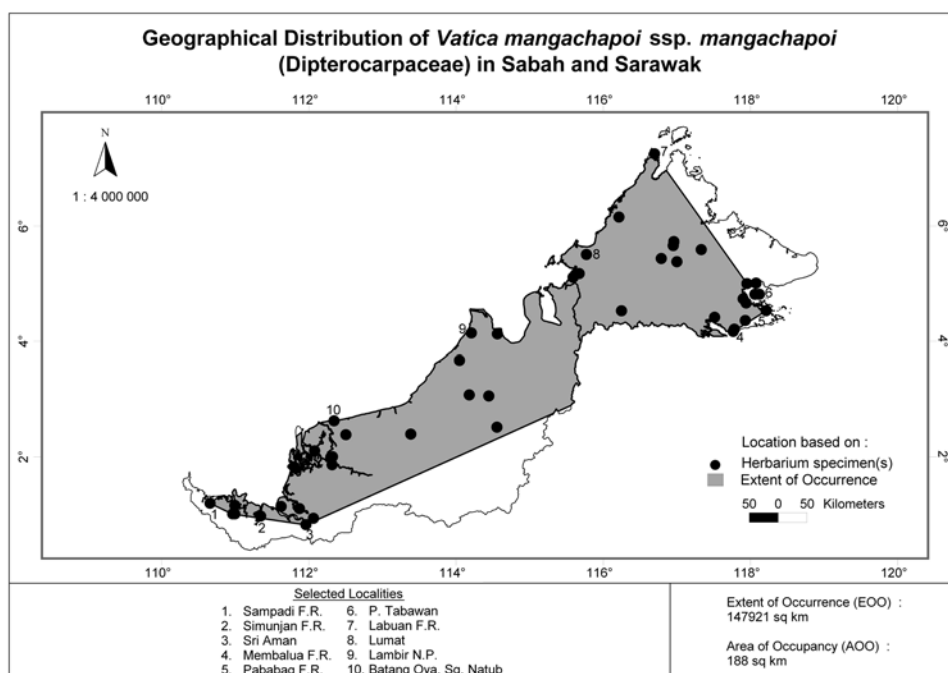
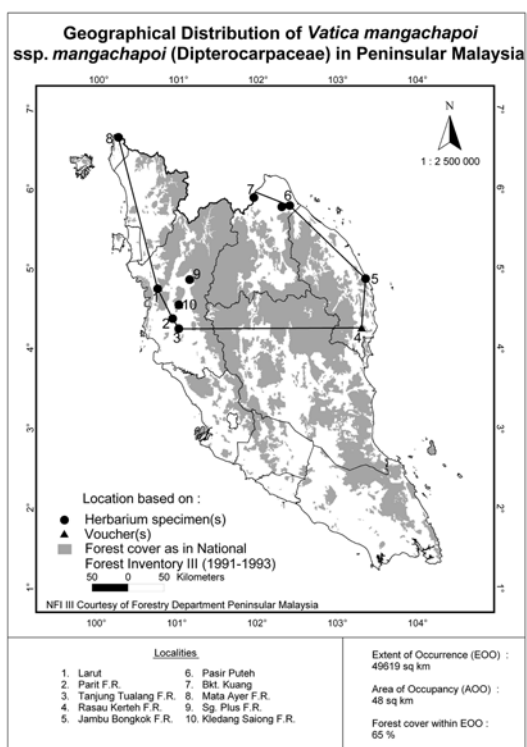
Peninsular Malaysia: Kedah, Kelantan, Perak, Perlis and Terengganu. **Sabah:** Beaufort, Beluran, Kinabatangan, Kudat, Lahad Datu, Sandakan, Semporna, Sipitang and Tawau. **Sarawak:** Belaga, Bintulu, Kuching, Lundu, Marudi, Miri, Sibiu, Simunjan and Sri Aman.

Habitat: Lowland to hill forests. In the peninsula, the species occurs on ridges between 300–650 m altitude. It also occurs on heath forest on coastal hills. In Borneo, it occurs near the coast on dry ridges in kerangas forest on deep podsols on raised beaches and in mixed peat swamp forest.

Conservation status: VU A4c for Malaysia.

Conservation notes: Populations in the peat swamp forests of Sarawak are endangered.

Other assessments: EN A1cd (IUCN, 2010); VU as ridge habitats are sites for logging roads (Symington, 2004); VU (Ashton, 2004).



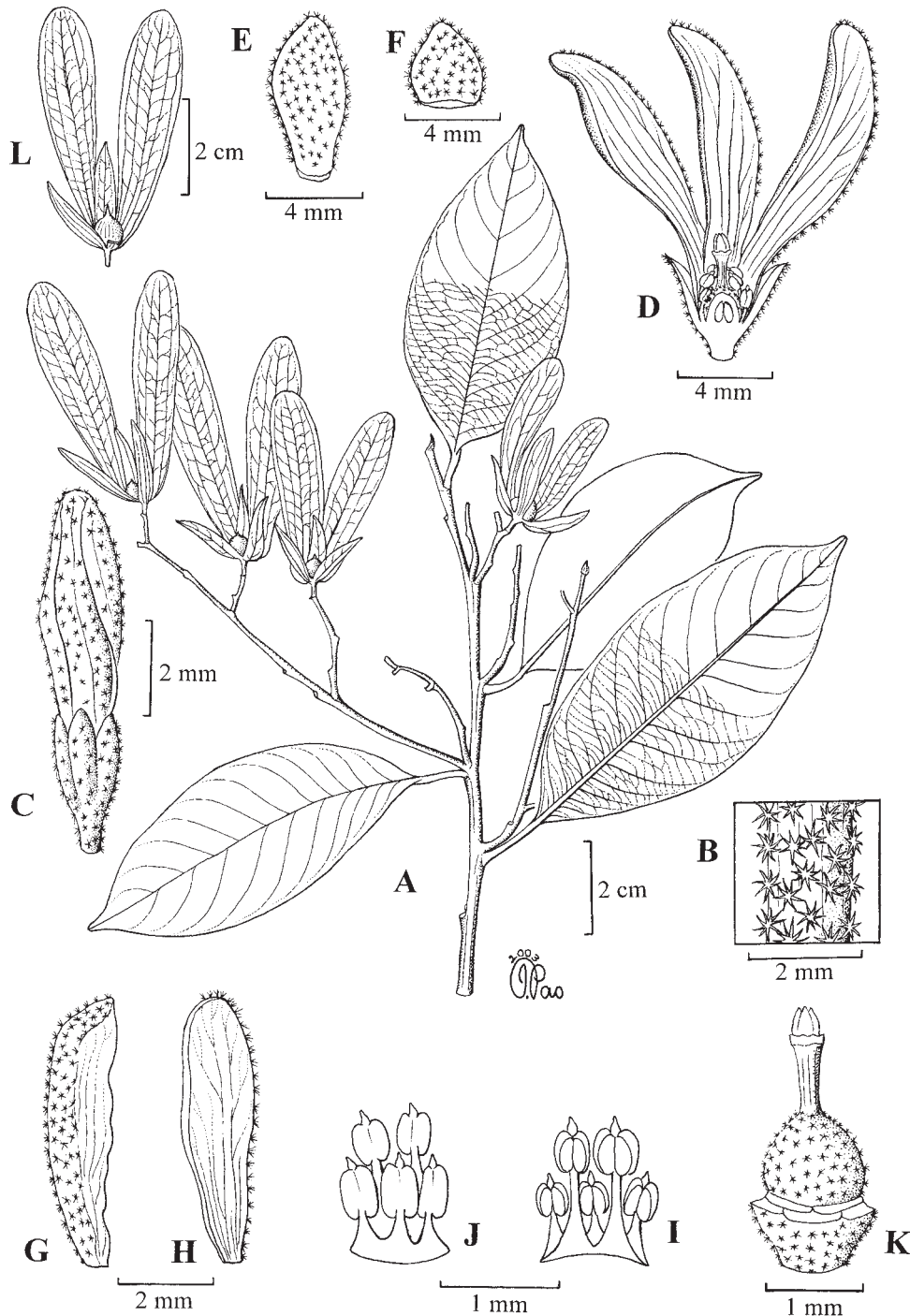


Fig. 10. *Vatica mangachapoi* ssp. *mangachapoi*. A, fruiting leafy twig; B, detail of indumentum of midrib on the lower leaf surface; C, flower bud; D, longitudinal section of open flower; E, abaxial view of outer sepal; F, abaxial view of inner sepal; G, abaxial side of petal; H, adaxial side of petal; I, adaxial view of stamens; J, abaxial view of stamens; K, gynoecium; L, fruit with exposed nut (A–B and L from *FMS 41100*, C–K from *SAN 15459*) (Reproduced with permission from the Tree Flora of Sabah and Sarawak project).

