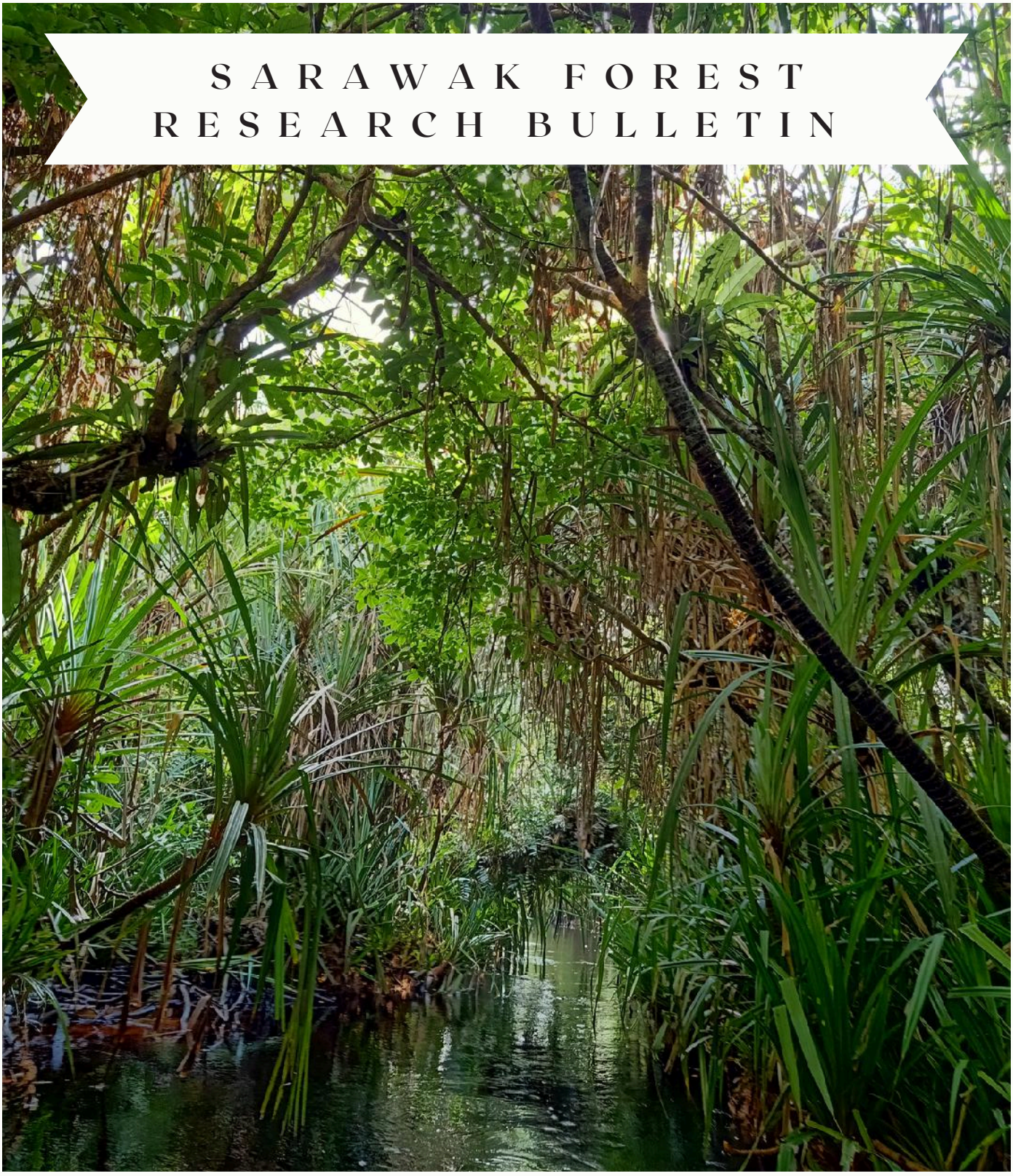
ISSUE 6| 2024

SARAWAKENSIS

SARAWAK FOREST
RESEARCH BULLETIN



Issue 6 | 2024

SARAWAKENSIS

Sarawak Forest Research Bulletin

ON THE COVER

"Entering the peat swamp forest of Jemoreng by boat, where the acidic waters create a unique brackish environment typical of freshwater swamps."

