
Heart of Borneo Series 19
GERENAI - LONG MEKABA
"Exploring Hinterland of North-Eastern Sarawak"
FOREST DEPARTMENT SARAWAK
HEART OF BORNEO INITIATIVE

The Heart of Borneo Series 19

GERENAI – LONG MEKABA

Exploring the Hinterland of North-Eastern Sarawak

FOREST DEPARTMENT SARAWAK

First published 2024

FOREST DEPARTMENT SARAWAK
Heart of Borneo Series 19. Gerenai – Long Mekaba: Exploring the Hinterland of North-Eastern Sarawak.
ISBN: 978-629-99294-5-1

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This publication is available from
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Printed in Malaysia by:
CL Ting Corporate Sdn Bhd

FOREWORDS

I am honoured to be given privilege of writing the message for this publication, *Heart of Borneo Series 19: Gerenai – Long Mekaba: Exploring the Hinterland of North-Eastern Sarawak.* I should, first of all congratulates the International Affair Division for their effort to publish this book.

Gerenai – Long Mekaba Scientific Expedition: Exploring the Hinterland of North-Eastern Sarawak, was held in August 2022 with participation of over 90 researchers and scientists from various government institutions, universities and local NGOs and also participants from Brunei Darussalam. It was conceived as an activity to illustrate and provide invaluable insight to the diverse of Gerenai FMU. The expedition was organized by the Forest Department Sarawak and mainly funded and supported by the Ministry of Natural Resources and Environmental Sustainability (NRES) and State Government of Sarawak as a continuation project under the Heart of Borneo (HoB) initiative. Gerenai – Long Mekaba Scientific Expedition, in fact is a ninth scientific expedition conducted in the project that revealed the diverseness of floras and faunas in the State.

The committee and editorial team deserve much credit for the time and effort put in the success of this book published. Special appreciations go to all the valued contributors who have been courteous to provide paper and photos which concluded into meaningful publication.

DATU HAMDEN BIN HAJI MOHAMMED
Director of Forests
SARAWAK

CONTENTS

INTRODUCTION

Sarawak is the largest component in Malaysia, lies between 0◦ 50’ to 5◦ N latitude and 109◦ 30’ to 115◦ 40’ E longitude, and resides in the northwestern part of Borneo. The coverage area is about equal in size to all of Peninsular Malaysia. Sarawak incorporates an area of about 12.4 million hectares and has a long-lying coastline of approx. 725 km along the South China Sea and as well the widest inland boundary, about 300km long. Kuching is the capital city and also the main entrance for the State, located on the very west of Sarawak.

The State of Sarawak is richly endowed Nature's splendours abound throughout the state of Sarawak. The indigenous vegetation of Sarawak is evergreen tropical rain forest. Floristically, the forests are rich in all major plant communities and estimates for the fauna are equally astounding.

WHAT IS THE HEART OF BORNEO (HOB) INITIATIVE?

Heart of Borneo (HoB) Initiative is a voluntary transboundary cooperation between Brunei, Indonesia and Malaysia to enable conservation and environment protection while enhancing sustainable development that improves the welfare of those living on the island. The cooperation of the three ASEAN nations was officially launched in Brazil on 27 March 2006.

Because of the global concerns and controversies about tropical forest development, the long-term objective of the HoB Initiative, as enshrined in the Bali Declaration, is as follows:

"With one conservation vision and to promote people's welfare, we will cooperate in ensuring the effective management of forest resources and conservation of a network of protected areas, productive forests and other sustainable uses".

THE SARAWAK'S HEART OF BORNEO AREAS AND THE 5 PILLARS

PILLAR 1

SUSTAINABLE FOREST MANAGEMENT

Focusing on maintaining the balance between forest and environmental protection

PILLAR 2

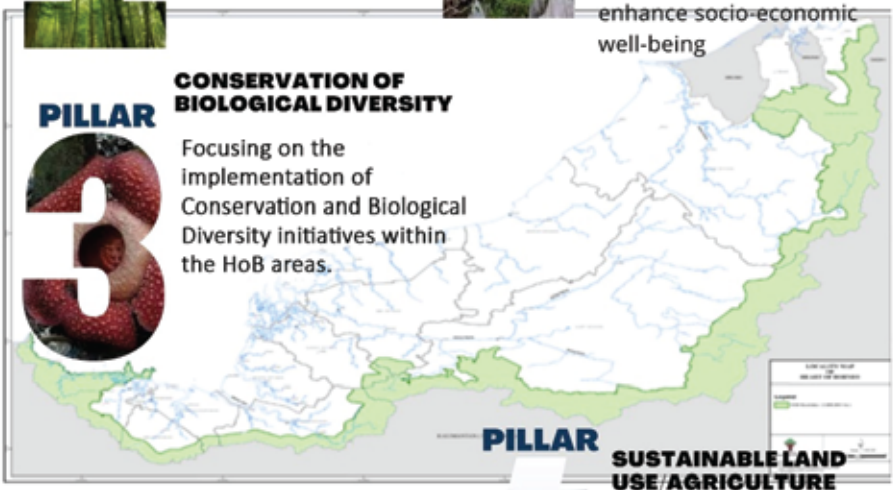
ECOTOURISM BASED ON CULTURE, ADVENTURE & NATURE

Focusing on developing ecotourism living involving the local communities to promote conservation and enhance socio-economic well-being

PILLAR 3

CONSERVATION OF BIOLOGICAL DIVERSITY

Focusing on the implementation of Conservation and Biological Diversity initiatives within the HoB areas.



PILLAR 4

SUSTAINABLE LAND USE/AGRICULTURE

Focusing on sustainable development of rural communities through wise management of natural resources and agriculture

PILLAR 5

COMMUNITY-BASED/ RURAL POVERTY ERADICATION PROPGRAM

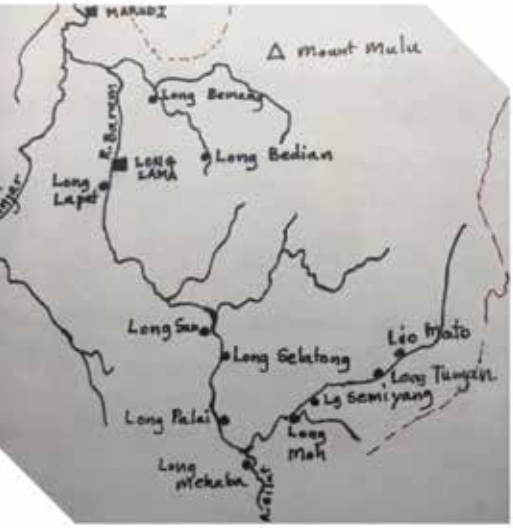
Focusing on the welfare of rural communities through effective management of Totally Protected Areas (TPAs), production, forest and agriculture

HEART OF BORNEO INITIATIVE

MIRI DIVISION

Miri division, comprised of two districts, Miri and Marudi, is one of Sarawak's twelve administrative divisions. It is the second largest division after the Kapit division, with a total size of 26,777.1 square kilometres. According to the 2000 census, the population is approximately 316,400 individuals of diverse ethnicities, including Iban, Chinese, Malay, Melanau, Kenyah, Kayan, Lun Bawang, Kelabit, Saban, and the Penan.