Vatica nitens King

Plate 36C

Vernacular names: Peninsular Malaysia and Sarawak: resak daun panjang.

Distribution: Sumatra, Peninsular Malaysia and Borneo.

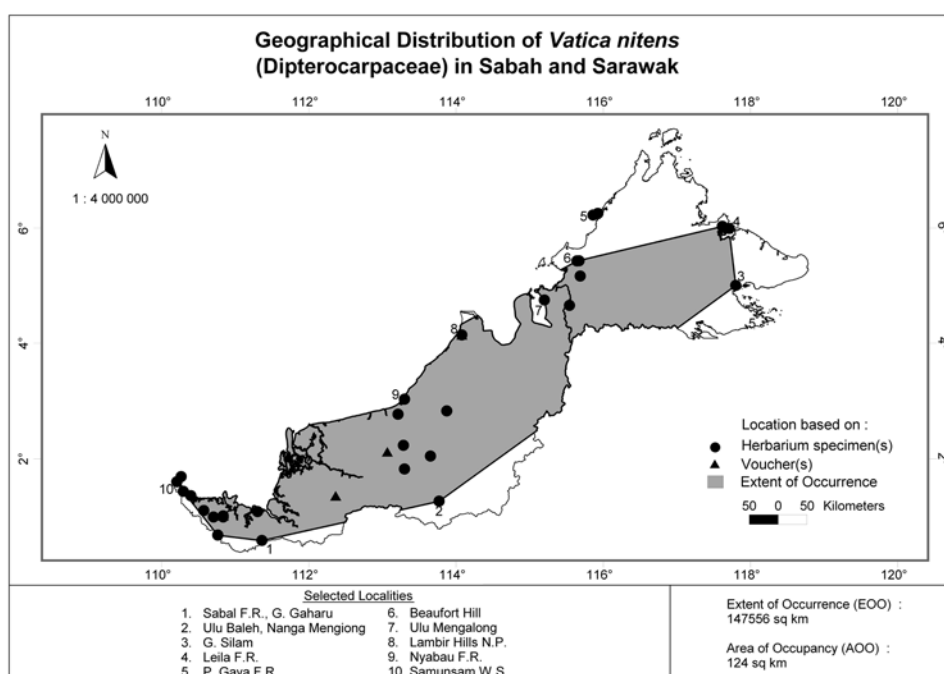
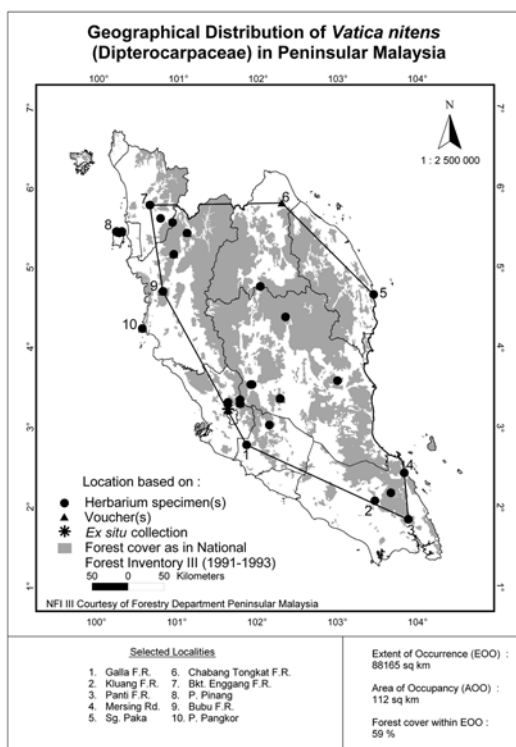
Peninsular Malaysia: Johor, Kedah, Kelantan, Negeri Sembilan, Pahang, Penang, Perak, Selangor and Terengganu. **Sabah:** Beaufort, Kota Kinabalu, Lahad Datu, Sandakan and Sipitang. **Sarawak:** Bau, Bintulu, Kapit, Kuching, Lundu, Miri, Simunjan and Tatau.

Habitat: Lowland to hill forests and in seasonally dry tropical rain forests to about 500 m altitude. In Borneo, it occurs on well-drained sandy and sandy clay soils on low ridges at altitudes to 600 m.

Conservation status: NT for Malaysia.

Conservation notes: Extrapolation from the Peninsular Malaysian Fourth National Forest Inventory (2007) data gave an estimated 69,000 adult stems (above 30 cm dbh) in the Permanent Reserved Forests. In 1991, at least 154 trees above 1 cm diameter were recorded from Lambir Hills 52-ha research plot with 55.8% having diameters less than 5 cm.

Other assessments: EN A1cd (IUCN, 2010); VU as a result of forest conversion and logging (Symington, 2004); VU (Ashton, 2004).



Vatica odorata (Griff.) Symington ssp. *odorata*

Plate 36D

Vernacular names: Peninsular Malaysia: resak ranting kesat; Sabah: resak biabas.

Distribution: South China, Myanmar, Thailand, Indo-China, Peninsular Malaysia, Borneo and the Philippines.

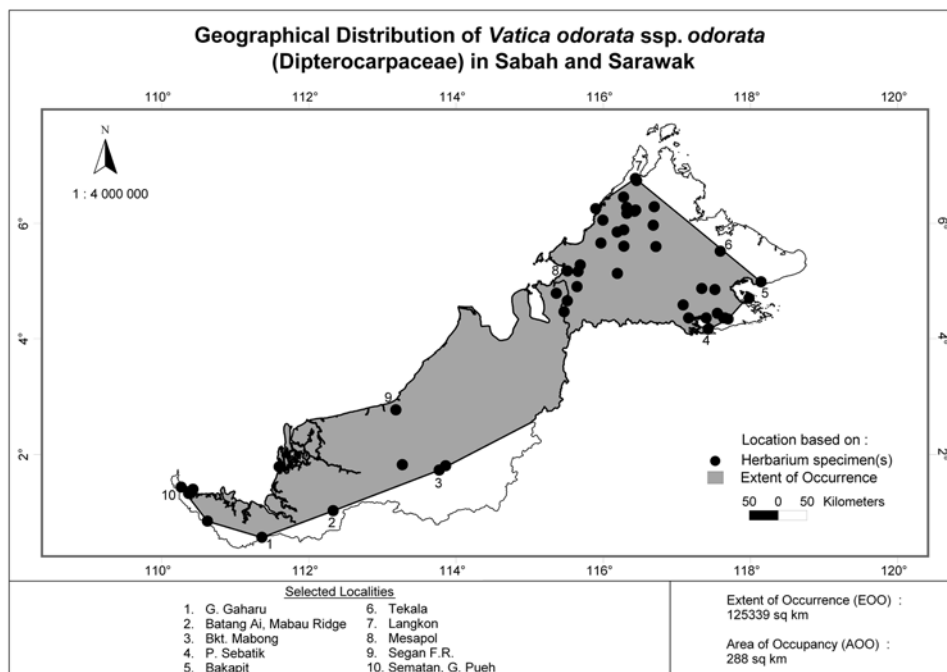
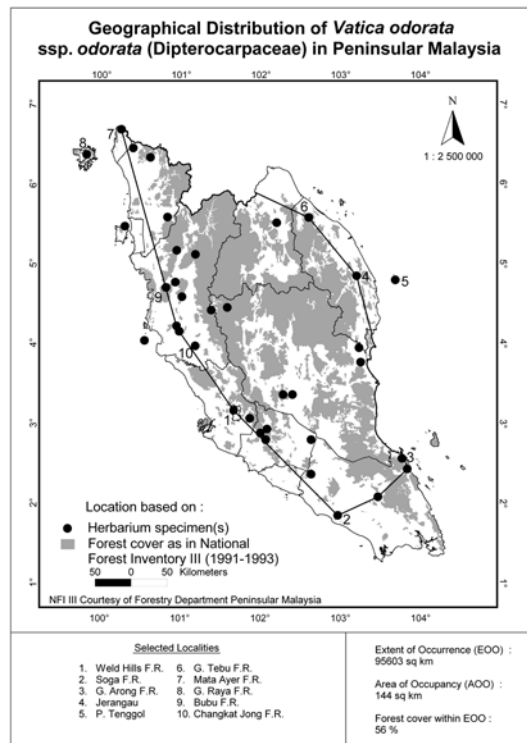
Peninsular Malaysia: Johor, Kedah, Kelantan, Negeri Sembilan, Pahang, Penang, Perak, Perlis, Selangor and Terengganu. **Sabah:** Beluran, Kudat, Lahad Datu, Ranau, Sandakan, Sipitang, Tambunan and Tawau. **Sarawak:** Bau, Belaga, Bintulu, Kapit, Lawas, Lubok Antu, Lundu and Simunjan.