COMPILATION:
AURELIA DULCE CHUNG, NUR BAZILAH ISMAIL , AILEEN SIM KAI FANG, NOORHANA MOHD SAPAWI, NUR SAFINAS JELANI, SITI HANIM SAHARI, VILMA BODOS, SHARIFAH ROHAIDAH WAN ALAM, MOHD NAFRI ALI & EMPENIT EMPAWI

EDITING & DESIGN:
AURELIA DULCE CHUNG

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ISSUE 6

HIGHLIGHTS

HEAD OF DIVISION NOTE

"What we do today, echoes in the environment of tomorrow."

Greetings and welcome to the 6th issue of the Sarawakensis Bulletin. It is my pleasure as the new patron for this edition, which showcases the diverse and significant work undertaken by the Research and Development Division in 2023.

This issue features a total of 11 articles, each highlighting the diverse range of research and activities undertaken by our division. Various topics are covered including botany, ecology, fungi, termites, wood properties, water quality monitoring, carbon study and more. These contributions reflect the hard work and dedication of our researchers, whose efforts continue to advance both local and global environmental knowledge.

In addition to these articles, we have included a special highlights section featuring photos of key activities carried out over the year.

We hope that this issue offers readers a comprehensive overview of the work being done within our division and serves as both an informative and inspiring resource. Thank you for your ongoing support of Sarawakensis. We look forward to sharing more research and activities in the future.

Happy reading!

Runi Sylvester Pungga
Senior Assistant Director
Research and Development Division

Perkongsian Kajian Kualiti Air di Lapangan

Mohd Yusuf Abd Rahman, Nur Bazilah Ismail, Wellesly Jamu, Ohando Mupa

Pengenalan

- Hampir 97% punca bekalan air mentah adalah dari sungai hutan semulajadi dan hutan simpan kekal.
- Peranan hutan sebagai “regulator” dengan mengawal kadar aliran air permukaan. Data asas kualiti air sungai di hutan dapat digunakan dalam usaha pemeliharaan hutan.

Pemantauan kajian kualiti air dapat memastikan aktiviti pengurusan/pengusahasilan hutan tidak memberi impak kepada ekosistem hutan; terutamanya sumber air.

Parameter

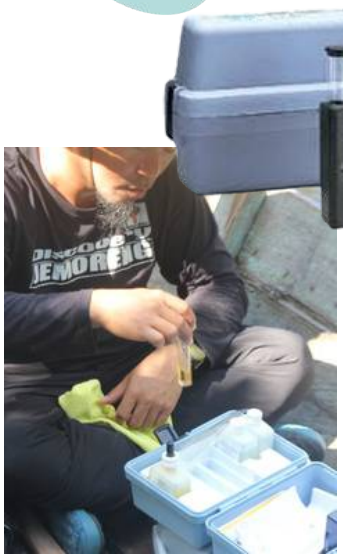
- pH Suhu Konduktiviti
- Kandungan oksigen terlarut
- Jumlah pepejal terlarut
- Jumlah pepejal terampai
- Kekeruhan *Biochemical*
- *oxygen demand Chemical*
- *oxygen demand*

Objektif Kajian Air

- Menilai status kualiti air sungai dalam hutan simpan kekal
- Mendapatkan data asas ciri fizikokimia air
- Memahami bagaimana aktiviti pengurusan hutan boleh mempengaruhi sumber air

Kaedah & Metodologi Kajian

- Pemilihan lokasi persampelan air
- Mencatat lokasi koordinat GPS dan pemerhatian persekitaran
- Membuat persampelan air
- Membuat pengukuran data *in-situ* di lapangan
- Membuat analisis air di makmal

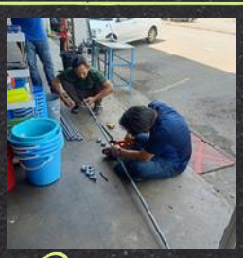


Projek Karbon

Ahmad Zaidi

01. Penyediaan

Membuat rangka pvc berukuran 1m x 1m untuk persampelan sarap daun



02. Sarap daun

Daun dan ranting kayu yang terletak dalam rangka segiempat ini akan dikumpul dan ditimbang. Sebahagian sarap ini akan dimasuk semula ke bag plastik dan dihantar ke makmal untuk proses pengeringan .

03. Pokok dirian

Biojisim pokok dikira dengan mengukur diameter pokok pada paras dada.

04. Pokok tumbang

Kayu mati/ pokok tumbang yang terletak pada transek akan diukur dan direkod diameternya

05. Semasa di makmal

Sarap daun yang dihantar ke makmal akan diasing mengikut kategori ranting dan daun. Selepas itu, ia akan dikering dalam oven untuk 3 hari.