LONG MEKABA



Long Mekaba or sometimes spelt with pronounced as “Mengkaba”, is located in Marudi district, with the majority of the population being Kenyah people. Long Mekaba lies on the Silat River, a tributary of the Upper Baram. Hitherto, it was one of the most remote villages due to its location just beyond an especially extreme stretch of rapids.

THE NINTH HOB EXPEDITION

Long Mekaba has been chosen as a base for the Sarawak HoB scientific expedition in 2022. Long Mekaba is part of the Gerenai Forest Management Unit (FMU), which is located in north-eastern Sarawak at Batang Baram. The Gerenai FMU borders the Usun Apau National Park and the Sungai Moh Wildlife Sanctuary. The Gerenai-Long Mekaba excursion is only the ninth HoB research mission organised by FDS since it began at the LEWS in 2008.

THE SITE

The geological of Gerenai – Long Mekaba scientific expedition areas range from riverside flats that quickly grade into low undulating hills which lead to rugged mountainous terrains that are generally steep and dissected by narrow valleys. The areas are covered by the hill mixed dipterocarp forest (HMDF), secondary forest and also scattered patches of kerangas forest, and montane forest at the peaks of hills (900 – 1,820 m altitudes).

THE CAMP

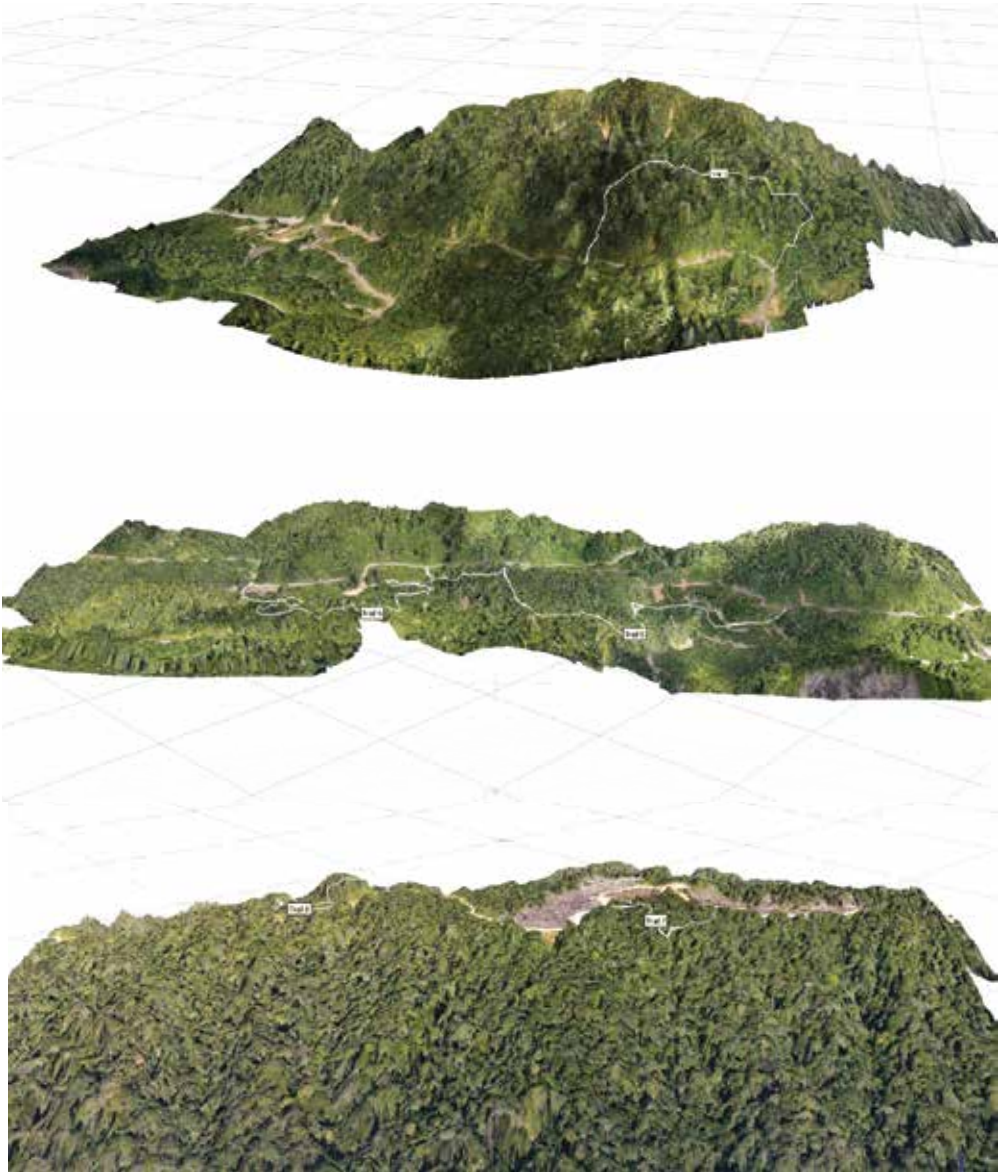
The Base Camp for Gerenai – Long Mekaba Scientific Expedition 2022 located just a few kilometers away from the Long Mekaba settlement.

THE TRAILS

The trails were established by the FDS months before the event and designed to meet the objectives of the expedition. Few trails come with rough, which is physically and mentally challenging. The participants need to climb up and down the steep slopes or cross the stream with the wild currents. Nonetheless, some trails might give a healing mind with a slow flow stream with an enjoyable scenic view.

Trails trekking via drone technology

Trails trekking via drone technology



THE ACTIVITIES

THE FINDINGS

THE SOURSOP FAMILY

Annonaceae, the Soursop family, sometimes also known as the Custard Apple family, is a pantropical flowering plant family. The family is represented by various types of habits, from shrubs to trees and lianas, with about 130 genera consisting of more than 2300 species. *Artobotrys, Cyathocalyx, Fissistigma, Goniothalamus, Mithrephora, Polyalthia* and *Uvaria* are the common genera recorded in the Gerenai-Long Mekaba scientific expedition areas.

THE BELIAN

The Belian tree, also known as “Bornean ironwood” with a scientific name, *Eusideroxylon zwageri* Teijsm. & Binn. is a member of the Lauraceae family. The Belian tree is one of the most durable and heaviest timbers in the world. This species is native to Borneo, Flores, Java, Sumatra and the southern parts of the Philippines. Not common in the Gerenai- Long Mekaba areas, only a few plants recorded along the river banks.

THE JAMBOS

The Jambos family is the third most dominant tree in the Bornean tropical forests, after the Dipterocarpaceae and Euphorbiaceae. Most of the species in the genus Syzygium probably straightforwardly can be identified up to the generic level, but difficult to confirm to species level due to high similarity.

THE MELASTOMAS

The family Melastomataceae is among the largest flowering plant families, consisting of about 175 genera with more than 5100 species recorded. In Gerenai FMU, about 9 genera with more than 20 species were observed (incl. herbaceous, shrub, epiphytic, climber and trees.).

THE COFFEE

Rubiaceae or the Coffee family is one of the largest flowering plant families (the fourth largest in the Angiosperms group) in the tropics. With 620 genera that contain approx. 13,500 species and varies in habits, this family is dominating every layer of the forest canopy. In the Gerenai FMU, this family is represented very well. Among the genera recorded here are, *Agrostemma, Bungarimba, Canthium, Gaertnera, Ixora, Jackiopsis, Nauclea, Pavetta, Porterandia*, etc.

Acranthera sp.

Agrostemma sp.