Habitat: Lowland and hill forests up to 700 m altitude.

Conservation status: VUB2b(iii)+c(ii) for Malaysia; NT for Peninsular Malaysia; VU B2b(iii)+c(ii) for Sabah and Sarawak.

Conservation notes: In the Tree Flora of Sabah and Sarawak Vol 5, the species is reported absent in Sarawak. There are however collections of what may be the species from Bau, Belaga, Bintulu, Kapit, Lawas, Lubok Antu, Lundu and Simunjan.

Other assessments: LR/lc (Oldfield *et al.*, 1998); VU as a result of harvesting and forest conversion (Symington, 2004); rare and EN in Sabah (Ashton, 2004).



Vatica pallida Dyer

Vernacular name: Peninsular Malaysia: resak kecil.

Distribution: Peninsular Malaysia.

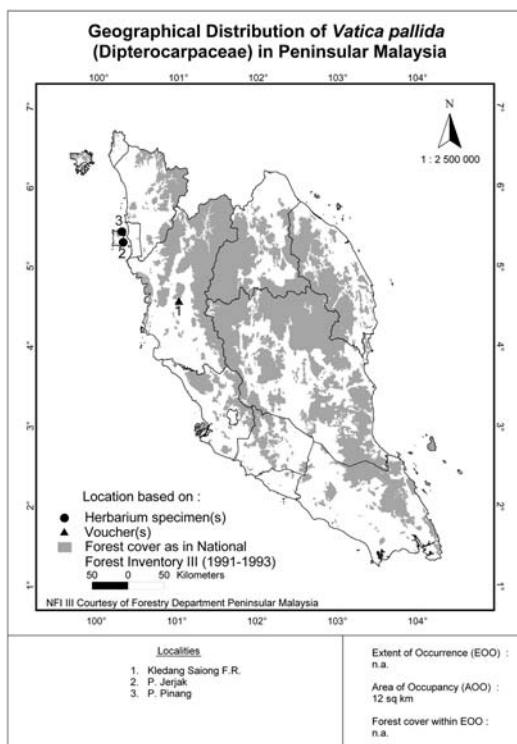
Peninsular Malaysia: Penang and Perak.

Habitat: Coastal lowland dipterocarp forests below 300 m altitude.

Conservation status: EN B2ab(iii) for Malaysia.

Conservation notes: Although there are several protected forest areas in Penang, it is not known what proportion of the population is protected. The locality in Johor lacks geographic details.

Other assessments: EN A1c (IUCN, 2010); VU from urban development (Symington, 2004).

*Vatica pauciflora* (Korth.) Blume

Plates 36E–F

Vernacular name: Peninsular Malaysia: resak laru.

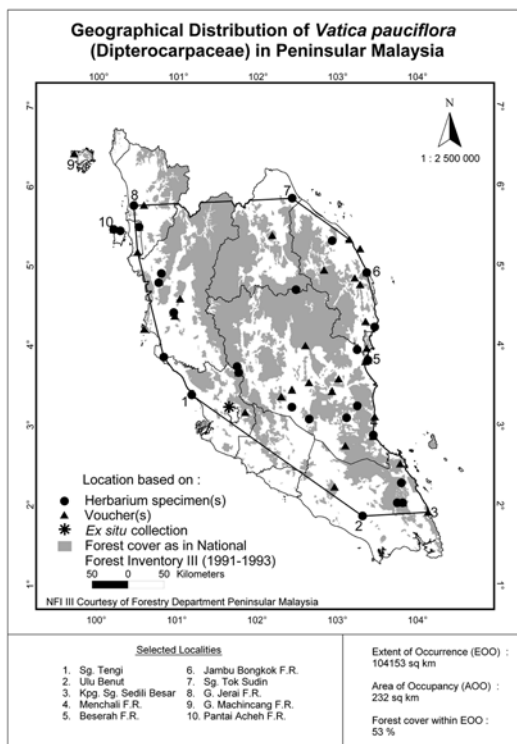
Distribution: Indo-China, Peninsular Thailand, Peninsular Malaysia and Sumatra.

Peninsular Malaysia: Johor, Kedah, Kelantan, Pahang, Penang, Perak, Selangor and Terengganu.

Habitat: In swamps and near streams in the lowland dipterocarp forests.

Conservation status: NT for Malaysia.

Other assessments: EN A1c (IUCN, 2010); VU as a result of rapid changes in habitat and fragmenting populations (Symington, 2004).



Vatica perakensis King

Vernacular name: Peninsular Malaysia: resak putih.

Distribution: Sumatra, Peninsular Malaysia and Borneo (Sabah).

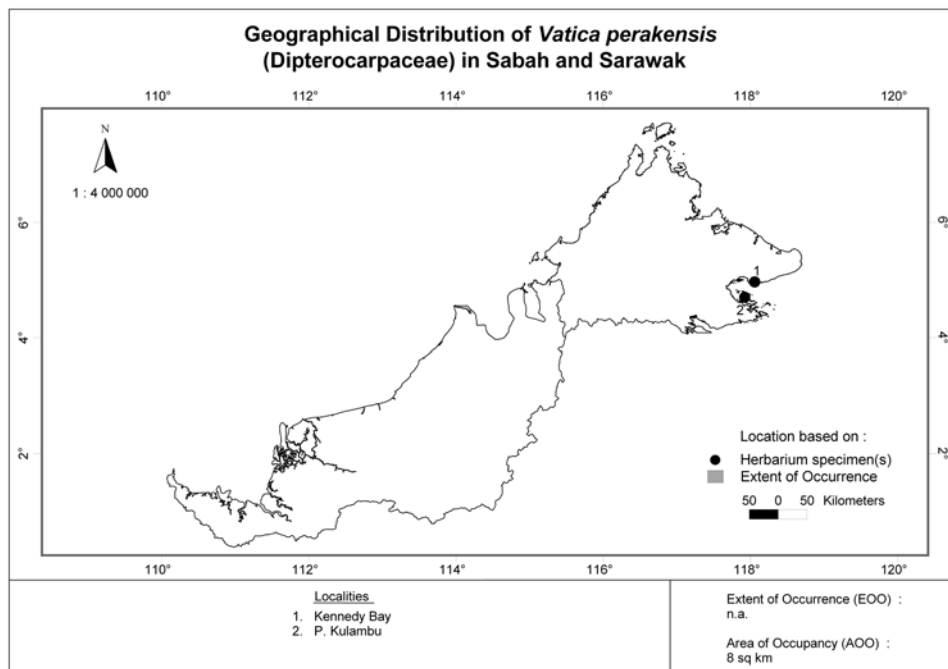
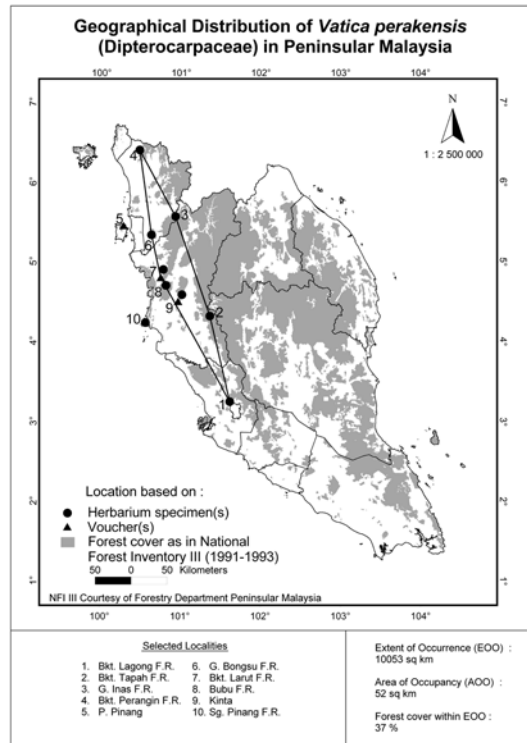
Peninsular Malaysia: Kedah, Perak and Selangor.

Sabah: Lahad Datu and Tawau.

Habitat: Hill forests from coastal hills up to 500 m altitude.

Conservation status: EN B2ab(iii) for Malaysia; VU A4c for Peninsular Malaysia; EN B2ab(iii) for Sabah.

Other assessments: EN A1c (IUCN, 2010); EN by logging and conversion (Symington, 2004); probably EN (Ashton, 2004).