Program Makmal

TERMITES OF ANAP MUPUT FMU

MOHAMAD NAFRI ALI, PAULUS MELENG, EMPENIT EMPAWI, MOHD YAZID HOSSMAN, WHILLANDER LAWRENCE & ALLEN PATTA ANDREW BUNDAK

Introduction

Termites are the significant soil fauna and among the most important organisms in the Mixed Dipterocarp Tropical Rain Forest especially for decomposition (Matsumoto and Abe 1979), to regenerate and promoting biodiversity by creating suitable condition for other biotas in an ecosystem (Korb, 2007). Termites live in colonies of up to several million individuals. The worker termites are about a few centimetres long with cream-colored and mostly without eyes. They use chemical forms of communication to perform their duties.

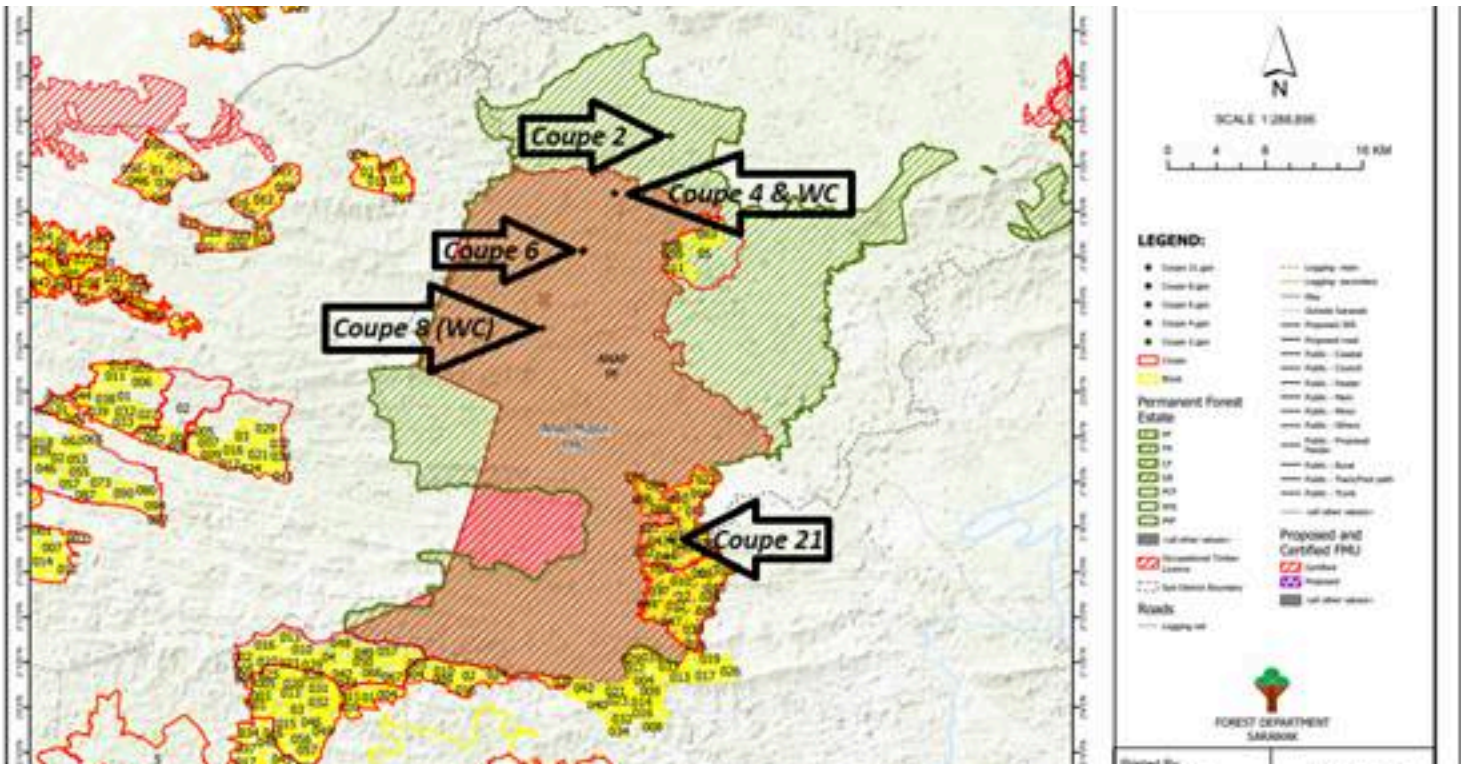
Anap-Muput FMU is located within the western catchment of the Anap River upstream from Bukit Kana and its tributary of the Muput River in Bintulu. Under Shin Yang Trading Sdn. Bhd. Timber Licience T/4317 consist of a landscape of around 29,055ha including state land and use land overlapping forest (LPF) and natural forest timber production area.