Gynochthodes sp.

UROPHYLLUM

The genus *Urophyllum* is one of major plant groups in the family Rubiaceae, with most of the members are trees or shrubs, and sometimes dioecious. They are native to south China to tropical Asia, with approx. 121 species recorded. In Sarawak this genus is common in the lowland and hill forests, in secondary and forests edges. About 4 species were recorded in the Gerenai FMU areas during the expedition.

SANTALACEAE

Santalaceae or the Sandalwood family is a widely distributed flowering plant family in the tropics. They vary in life forms such as herbs, shrubs, climbers or small trees. About 43 genera consisting of about 1,000 species are recognized throughout the world.

AULANDRA

The genus *Aulandra* is a member of the flowering plant Sapotaceae. This genus is endemic to Borneo with only two species have been recognized. One species, Aulandra longiflora, is recorded in the Gerenai FMU during the expedition.

LEPTONYCHIA

Leptonychia is a genus of flowering plants belonging to the family Malvaceae. It is native to tropical Africa, Indo-China and Southeast Asia. One common species was reported during the expedition, *Leptonychia caudata* (Wall. ex G. Don) Burret. This species is known by many names, such as Buah dangan, Karai, Bunsi, Melebu, Pakan manok, Mamaliaan by the local peoples pending on their localities. While in Peninsular Malaysia is called Saga-saga, Cermai burung or Sekincak. Usually found as a shrub plant, but also can reach a small tree. *Leptonychia caudata* has a high potential to be a valuable medicinal plant. The roots are used to treat fever and also during childbirth. The leaves are used as a poultice for ulcerated noses, and the leaf juice is used as a cooling lotion for fever. Pounded leaves are applied on the stomach against stomach aches.

WILD PIPERS

Wild pipers, from the flowering plant family Piperaceae are one of the most common understory or climbing plants in the tropical rainforest, especially in Borneo. Yet, this family is always neglected by the collectors due to the problem of identifying with a lower rank. The flowers are usually very tiny and very hard to see if you are not careful enough. The fruits are berries, small to medium-sized, but strong enough to be used to differentiate the species. At least 12 wild piper species were encountered in the Gerenai FMU.

Piper sp.7

Piper sp.8

Piper sp.11

AROIDS

The aroids or the Araceae is a flowering plant of the Monocotyledons group with unique flowers that are borne on a type of inflorescence called a “spadix”. The Araceae contains about 140 genera and consists of approx. 4,075 species throughout the world, but more diverse in the new world. Many species display very decorative leaves and flowers, thus making them widely planted for gardening (particularly indoor plants). In Gerenai FMU, the aroids are common and easily spotted anywhere. Some of them are under the shaded canopies, a few as rheophytes on the rock, climbers on the tree trunks or epiphytic on the branches. Among the genera recorded here, such as *Alocasia, Amorphophallus, Homalomena, Photos, Schismatoglottis*, etc

BEGONIAS

The Begonias are readily known by the very unequal-sided leaf. They are accustomed to garden or indoor decoration plants because of their charmingly beautiful foliage and flower. The genus Begonia is one of the largest genera of flowering plants in the world, with over 1600 natural species and more than 10,000 hybrids named have been registered (Tebbitt, 2005).

The diversity of Begonia in Borneo is amazing, with many new species being discovered every year. Currently, more than 300 species are recorded from the island, with Sarawak registered the most; 115 species with bulks of unidentified specimens yet to be confirmed. Gerenai FMU recorded about 10 species, with three possibly new to science.

One of few unidentified Begonia species discovered in the Gerenai FMU areas during the expedition.






CYRTANDRA

Cyrtandra is a genus of flowering plants belonging to the family Gesneriaceae. It is the largest genus in the family Gesneriaceae containing about 600 species worldwide. This genus is native to Southeast Asia, Australia and the Pacific islands. Their habits are varying from small herbs, vines, shrubs, epiphytes or trees. The genus is characterized by having two stamens, and most species have white flowers, with a few red-, orange-, yellow- and pink-flowered.

he diversity of *Cyrtandra* species in Sarawak is tremendous. About 20% or approximately 120 species have been recorded for the State. Off the number recorded for the State, only 4 species are in common with Peninsular Malaysia. Many species are either endemic to Borneo or specifically in limited distributions.

The Gerenai FMU areas (incl. Long Mekaba) have a great number of *Cyrtandra* species. About 18 species were recorded during the expedition.

Cyrtandra sp.1 (with bullate leaves).

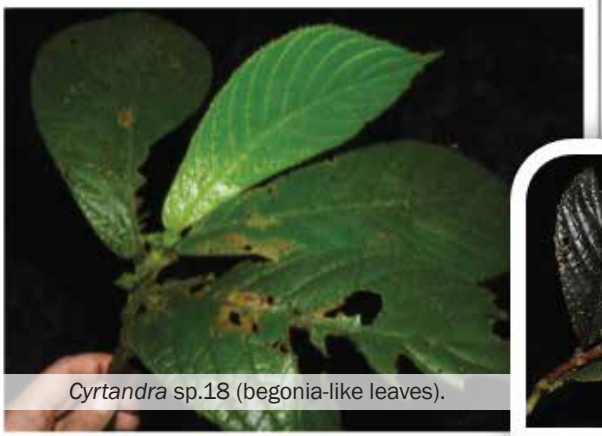
Cyrtandra sp.2 (with long peduncle).

Cyrtandra sp.8 (with winged-petiole).

Cyrtandra sp.10 (with rough surface leaves).

Cyrtandra sp.15 (leaf-like bracts).

Cyrtandra sp.16 (leaf-like bracts).



Cyrtandra sp.18 (begonia-like leaves).

SEDGES

The genus Mapania is a member of Cyperaceae that is placed under the subfamily Mapanioideae. In Malaysia, they are locally known by many names, e.g. *Pandan tikus, Rumput serapat, Daon siset, Eee, Mieng* etc. Borneo with 42 species recorded is considered the centre of species richness. Of the total, 40 species are recorded in Sarawak.

Mapania latifolia

Mapania caudata

During the expedition, 12 species of *Mapania* were recorded viz. *Mapania ballehensis, M. caudata, M. cuspidata, M. debilis, M. hispida, M. latifolia, M. palustris, M. wallichii* and four unidentified species. The four unidentified species are possibly undescribed species and verification is still ongoing.

Mapania aff. palustris

Unidentified *Mapania* sp.

PITCHER PLANTS

The genus *Nepenthes* or locally known as *Periuk kera* or *Pok yuk*, is one of the carnivorous plants native to Sarawak. The genus was first introduced by Carl Linnaues in 1737 in his book, *Hortus Cliffortianus*. Currently, there are more than 100 species worldwide with many new species still being discovered and described (e.g. *N. bracteosa, N. malayensis, N. putaiguneung, N. rosea*, etc.). Borneo with 41 and Sumatra with 33 species are considered the centre of the species richness. A total of five *Nepenthes* species have been recorded from the Gerenai-Long Mekaba areas. The species are *N. ampullaria, N.gracilis, N. hirsuta, N. mirabilis and N. reinwardtiana.*

ORCHIDS

The Orchidaceae is one of the largest and most widespread flowering plant families that is distributed everywhere and in almost every habitat except the Arctic. The family consists of more than 880 genera with about 30,000 – 40,000 natural species (excluding more than 100,000 names of hybrids). The world's richest diversity of orchid species is found in the tropics. The Borneo island with more than 3,000 species recorded (approx. 1100 species in Sarawak) or 10% of the world's total number is considered among the highest diverse spot for orchids.