Vatica ridleyana Brandis

Vernacular name: Peninsular Malaysia: resak buah kana.

Distribution: Sumatra, Peninsular Malaysia and Singapore.

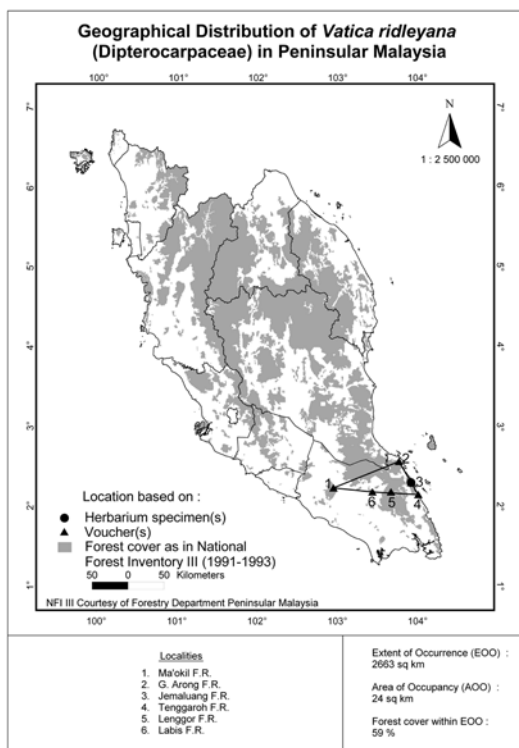
Peninsular Malaysia: Johor.

Habitat: Lowland dipterocarp forests.

Conservation status: EN B1ab(iii) for Malaysia.

Conservation notes: The species occurs in Labis, Lenggor and Ma'okil Virgin Jungle Reserves.

Other assessments: CR (Symington, 2004).

*Vatica scortechinii* (King) Brandis

Plates 37A–E

Vernacular name: Peninsular Malaysia: resak langgung.

Distribution: Peninsular Malaysia.

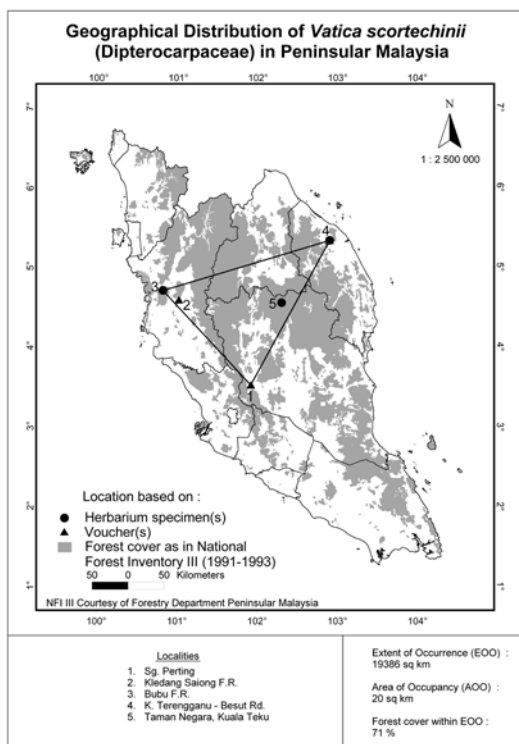
Peninsular Malaysia: Pahang, Perak and Terengganu.

Habitat: Lowland to hill dipterocarp forests of 800 m altitude.

Conservation status: EN B2ab(iii) for Malaysia.

Conservation notes: One population is protected in Taman Negara National Park.

Other assessments: CR A1c, C2a (IUCN, 2010); EN by logging and conversion (Symington, 2004).



Vatica stapfiana (King) Slooten

Vernacular name: Peninsular Malaysia: resak mempening.

Distribution: Peninsular Thailand, Peninsular Malaysia and Sumatra.

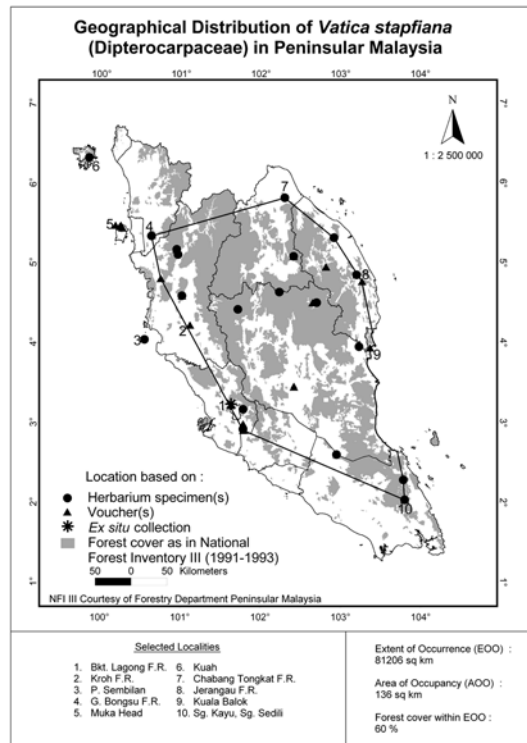
Peninsular Malaysia: Johor, Kedah, Kelantan, Pahang, Penang, Perak, Selangor and Terengganu.

Habitat: Lowland to hill dipterocarp forests in low-lying areas, valleys and near streams. Its altitudinal range is up to 500 m.

Conservation status: VU B2b(iii)+c(iii) for Malaysia.

Conservation notes: The species has a scattered occurrence.

Other assessments: EN A1c (IUCN, 2010); VU, threats from forest conversion (Symington, 2004).



Vatica umbonata (Hook.f.) Burck ssp. *umbonata*

Fig. 11, Plates 38A–F

Vernacular name: Sarawak: resak air.

Distribution: Peninsular Malaysia, Borneo and the Philippines.

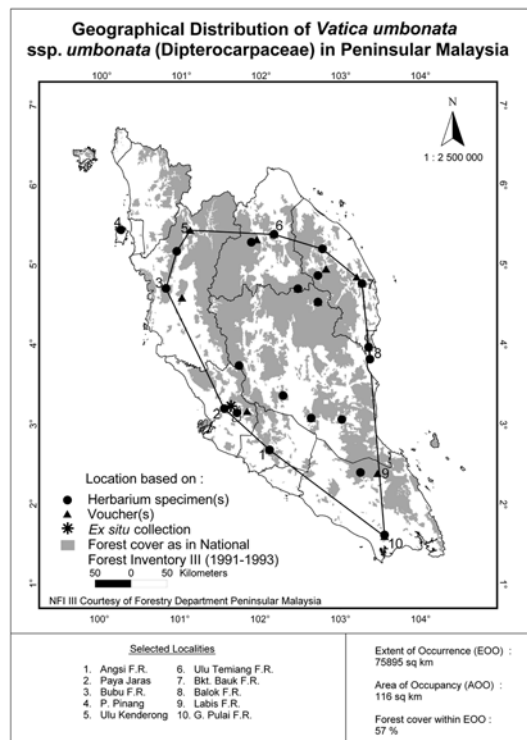
Peninsular Malaysia: Johor, Kelantan, Negeri Sembilan, Pahang, Penang, Perak, Selangor and Terengganu. **Sabah:** Beaufort, Keningau, Kota Kinabalu, Lahad Datu, Ranau, Sandakan, Sipitang and Tenom. **Sarawak:** Belaga, Bintulu, Kapit, Kuching, Lundu, Marudi, Miri, Serian and Sri Aman.

Habitat: Lowland to hill forests, locally abundant on alluvium river banks and on poor sandy clay soils to altitudes of 1,300 m.

Conservation status: LC for Malaysia.

Conservation notes: The species occurs in the network of Totally Protected Areas.

Other assessments: LR/lc (IUCN, 2010); VU (Symington, 2004); not VU (Ashton, 2004).