The policy direction by Sarawak Government on Forestry Management Certification that is mandatory to all timber licenses to manage the forest in a sustainable manner (RIL over conventional logging)

Objectives

1. To conduct a termite census dan survey in the selected logging area base on 'Block" and 'Coupe'.
2. The effect of logging on termite communities and diversity in FMU's in Sarawak, but for today's presentation I will focus on data from Anap Muput FMU
3. Get general data on species distribution and abundance in the different logging and non-logging area compare to primary forest

To get the relationship between termite assemblages and forest recovery after logging



Map of Anap Muput Forest Management Unit

Methodology

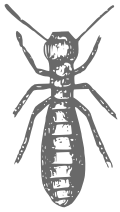
A standardized Belt-Transect Design protocol were set in selected area within Anap-Muput FMU measuring (100m x 2m) and divided into 20 contiguous section (each 2m x 5m) as described by Eggleton et.al. and Davies. Each section was sampled for 30 minutes. During the study we managed to cover Coupe 2, Coupe 4, Coupe 6, Coupe 8, Coupe 21 and Coupe 4 (water catchment) in which the sampling was done randomly.
Presence of termites were observed in soil, mounds, nests, gallery, leaf litter, dead or rotten woods, branches and tree stumps. All samples collected (soldiers and workers) were put in plastic tubes containing 80% ethanol. Alates were also collected for future taxonomic studies. They were then sorted further to eliminate dirts and preserved in vials with 99.5% ethanol.