Bromheadia finlaysoniana

Vrydagzynea sp.

Nephelaphyllum sp.

Coelogyne sp.

Bulbophyllum signatum

Bulbophyllum sp.

WILD BANANAS

Wild bananas are very common in the roadsides, secondary forests and degraded areas in the Gerenai – Long Mekaba areas. At least five taxa were recorded (observed) during the expedition, namely, *Musa acuminata* var. *microcarpa, M. acuminata* var. *truncata, M. borneensis var. flavida, M. campestris and M. lawitensis.*

ELATOSTEMA

A genus of flowering plants in the nettle family Urticaceae. There are approx. 350 species worldwide that native to the tropical forests of Australia, Africa and Asia. Most of the species are shade-loving plants, usually on moist soils.

Elatostema sp.2

Elatostema sp.3

Elatostema sp.5

MONKEY LIPSTICK

The Monkey Lipstick plants are members of the genus *Aeschynanthus,* belonging to the flowering plants family, Gesneriaceae. There are about 150 species in this genus, found in the tropics and subtropics forests. Most of the *Aeschynanthus* species are trailing epiphytic on the trees. They are commonly found in the high moist conditions, such as riparian or riverine and limestone habitats and high altitudes. Many specimens were collected and recorded from the Sarawak HoB areas, but currently, only seven verified names were reported. From the Gerenai FMU areas, about five species were recorded with only two names identified (*A. havilandii and A. tricolor*), whereas others are yet to be confirmed.

Unidentified *Aeschynanthus* species from Gerenai FMU

Alpinia

Alpinia is the largest genus in the Zingiberaceae family with over 260 species in tropical Asia. They are easily recognized from other genera by most of them having terminal inflorescence on the leafy shoot with large showy flowers. Six *Alpinia* species were recorded from Gerenai FMU areas, with *A. glabra* and *A. ligulata* being the two most common species found.

Burbidgea

For many years, this genus is thought to be endemic to Borneo, with only five species recognized. Recently, Philippines scientists discovered the genus *Burbidgea* also occurred in the southern Philippines. Only one species, B. stenantha was recorded from the Gerenai FMU during the expedition.

Etlingera

The *Etlingera* members are probably the most common gingers in the opened spaces throughout Sarawak, i.e. *E. coccinea, E. elatior, E. nasuta*, etc. The *Etlingera* was the most specious genus in the Gerenai FMU areas, with 10 species recorded. Among the species recorded are, *E. barioensis, E. brevilabrum. E. burttii, E. coccinea, E. elatior, E. nasuta, E. rubromarginata,* etc. *Etlingera elatior* or "Kantan" is common on the roadsides.

Etlingera brevilabrum

Plagiostachsy

The members of this genus are tall and easily recognized by the terminal inflorescence that breaks through the leaf sheaths and thus appears lateral on the leafy shoot. Five species were recorded from the Gerenai FMU areas. *Bajang (Plagiostachys crocydocalyx)* and *P. brevicalcara* are common.

Sundamomum

Sundamomum is a genus created to accommodate a group of ginger species (previously under the large genus *Amomum*) with the following characteristics; (1) coriaceous bracts supporting a single flower, (2) flowers open to gullet-shaped, and (3) fruits are ribbed or grooved. Seventeen species, mainly in Borneo (only 3 species outside Borneo), and 12 species were recorded in Sarawak. Gerenai FMU, however only three species were recorded.

Zingiber

Zingiber is probably the third common genus found in Sarawak, after *Etlingera* and *Globba*. Gerenai FMU areas recorded 8 *Zingiber* species during the expedition, the second highest after *Etlingera*. Two common Zingiber species recorded were, *Z, pachysiphon* and *Z. pseudopungens.*

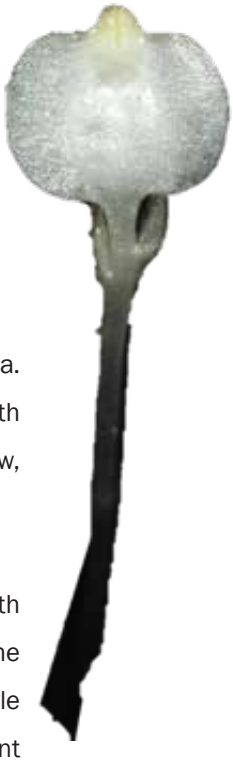
The ferns or Pteridophytes are more advanced than the Lycophytes (fern-allies) in terms of, (a) highly divided fronds with branching veins, and (b) spore-bearing structures (sporangia) on the margins or underside leaves. Whereas, the Lycophytes, the leaves with a single vein that runs along the length of the leaf, and the presence of strobilus.

During the expedition, about 91 specimens were collected (incl. observations). Approximately 62 specimens were identified to the lower taxa and 20 are still pending determinations. The records consist of two families from the Lycophytes and 19 families of the true ferns. Off the total number, 8 species were identified as endemic to Borneo, and 5 species were considered new records for Sarawak.

THISMIA

The genus *Thismia* is an achlorophyllous and mycoheterotrophic plant in the family Burmanniaceae. Also known as the terrestrial lantern plant or fairy lantern, is native to east and southeast Asia, New Guinea, Australia, New Zealand and the Americas. Described in the year 1845 by a British botanist, William Griffith, consists of about 80 species.

The *Thismia* are not easy to notice because their tiny in size and sometimes are in dull colour similar to the forest litter. By luck, at the right time and right place, you can see it. The biggest challenge to studying this tiny plant is the lack of references and good specimens in the herbaria. Only one species was discovered during the expedition. It was identified as *Thismia cf. pallida.* The status, however, is still pending, subject to further verification



BURMANNIA

Burmannia is a tiny genus of tropical flowering plants found in India, Malaysia, Indonesia, and Australia. Members of this genus have a unique morphology, with a tiny stem, reduced leaves, and a single white, yellow, pink, or purple flower.

Instead, it relies on a symbiotic relationship with fungus that reside in its roots and feeds it with the nutrients it requires. *Burmannia's* carnivorous lifestyle is one of its most intriguing behaviours. The fragrant smell that comes from the flowers of the plants in this genus attracts little insects. When an insect lands on a flower, it gets caught in the sticky, glandular hairs that cover the inner of the petals. The plant absorbs nutrients through its sticky hairs once the nourishment is ingested. This technique of nutrition is uncommon among flowering plants, giving *Burmannia* a distinct place in the botanical world. Three species were recorded in the Gerenai FMU during the expedition, *B. disticha, B. lutescens* and *B. oblonga*.