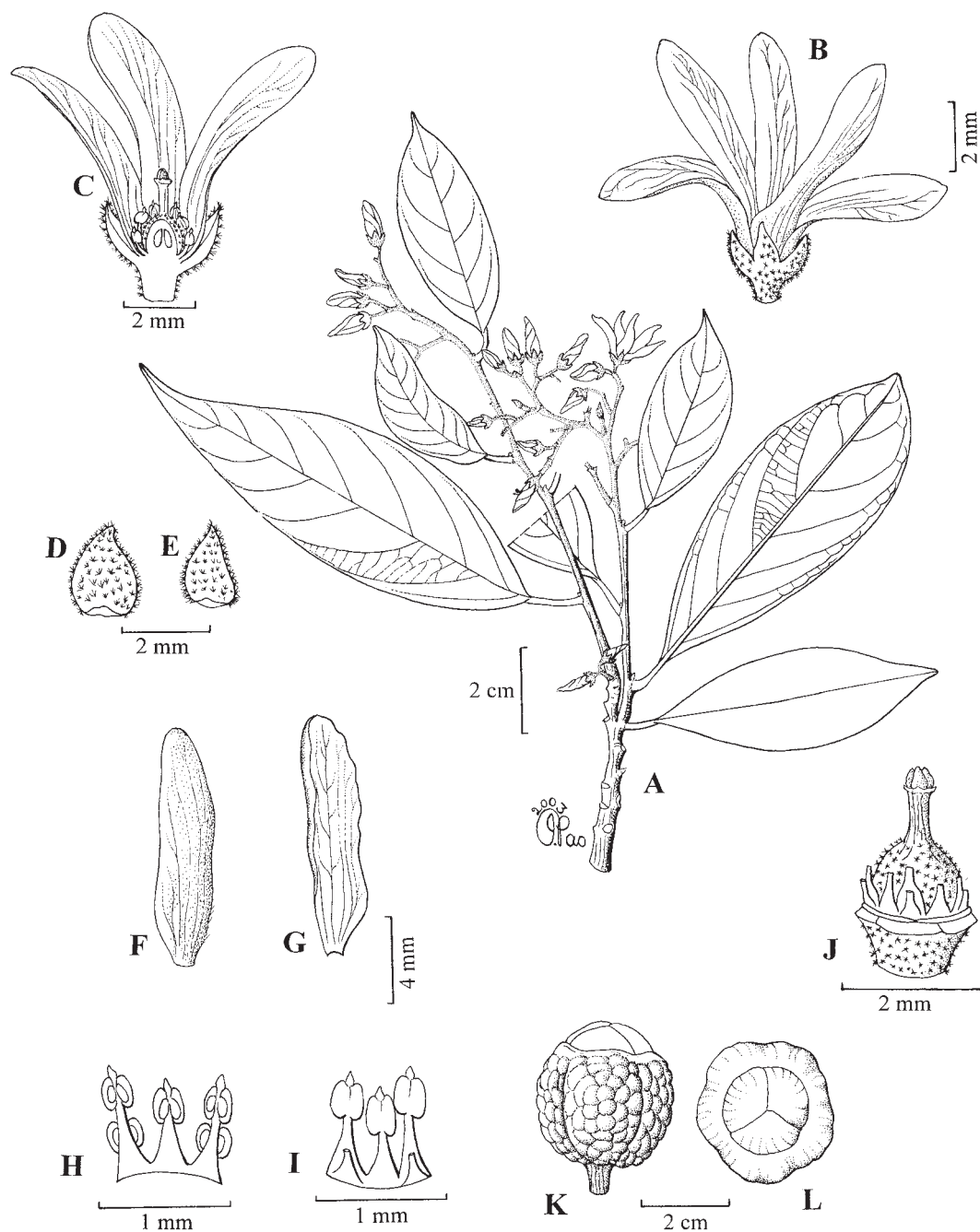
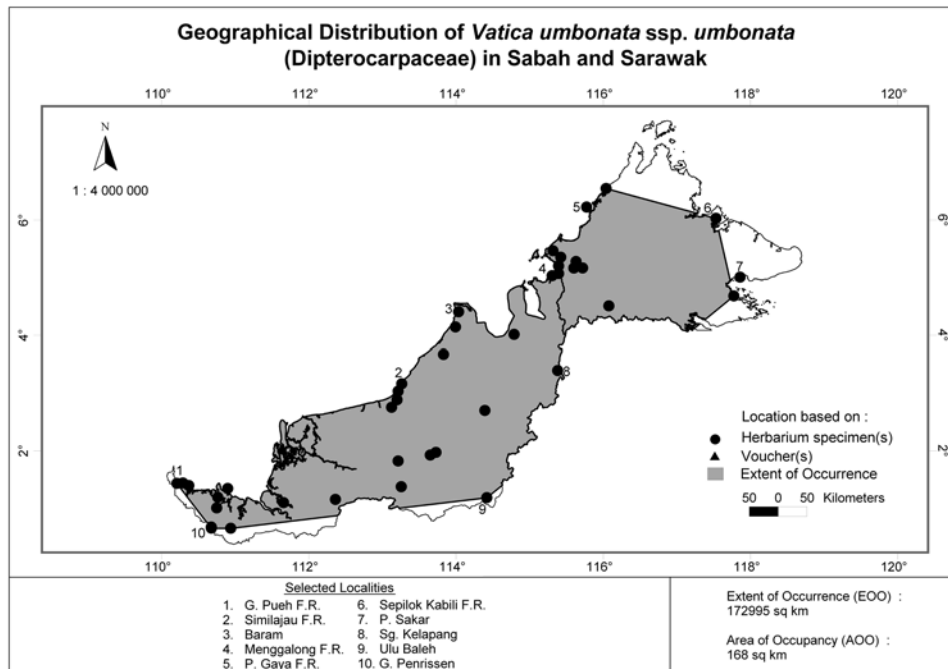


Fig. 11. *Vatica umbonata* ssp. *umbonata*. A, flowering leafy twig; B, open flower; C, longitudinal section of open flower; D, abaxial view of outer sepal; E, abaxial view of inner sepal; F, abaxial view of petal; G, adaxial view of petal; H, adaxial view of stamens; I, abaxial view of stamens; J, gynoecium; K, side view of fruit; L, apical view of fruit (A–J from BRUN 1380, K–L from S 49284) (Reproduced with permission from the Tree Flora of Sabah and Sarawak project).



Vatica venulosa Blume

Vernacular names: Peninsular Malaysia and Sarawak: resak letup; Sabah: resak banka.

Distribution: Sumatra, Peninsular Malaysia, Java and Borneo.

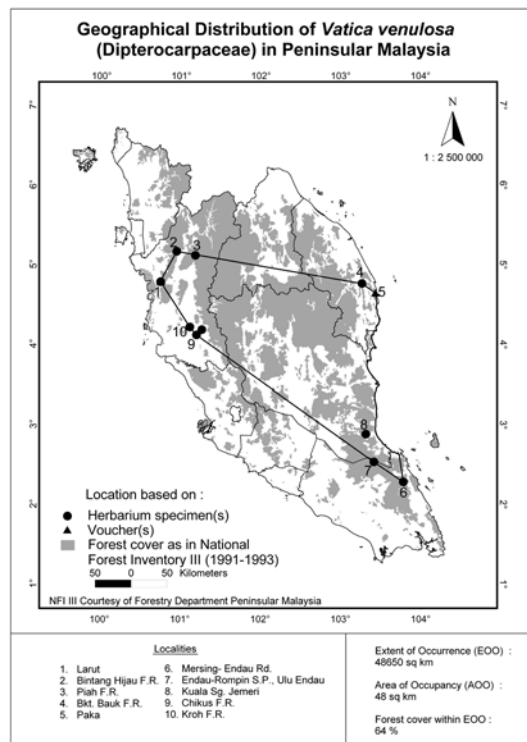
Peninsular Malaysia: Johor, Pahang, Perak and Terengganu. **Sabah:** Kinabatangan and Papar. **Sarawak:** Kuching and Lundu.

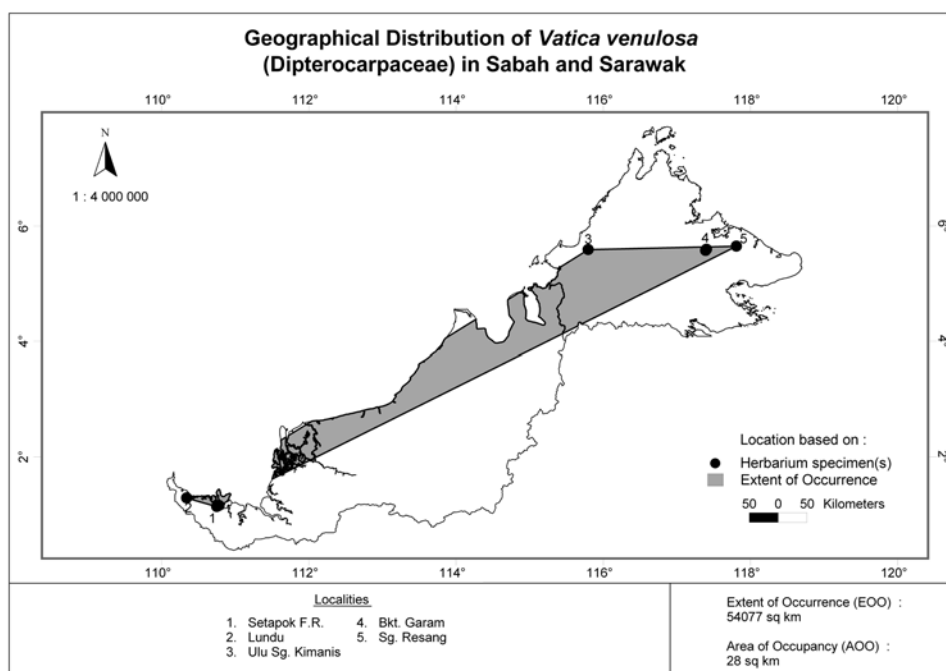
Habitat: Lowland forests favouring damp soils in the vicinity of streams. In Borneo, it occurs on clay alluvium banks of sluggish rivers at low altitudes.