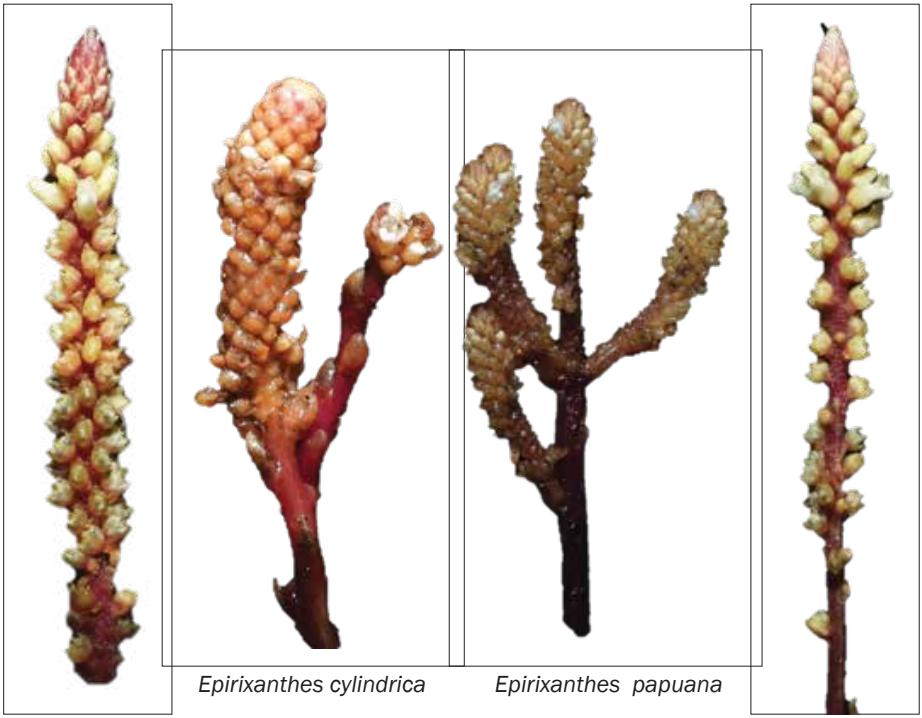
BALANOPHORA

Balanophoraceae is an obligate parasitic flowering plant of tropical and subtropical forests. The family consists of 16 genera that are mostly from the New World. *Balanophora* is the only genus in the family recorded in Sarawak. This genus is a holoparasitic plant that commonly parasitizes the roots of a wide variety of plant species. The inflorescences of *Balanophora* emerge from warty tubers that are attached to their host plant. There are 15 recognised species throughout temperate and tropical areas. Two species are recorded in the HoB areas of Sarawak. *Balanophora papuana* was found in Pueh Forest Reserve, and B. reflexa was recorded in Payeh Maga, Lawas.

The warty tubes of *Balanophora* species discovered in the Gerenai FMU

EPIRIXANTHES

Epirixanthes, is a genus of flowering plants belonging to the family Polygalaceae. They are holo-mycoheterotrophic herbaceous that inhabit the understorey of tropical rainforests. Generally, they are tiny plants, with reduced bract-like leaves and dense spike-like inflorescence. The distribution of this genus is in Indo-China and Southeast Asia, and currently, only seven species are recognized. Six species are recorded for Borneo with one species registered as endemic to the island. *Epirixanthes confusa* Tsukaya et al. is endemic to Borneo, and this species was recorded in the Gerenai FMU during the expedition. Other Epirixanthes species recorded in the Gerenai FMU areas are, *E. cylindrica, E. elongata* and *E. papuana.* Most of the Epirixanthes are considered lowland species, found at 40-meter altitudes to about 500 m above sea level. Two species, *E. kinabaluensis* and *E. papuana* have wide altitudinal habitats, from 60 meters to 1800 meters above sea level.



Epirixanthes cylindrica *Epirixanthes papuana*

Epirixanthes confusa *Epirixanthes elongata*

SCIAPHILA

Sciaphila is a genus of mycoheterotrophic in the flowering plant family Triuridaceae. It grows in deep shade understory of ever-wet forests in the tropical. Currently, there are 40 species registered in this genus, making it the largest in the family. Only one species was recorded in the Gerenai FMU during the expedition.

MACROFUNGI

Macrofungi are one of the important forest elements in the tropics and subtropics. They act as the main decomposers, as they possess enzymes that can break down the molecules in wood debris, leaf litter, certain living tissues, and dead organic matter in the soil. Gerenai FMU areas are exceptionally rich in macrofungi. A total of 107 specimens from 10 types of macrofungi were recorded.

Ten types of macrofungi collected from the Gerenai FMU areas,


Microporus affinis


Microporus xanthopus


Polyporus sp.


Cortinarius sp.


Marasmius sp.


Auricularia delicata


Clavulinopsis sp.


Cookeina sp.


Tulostoma sp.


Geastrum sp.


Xylaria polymorpha

TOOTHED FUNGI

Toothed fungi are distinguished by spore-bearing structures that resemble tiny teeth on the surface of the fleshy fruiting body. The fungus are named after their features, which are pointy or elongated projections that look like teeth. Toothed fungus grow on a wide range of substrates, including decaying wood, leaves, and dirt. They are commonly found in tropical jungles of Borneo.

Some species are used in Chinese medicine to treat a wide range of diseases, including high blood pressure, diabetes, and cancer. Toothed fungus are used in the food business to taste and preserve food. Among the genera recorded in the Gerenai FMU are *Tramella, Hydnum*, etc.

Hydnum sp.

Geastrum sp.

EARTHSTAR FUNGI

Earthstar fungi are a unique form of mushroom in the Geastraceae family. These fungi are distinguished by their distinctive look, which is reminiscent of a star-shaped structure with a central ball-shaped spore case. The spore case is enclosed by a "peristome," a star-like structure that rips open to release the spores. One of the most interesting characteristics of earthstar fungi is their ability to alter their position in response to changes in humidity. The fungus contracts when it is dry, enabling it to protect its delicate spore capsule. When humidity levels rise, the fungus grows, which aids in the dispersal of its spores.

PUFFBALL FUNGI

Puffballs are a type of fungus with a ball-shaped fruit body that spurts on influence, freeing a cloud of dust-like spores when mature. The puffballs encompass several genera that are grouped into stalked puffballs, true puffballs and false puffballs, but under the one big division of Basidiomycota. Among the genera recorded for Sarawak are such ones as *Calostoma, Calvatia, Geastrum,* and *Lycoperdon.*

JELLY FUNGI

The jelly fungi are distinguished by its distinct appearance, which mimics that of jelly or rubber. These fungi can be white, yellow, orange, or red in colour, and some are bioluminescent, illuminating in the dark. Jelly fungi, which are commonly seen growing on rotting wood or plant debris, perform an important function in the environment by breaking down organic material and recycling nutrients. Jelly fungi have long been utilised in traditional medicine due to their therapeutic characteristics. Bioactive substances found in these fungi include polysaccharides, lectins, and terpenoids, which have anti-inflammatory, anti-tumour, and antioxidant activities. They are also used to treat respiratory tract infections, excessive blood pressure, and immune system boosters.

ZOMBIE FUNGI

Most of the fungi are feeds on dead bodies (leaves, wood, branches etc.). But a few can parasitize living things, such as insects (particularly ants). The fungi species that can do that mechanism are from the family *Clavicipitaceae,* genus *Cordyceps* (≈ 400 spp.). During the expedition, about 9 Cordyceps species have been collected and all are still in the determination process.

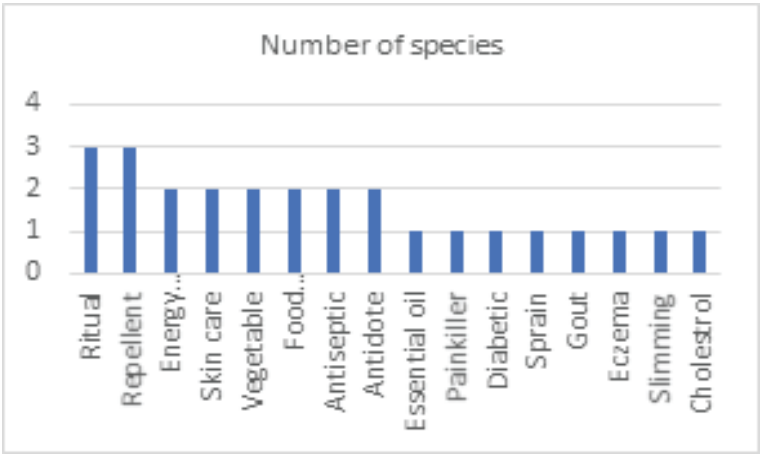





ETHNOPLANTS

Ethnobotany is a study of the plants being used by the ethics for living. It includes plants for food, dye, construction, handicrafts, ornamental and as well as for ritual or spiritual events. The ethnoplants of Long Mekaba, however, have never been recorded or reported before. During the Gerenai-Long Mekaba scientific expedition, a group of scientists from the Sarawak Biodiversity Centre (SBC) conducted a study to record the useful plants from the Gerenai FMU areas.

A preliminary result of the finding recorded about 16 plant families consisting of 27 species of useful plants by the Kenyah community of Long Mekaba. Piperaceae and Annonaceae with 4 and 3 species respectively, were the most used plants by the community.



Piper porphyrophyllum (Daun rimo), a useful plant used by the Kenyah to relief pains and bruishes.

Piper vestitum (Tong burong), a useful plant used as food flavour.

Goniothalamus macrophyllus (Timang perempuan), a useful plant used to cast evil spirit away and as mosquitos' repellent

Baccaurea sp. (Lepesuk) a useful plant, fruits are edible to reduced cholestrol, and, immatured fruits are used to treat arthritis.

Boesenbergia stenophylla (Jerangau putih) a useful plant by the kenyah. Plant is used as part of ingredient to make a massage oil. Leaf or stem of dried or fresh plant is used internally for alergi (seafood).

FAUNA

Borneo is one of the important sites for fauna studies with an amazing number of species recorded and many are endemic. The HoB areas particularly have a tremendous fauna diversity. Due to many reasons, the Gerenai – Long Mekaba Scientific Expedition 2022 only represents small groups (bats, birds, termites, dragonflies and damselfly). It is clear that, during the expedition, much evidence of the presence of big mammals in the Gerenai FMU areas was spotted.

THE BATS

The bats survey in the Gerenai FMU was conducted via mist nets and observations. A total of 5 species were captured and 8 species were recorded [6 families, 8 genera, 9 species].

Family: *Emballonuridae*
Species: *Emballonura sp.*
Vern. Name: Sheath-tailed bat
Notes: It is nocturnal, roosting in sheltered places during the day.

Family: *Hipposideridae*
Species: *Hipposideros galeritus*
Vern. Name: Cantor's roundleaf bat
Notes: This species is insectivorous, usually in small colonies. Their habitat is in the cave, crevices and piles of rock boulders.

Family: Molossidae
Species*: Cheiromeles torquatus*
Vern. Names: Naked bat, Hairless bat, Naked bulldog bat, Greater naked bat.
Notes: This species is a hawking insectivore. They inhabit mainly lowlands, rock surfaces with holes and crevices and trees.

Family: Rhinolophidae
Species*: Rhinolophus trifoliatus*
Vern. Name*:* Trefoil horseshoe bat
Notes: A medium-sized bat with wide habitats, from mangrove to montane forests at 1,800-meter altitudes.

Family: Pteropodidae
Species: *Macroglossus minimus*
Vern. Names: Long-tongue nectar bat, Honey nectar bat
Notes: One of the smallest species in the family. It feeds on nectars and pollens.

Family: Vespertilionidae
Species: *Murina suilla*
Vern. Names: Lesser tube-nosed bat, Vesper bat
Notes: One of the smallest species in the genus. Its distribution is widespread in Southeast Asia. This species is insectivorous.

Family: VPteropodidae
Species: *Penthetor lucasi*
Vern. Name: Dusky fruit bat
Notes: Irregularly distributed throughout the lowland and hill forests. This species is a frugivore.

THE BIRDS

The bird survey was conducted at the Gerenai FMU areas during the expedition. The objective was to produce a preliminary list of resident birds in the Gerenai FMU areas. A total of 19 species were recorded during the expedition. Four species of Bulbuls, 3 species each for spiderhunters and sunbirds, two babblers and others represented by a single species.

Rufous Piculet

The Rufous piculet or *Sasia abnormis*, is a species of bird in the family Picidae. This species is one of the world's smallest woodpeckers. It is found in Southeast Asia in habitats of lowland forests up to a moist montane forest.

Gold-whiskered Barbet

The Gold-whiskered Barbet or *Psilopogon chrysopogon*, is a member of the bird family Megalaimidae. The distribution of this species is range from Peninsular Malaysia to Borneo and Sumatra.

Hairy-backed Bulbul

The hairy-backed Bulbul *(Tricholestes criniger)* is a songbird from the family Pycnonotidae. The distribution is Peninsular Malaysia, Borneo and Sumatra.

Bornean Spiderhunter

This medium-sized *spiderhunter* or *Arachnothera everetti,* with an olive back and streaked grey underparts, inhabits lowland and sub-montane forests and forest edges. It feeds primarily on nectars in the understory forests, favors blossom bananas and gingers.

Little Spiderhunter

Active little bird with a long and decurved bill, feed on insects and nectars. *Arachnothera longirostra* or little spiderhunter is commonly found in secondary forests, forest edges, plantations and gardens.

Thick-billed Spiderhunter

Dull and largely unmarked spiderhunter. Scientifically known as *Arachnothera crassirostris* it feeds on insects and sips nectars from flowers. It usually forages in the middle levels of foothills and lowland rainforests.

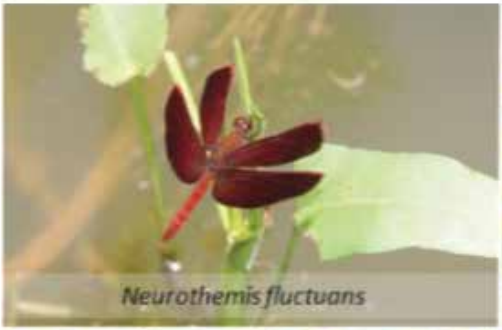
Malaysian Blue Flycatcher

Lowland species *Cyornis turcosus* is only found in isolated riverine forests in Sumatra and Peninsular Malaysia, but it can also be found on Borneo in both dry and wet forests. This species is a small flycatcher has vivid blue upperparts, a breast and throat that are pale orange, and a belly that is white.

Plain Sunbird

A medium-large sunbird with a rather thick, slightly decurved bill. Inhabits a wide range of forest types from lowlands into foothils, but more common in coastal forest and forest edge. [*Anthreptes simplex*].