Conservation status: EN B2ab(iii) for Malaysia; VU B2b(iii)+c(ii) for Peninsular Malaysia; EN B2ab(iii) for Sabah and Sarawak.

Conservation notes: The species occurs in the Endau-Rompin State Park.

Other assessments: CR A1c (IUCN, 2010); EN, perhaps CR (Symington, 2004); VU as a result of loss of riparian lowland habitat (Ashton, 2004).





Vatica yeechongii Saw

Plates 39A–C

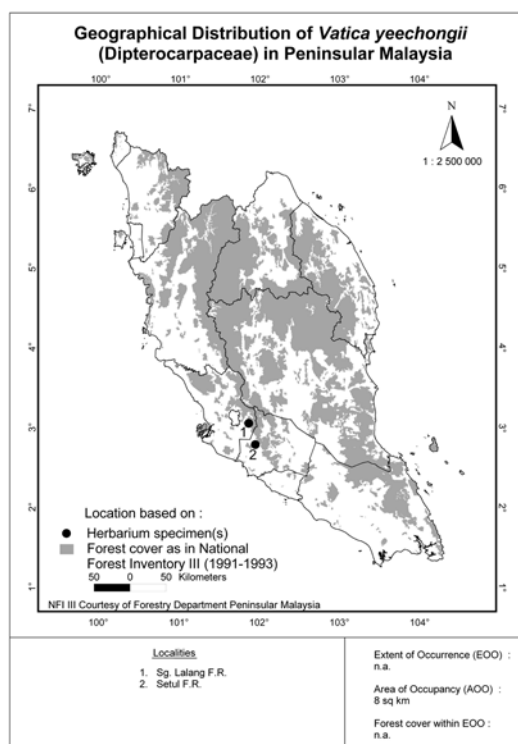
Distribution: Peninsular Malaysia.

Peninsular Malaysia: Negeri Sembilan and Selangor.

Habitat: Lowland dipterocarp forests along gentle and steep slopes of water courses.

Conservation status: CR A4c, D2 for Malaysia.

Conservation notes: Less than 10 trees occur in the amenity forest in Selangor. Although there are management plans in place for amenity forests, these do not favour the regeneration of saplings as the area is constantly cleaned of litter. The germplasm materials are maintained in *ex situ* sites. The site in Negeri Sembilan is a small fragment.



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GLOSSARY

Borneo	A phytogeographical region comprising Sabah, Sarawak, Brunei and Kalimantan
Habitat	Refers to the habitats occupied by the taxon in Peninsular Malaysia, Sabah and Sarawak
Malaya	A phytogeographical region comprising Peninsular Thailand, Peninsular Malaysia and Singapore

ABBREVIATIONS

Bkt.	Hill (<i>Bukit</i>)
Bt.	Rock (<i>Batu</i>)
Cpt.	Compartment
dbh	Diameter at breast height
FMU	Forest Management Unit
FR/F.R.	Forest Reserve
F.R.I.M	Forest Research Institute Malaysia
G./Mt.	Mount (<i>Gunung</i>)
K.	Mouth of river (<i>Kuala</i>)
Kpg./Kg.	Village (<i>Kampung</i>)
LR/lc	Lower Risk (Least Concern) (after IUCN 1994)
NFI	National Forest Inventory
N.P./NP	National Park
P.	Island (<i>Pulau</i>)
P.F.	Protected Forest
Rd.	Road
Sg.	River (<i>Sungai</i>)
S.P.	State Park
Tmn.	Park (<i>Taman</i>)
V.J.R.	Virgin Jungle Reserve
W.C.	Wildlife Corridor
W.R.	Wildlife Reserve
W.S./WS	Wildlife Sanctuary

PLATES



L.G. Saw

Plate 1. *Anisoptera laevis*: A, trunk; B, fruiting twig. *Cotylelobium lanceolatum*: C, bark; D, fruiting twig.

M. Suhaida



M. Suhaida

W.S.Y. Yong



W.S.Y. Yong

Plate 2. *Cotylelobium melanoxylon*: A, bark; B leaf. *Dipterocarpus acutangulus*: C, bark; D, fruiting twig.



Plate 3. *Dipterocarpus caudatus* ssp. *penangianus*: A, trunk; B, fruiting twig; C, leafy twig.



Plate 4. *Dipterocarpus gracilis*: A, trunk; B, fruiting twig. *Dipterocarpus kunstleri*: C, bark; D, fruiting twig.

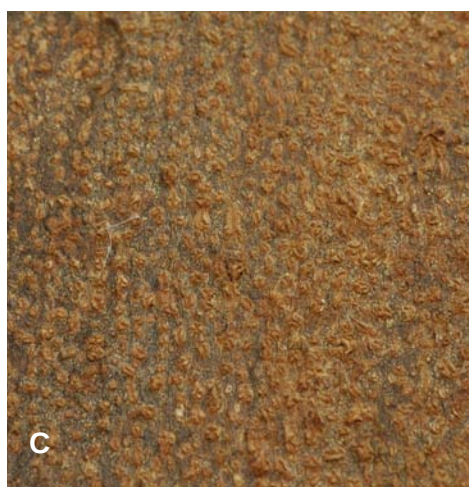
M. Suhaida



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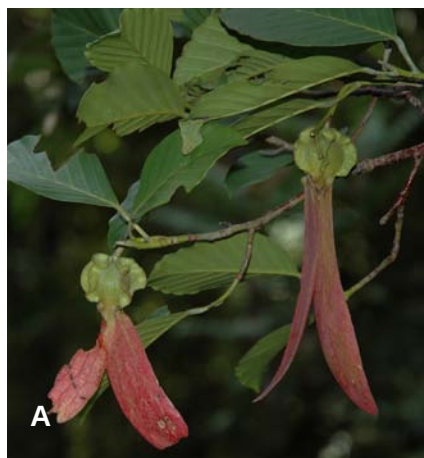


E. Soepadmo

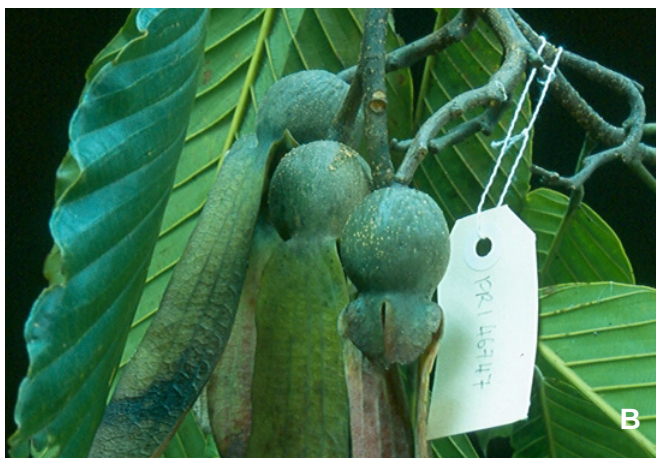


Plate 5. *Dipterocarpus lowii*: A, bark; B, leaf. *Dipterocarpus oblongifolius*: C, trunk; D, flowers; E, fruits.