Gray-headed Babbler *[Stachyris poliochepala]*


Neurothemis fluctuans


Neurothemis terminata


Neurothemis ramburii


Trithemis aurora


Orthetrum testaceum

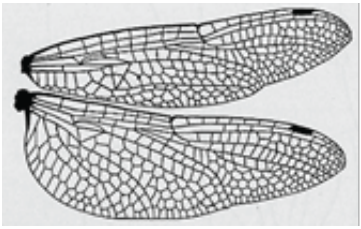

Orthetrum pruinosum


Orthetrum glaucum

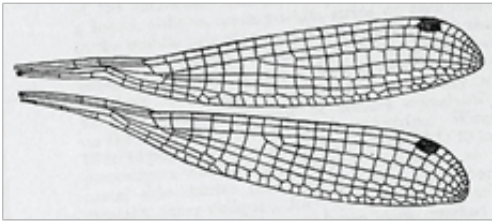

Aethriamanta gracilis

DRAGONFLY AND DAMSELFLY

Dragonfly is a flying insect belonging to the Order Odonata. There are about 3,000 species known in the world which are mostly in the tropics. Dragonfly can be mistaken for the closely related, Damselfly. The Dragonfly can be distinguished from Damselfly by the eyes, the position of wings at rest and, the size and shape of forewings and hindwings.



Dragonfly



Damselfly

Both Dragonflies and Damselfly are important as they can be used as a bio indicator for water quality, biological control for pest insects, larvae as a source of food and ecotourism (Dragonfly watching). About 400 species are recorded for Malaysia and 310 species are recorded for Sarawak. From the records and results from this expedition, 85 species are recorded for Gerenai FMU.

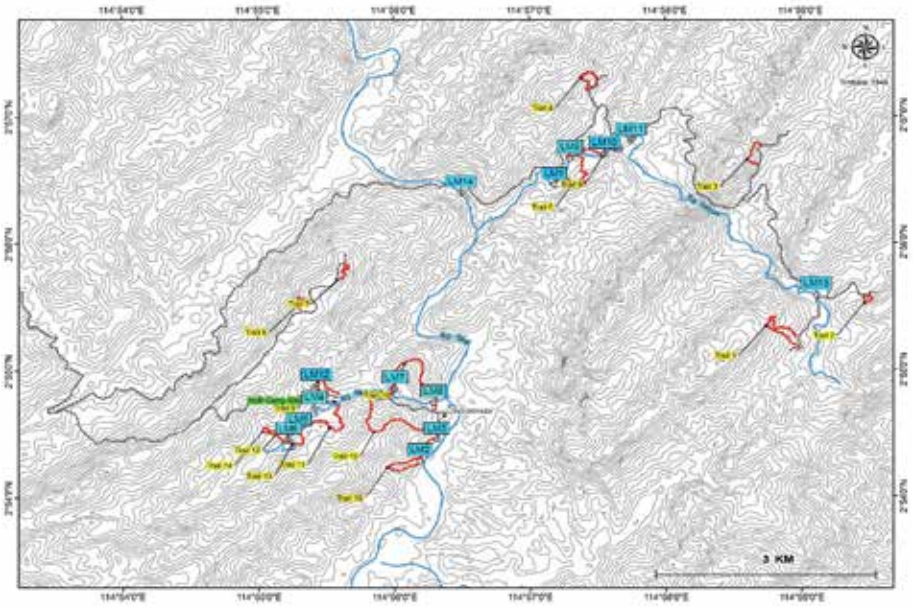

Coelicia nigrohamata
Devadatta cyanoaudata
Euphaea impar
Euphaea subcostalis
Vestalis amnicola
Agriocnemis femina
Rhinocypha aurofulgens
Copera vittata

TERMITES

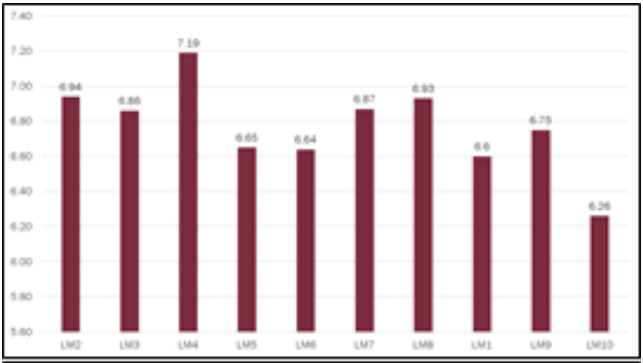
The study was conducted during the expedition with the aims to compare the diversity of termites in three sampling areas; (1) virgin forest, (2) logged-over forest, and (3) secondary forest (Temudak). Two families (Rhinotermitidae and Termitidae), consisting of 6 subfamilies and 22 genera were recorded. The family Termitidae is the most diverse with 17 genera recorded.

WATER QUALITY STUDY

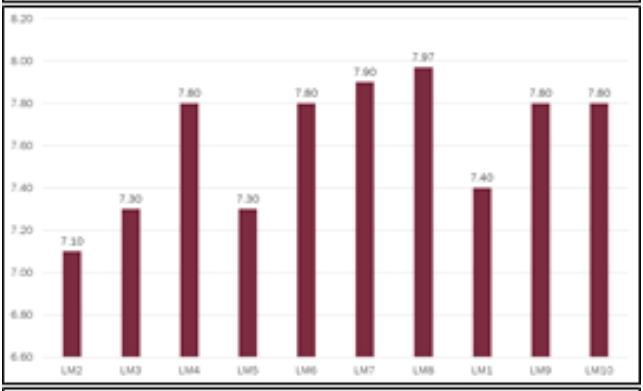
The water quality study was conducted in the Gerenai FMU during the expedition to determine the effect of post-logging activities on the surface of water quality. A total of 14 sampling stations were chosen based on accessibility and homogenous to obtain representative samples.



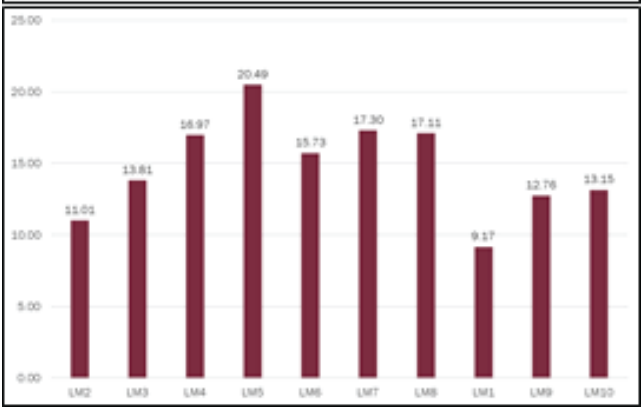
Logged-over forests in the present study were well-oxygenated with nearly natural pH values. Before the rainfall event, the water is quite clear. However, post-logging activities around the expedition study area have an impact on the water quality. Turbidity and suspended solids were higher at sampling stations with the presence of post-logging activities compared to the undisturbed sampling stations.