W.S.Y. Yong



A



B

M. Suhaida



C



D

M. Suhaida



E



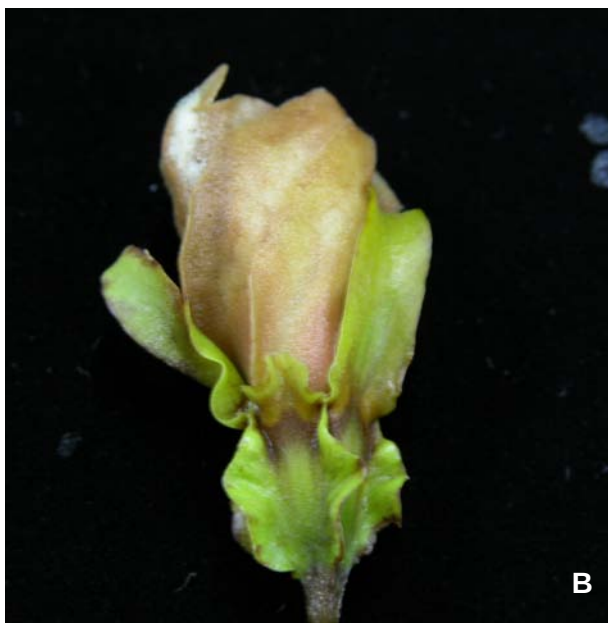
F

M. Suhaida

Plate 6. *Dipterocarpus perakensis*: A, fruit. *Dipterocarpus retusus*: B, fruiting twig. *Dipterocarpus rotundifolius*: C, trunk; D, E, flowering twig; F, fallen corolla.



A



B

W.S.Y. Yong



C



D

W.S.Y. Yong



E

Plate 7. *Dipterocarpus sarawakensis*: A, trunk; B, C, flowers; D, fruit; E, seedling.



W.S.Y. Yong

Plate 8. *Dipterocarpus semivestitus*: A, bark; B, twig; C, fruiting twig; D, stipules.



Plate 9. *Dipterocarpus tempehes*: A, trunk; B, lenticels on trunk; C, fruiting twig; D, stipule.



A



B



C



D

L.G. Saw

Plate 10. *Dipterocarpus verrucosus*: A, leafy twig; B, fruits. *Dryobalanops aromatica*: C, tree; D, fruit.



Plate 11. *Dryobalanops beccarii*: A, trunk; B, fruiting twig. *Dryobalanops oblongifolia* ssp. *occidentalis*: C, inflorescences; D, flower; E, fruits.



A



B

W.S.Y. Yong



C

W.S.Y. Yong



D

W.S.Y. Yong

Plate 12. *Hopea apiculata*: A, inflorescence. *Hopea auriculata*: B, buttress; C, bark; D, fruiting twig.



Plate 13. *Hopea beccariana*: A, fruiting twig. *Hopea bilitonensis*: B, coppices (marked red on trunk); C, fruiting twig.



W.S.Y. Yong

W.S.Y. Yong

Plate 14. *Hopea coriacea*: A, trunk; B, leafy twig. *Hopea glaucescens*: C, fruiting twig; D, seedlings on the forest floor.



Plate 15. *Hopea griffithii*: A, trunk; B, sapling. *Hopea latifolia*: C, leaves and fruits.

M. Suhaidda



M. Suhaidda

M. Suhaidda



M. Suhaidda

Plate 16. *Hopea pachycarpa*: A, trunk; B, fruiting twig. *Hopea polyalthioides*: C, trunk; D, leafy shoots.



K.H. Lau

Plate 17. *Hopea subalata*: A, base of trunk; B, inflorescences. *Hopea subalanceolata*: C, bark; D, leafy twig; E, fruiting twig.

W.S.Y. Yong



W.S.Y. Yong



M. Suhaida

Plate 18. *Hopea sulcata*: A, bark; B, fruiting twig. *Neobalanocarpus heimii*: C, trunk; D, fruits.



Plate 19. *Parashorea stellata*: A, trunk; B, leafy twig; C, fruits.



M. Suhaida

M. Suhaida

Plate 20. *Shorea acuminata*: A, trunk; B, fruiting twig. *Shorea blumutensis*: C, tree; D, bark.



W.S.Y. Yong

Plate 21. *Shorea curtisii* ssp. *curtisii*: A, bluish grey crown; B, trunk; C, fruiting twig.

M. Suhaida



A



B

M. Suhaida

M. Suhaida



C



D

M. Suhaida

Plate 22. *Shorea curtisii* ssp. *grandis*: A, trunk. *Shorea dealbata*: B, leafy twig of sapling; C, trunk; D, stipules of sapling.



Plate 23. *Shorea guiso*: A, fruiting twig; B fruits. *Shorea hemsleyana* ssp. *hemsleyana*: C, bark; D, stipules; E, fruit.



M. Suhaida



M. Suhaida



W.S.Y. Yong

Plate 24. *Shorea inappendiculata*: A, trunk; B, leafy twig of sapling. *Shorea kunstleri*: C, fruiting twig.



M. Suhaida



M. Suhaida

Plate 25. *Shorea laevis*: A, trunk. *Shorea lamellata*: B, trunk; C, leafy twig.



Plate 26. *Shorea leprosula*: A, trunk; B, flowering crown; C, fruiting twig.



M. Suhaida



W.S.Y. Yong



W.S.Y. Yong



W.S.Y. Yong

Plate 27. *Shorea macrantha*: A, buttress; B, leafy twig; C, bark; D, flowering twig.



Plate 28. *Shorea maxwelliana*: A, fruiting twig. *Shorea multiflora*: B, tree; C, flowering twig.



Plate 29. *Shorea ovalis* ssp. *ovalis*: A, fruiting twig; B, fruits. *Shorea parvifolia*: C, fruiting twig.



A



B



C

Plate 30. *Shorea peltata*: A, dammar on trunk; B, leafy twig. *Shorea platycarpa*: C, trunk.



Plate 31. *Shorea resinosa*: A, flowering twig. *Shorea singkawang* ssp. *singkawang*: B, flowers; C, fruit.



Plate 32. *Shorea submontana*: A, buttress; B, fruiting twig. *Shorea sumatrana*: C, bark; D, flowering twig.



M. Suthaida



M. Suthaida



W.S.Y. Yong

Plate 33. *Vatica cinerea*: A, trunk; B, flowering twig; C, fruiting twig. *Vatica cuspidata*: D, fruiting twig.



A



B

W.S.Y. Yong



C



D

W.S.Y. Yong



E

Plate 34. *Vatica flavida*: A, trunk; B, inflorescence; C, fruiting twig; D, crown in fruit; E, seedlings.



C.L. Lim

A



C.L. Lim

B



C



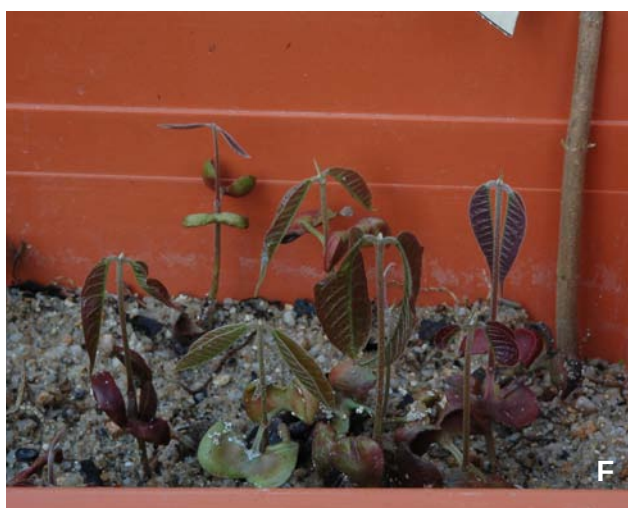
D

C.L. Lim



C.L. Lim

E



F

Plate 35. *Vatica havilandii*: A, trunk; B, leafy twig; C, stipule; D, E, fruits; F, seedlings.



A



B



C



D



E



F

M. Suhaida

M. Suhaida

Plate 36. *Vatica mangachapoi* ssp. *mangachapoi*: A, leafy twig; B, fruits. *Vatica nitens*: C. fruiting twig. *Vatica odorata*: D; flowers. *Vatica pauciflora*: E, flower buds; F, fruits.

M. Suhaida



M. Suhaida



Plate 37. *Vatica scortechinii*: A, trunk; B, stipules; C, flowering twig; D, fruiting twig; E, flower.

M. Suhaida



M. Suhaida



M. Suhaida



M. Suhaida



M. Suhaida



Plate 38. *Vatica umbonata* ssp. *umbonata*: A, tree; B, trunk; C, dammar on trunk; D, crown in flower; E, inflorescence; F, fruiting twig.

W.S.Y. Yong



A

W.S.Y. Yong



B

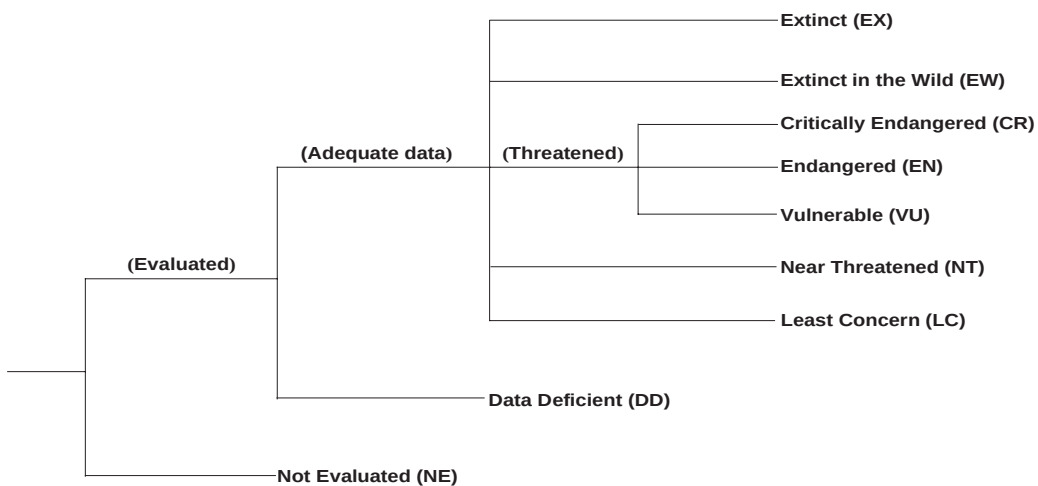
W.S.Y. Yong



C

Plate 39. *Vatica yeechongii*: A, inflorescence; B, seedling; C, fruiting twig.

Appendix 1. The threatened categories – Critically Endangered (CR), Endangered (EN) and Vulnerable (VU) (available from the IUCN website (<http://www.iucn.org>)).



Appendix 2. Summary of the five criteria (A–E) used to evaluate if a taxon belongs in a threatened category (Critically Endangered, Endangered or Vulnerable) (available from the IUCN website (<http://www.iucn.org>)).

Criterion	Critically Endangered	Endangered	Vulnerable
A. Population reduction	Declines measured over the longer of 10 years or 3 generations		
A1	>90%	>70%	>50%
A2, A3 & A4	>80%	>50%	>30%
A1. Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction are clearly reversible and understood and ceased based on and specifying any of the following: a) direct observation b) an index of abundance appropriate for the taxon c) a decline in area of occupancy, extent of occurrence and/or habitat quality d) actual or potential levels of exploitation e) effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites. A2. Population reduction observed, estimated, inferred or suspected in the past where the causes of reduction may not have ceased or may not be understood or may not be reversible based on any of (a) to (e) under A1. A3. Population reduction projected or suspected to be met in the future (up to a maximum of 100 years) based on any of (b) to (e) under A1. A4. An observed, estimated, inferred, projected or suspected population reduction (up to a maximum of 100 years) where the time period must include both the past and the future and where the causes of reduction may not have ceased or may not be understood or may not be reversible based on any of (a) to (e) under A1.			
B. Geographic range in the form of either B1 (extent of occurrence) or B2 (area of occupancy)			
B1. Either extent of occurrence	<100 km ²	<5,000 km ²	<20,000 km ²
B2. Or area of occupancy	<10 km ²	<500 km ²	<2,000 km ²
and 2 of the following 3:			
a) severely fragmented or # location	=1	=2–5	=6–10
b) continuing decline in (i) extent of occurrence (ii) area of occupancy (iii) area, extent and/or quality of habitat (iv) number of locations or subpopulations (v) number of mature individuals			
c) extreme fluctuations in any of (i) extent of occurrence (ii) area of occupancy (iii) number of locations or subpopulations and (iv) number of mature individuals			
C. Small population size and decline			
Number of mature individuals and either C1 or C2	<250	<2,500	<10,000
C1. An estimated continuing decline of at least up to a maximum of 100 years	25% in 3 years or 1 generation	20% in 5 years or 2 generations	10% in 10 years or 3 generations
C2. A continuing decline and (a) and/or (b)			
(a i) # mature individuals in largest subpopulation	<50	<250	<1,000
(a ii) or % individuals in one subpopulation =	90–100%	95–100%	100%
(b) extreme fluctuations in the number of mature individuals			
D. Very small or restricted population			
Either (1) number of mature individuals	<50	<250	<1,000
or (2) restricted area of occupancy	na	na	typically AOO<20 km ² or # locations ≤5
E. Quantitative analysis			
Indicating the probability of extinction in the wild to be at least	50% in 10 years or 3 generations (100 years maximum)	20% in 20 years or 5 generations (100 years maximum)	10% in 100 years

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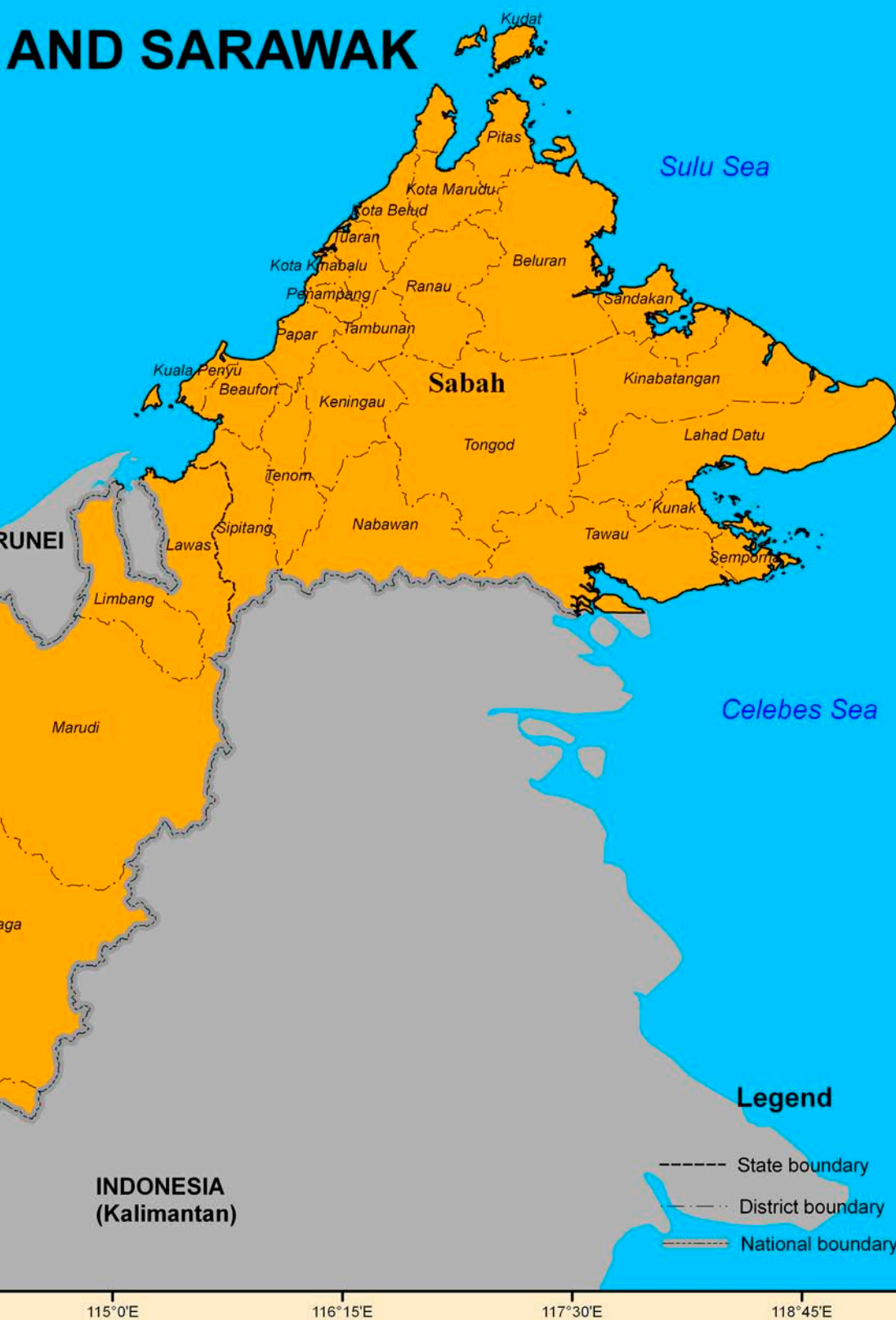
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AND SARAWAK



MALAYSIA PLANT RED LIST

PENINSULAR MALAYSIAN
DIPTEROCARPACEAE

This publication is Malaysia's first attempt to list indigenous plants into the national Red List. This output is one of the many envisaged for the work on threat assessment of native plants of Malaysia which will accomplish Target 2 of Malaysia's National Strategy for Plant Conservation. Target 2 aims to have a preliminary assessment of the conservation status of all known plant species of the nation.



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