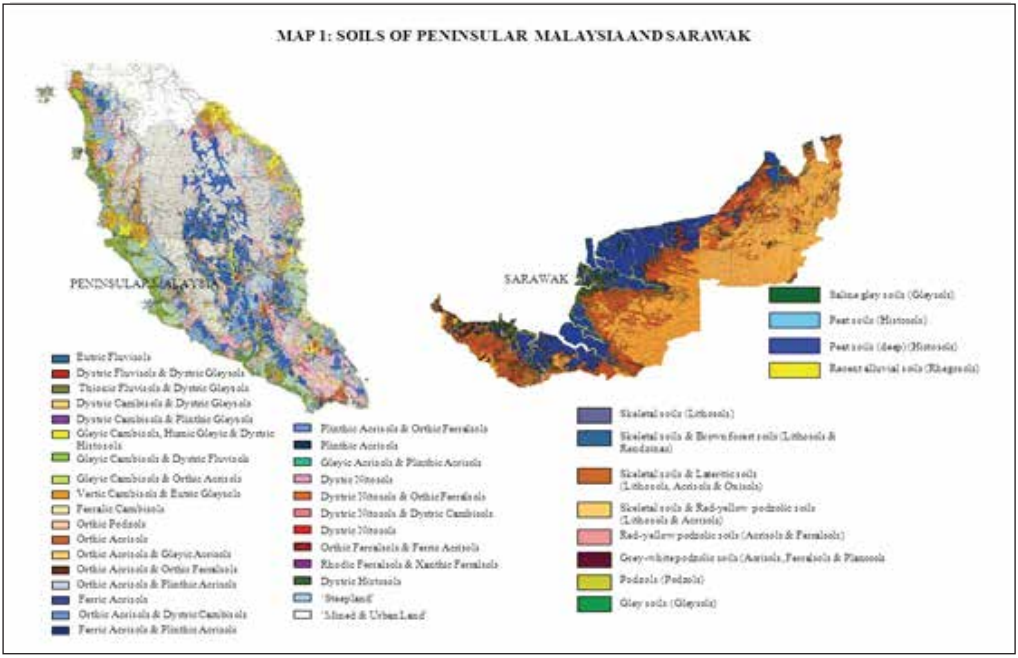
Ph



Dissolve oxygen (Mg/L)



TDS (Mg/L)



The dominant soil type at an expedition site is anticipated to provide some insight into the presence of vegetation or the endemism of particular plant species that are tolerant of the environment. Hence, along the route, characteristics of typical soils were noted to compare and, ultimately, classify the dominating soil into Sarawak's soil classification.

Four soil types in the Gerenai FMU areas

Alluvial

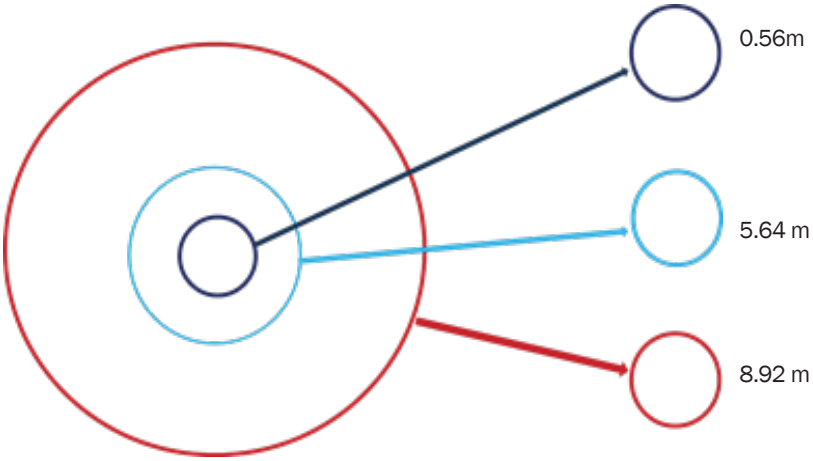
Red-yellow Podzolic

Skeletal

Podzol

CARBON STOCK STUDY

A preliminary study on the carbon stock in the Gerenai–Long Mekaba was also conducted during the expedition. The findings will be presented during the HoB Seminar.



Circular Plot design – to analyse the carbon stock

Plot: 0.56m

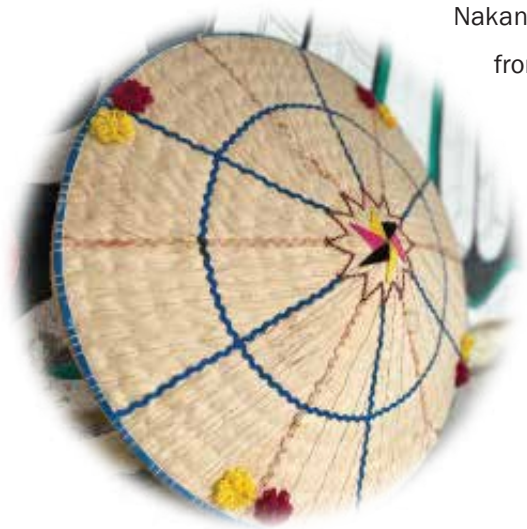
Establishing 100 m^2 plot

Collecting leaf litters

Measuring dead tree

SOCIAL STUDY – LONG JEKITAN

Long Jekitan is a rural settlement within the vast Baram District in the Miri division. The people there are predominantly Penan. The long house consists of 162 doors with about 800 populations. About 34% of the population was surveyed for this study. The majority of the respondents were aware of the existence of Tapang-Baiong PF (95.7%) and Usun Apau NP (67%), but only 41% knew about Nakan-Kalulong FR. Most of them are harvested from the NFTPs for their use.



THE CHALLENGES

Sarawak's HoB scientific expeditions are synonymous with extreme challenges. Apart from slippery steep slopes and heavy water currents of rocky streams, the weather sometimes made it more difficult. But all those obstacles make Sarawak's HoB expeditions unique and special.

THE WAYS FORWARD

The Gerenai-Long Mekaba area is very rich in flora and fauna and should be considered among the richest forests in the HoB Initiative Project Areas. The State Government of Sarawak (via FDS) has taken the right step to pledge inclusive documentation of Gerenai-Long Mekaba for further contemplation. However, more such studies and research need to be conducted in Gerenai-Long Mekaba, as the expedition only covered a small portion of the area. It is believed that more exciting biodiversity gems will be unveiled from the Gerenai-Long Mekaba area.

THE CLOSING

The Gerenai – Long Mekaba Scientific Expedition 2022 was officially closed on 24th September 2022 by the Deputy Director of Forests, Mr Jack Liam.

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ABBREVIATIONS

FDS	- Forest Department Sarawak
FMU	- Forest Management Unit
FR	- Forest Reserve
FRIM	- Forest Research Institute Malaysia
HMDF	- Hill mixed dipterocarp forest
HoB	- Heart of Borneo
NP	- National Park
NTFP	- Non-Timber Forest Product
PF	- Permanent Forest
SBC	- Sarawak Biodiversity Centre
UKM	- Universiti Kebangsaan Malaysia
UM	- Universiti Malaya
UNIMAS	- Universiti Malaysia Sarawak
UPM	- Universiti Putra Malaysia

ACKNOWLEDGEMENTS

Many people have made contributions to this Coffe Table book in various ways. First and foremost, we would like to extend our gratitude to the Ministry of Natural Resources and Environment Malaysia (MNRE) and the State Government of Sarawak for providing the fund under the Heart of Borneo (HoB) Initiative Project to enable us to publish this book on the Heart of Borneo Series. This book is mainly based on reports and field observations by contributors from the Gerenai-Long Mekaba Scientific Expedition 2022. Details of the scientific reports are available in a separate monograph of the Heart of Borneo Series.

We wish to record our appreciation to:-
Forest Department Sarawak (FDS), Forest Department Sabah, Forest Department of Brunei Darulssalam, Forest Research Institute Malaysia (FRIM), Sarawak Biodiversity Centre (SBC), Universiti Malaysia Sarawak (UNIMAS), Universiti Putra Malaysia (UPM) Bintulu Campus, Universiti Kebangsaan Malaysia (UKM) and Universiti Malaya (UM). Also to the local peoples of Long Menkaba.

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HEART OF
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ISBN 978-629-99294-5-1