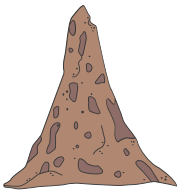
A

C

B

D



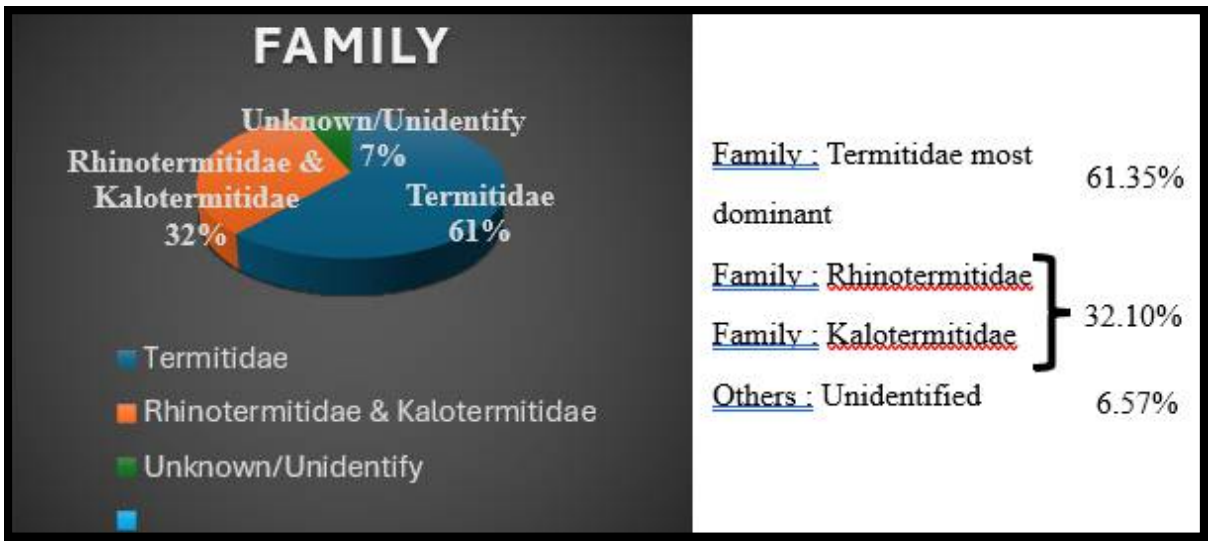


Identification and References

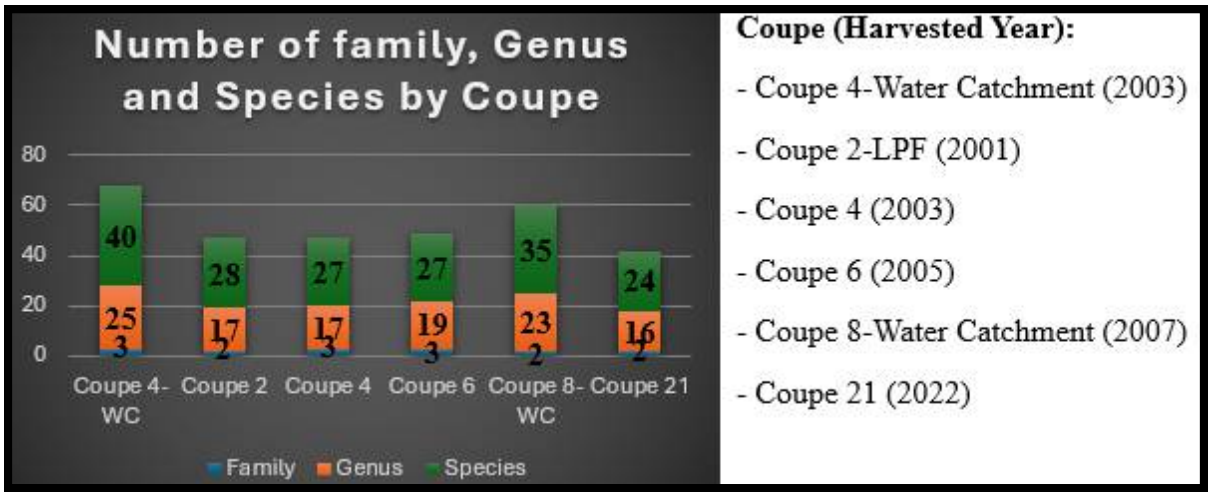
Termites soldier were identified based on morphology base on external characters, structure of head, mandible, body coloration and length of antennae. Amongst the reference used were:

- Taxanomic works of :
1. Thapa (1981),
2. Ahmad and Akhtar (1981),
3. Tho (1982, 1992)
4. Gathorne-Hardy (2001)
5. Krishna et al (2013)

Results



Graph 1: Accumulative Termite Pie Chart



Graph 2: Termites species / Coupe Comparison Bar Chart

Discussion & Conclusion

Only 3 field-trip were able to be conducted and the results can be used as the baseline data and reference for future survey however, more area should be covered to collect more species with more extensive sampling in order to get a better representation of the entire termites composition of this area. Most of the termites collected feed on soils, litter and woody decomposed materials (fallen trunks, branches, leaves lying on the ground surface). These species are important in the decomposition of plant material and regeneration on soils and lands in natural landscapes

FAMILY	SUB-FAMILY	GENUS	SPECIES
Termitidae	Termitinae	*Procapritermes*	*setiger*
		Procapritermes	*otypus*
		Pericapritermes	*latignathus*
		Pericapritermes	*semarangi*
		Bulbitermes	*flavicans*
		Bulbitermes	*borneensis*
		Bulbitermes	*sarawakensis*
		Amitermes	*dentatus*
		Globitermes	*globosus*
		Termes	*comis*
		Termes	*laticornis?*
		Termes	*rostratus?*
		Homallotermes	*eleanorae*
		Dicuspiditermes	*nemerosus*
		Dicuspiditermes	*santschi*
		Longipeditermes	*longipes*
	Macrotermitinae	*Macrotermes*	*gilvus*
		Macrotermes	*malaccensis*
		Prohamitermes	*mirabilis*
		Odontotermes	*minutus*
		Odontotermes	*prodives*
		Odontotermes	*sarawakensis*
		Microcerotermes	*serratus*
		Microcerotermes	*sabahensis*
FAMILY	SUB-FAMILY	GENUS	SPECIES
Termitidae	Nasutermitinae	*Nasutitermes*	*atripennis*
		Nasutitermes	*longinasoides*
		Nasutitermes	*longinasus*
		Nasutitermes	*neoparvus*
		Nasutitermes	*triangularis*
		Nasutitermes	*longirostris?*
		Hospitalitermes	*bicolor*
		Hospitalitermes	*hospitalis*
		Bulbitermes	*borneensis*
		Hirtitermes	*hirtiventris*
		Subulitermes – genus group	
Kalotermitidae		*Glyptotermes*	*sp.*
Rhinotermitidae		*Parrhinotermes*	*aequalis*
		Parrhinotermes	*propinquus*
		Parrhinotermes	*pygmaeus*
		Parrhinotermes	*microdentiformis*
		Schedorhinotermes	*brevilatus*
		Schedorhinotermes	*malaccensis*
		Schedorhinotermes	*medioobscurus*
		Coptotermes	*curvignathus*
		Coptotermes	*travians*
		Heterotermes	*tenuior*
		Termitogeton	*planus*
Termitidae	Termitinae	*Labritermes?*	*sp.*

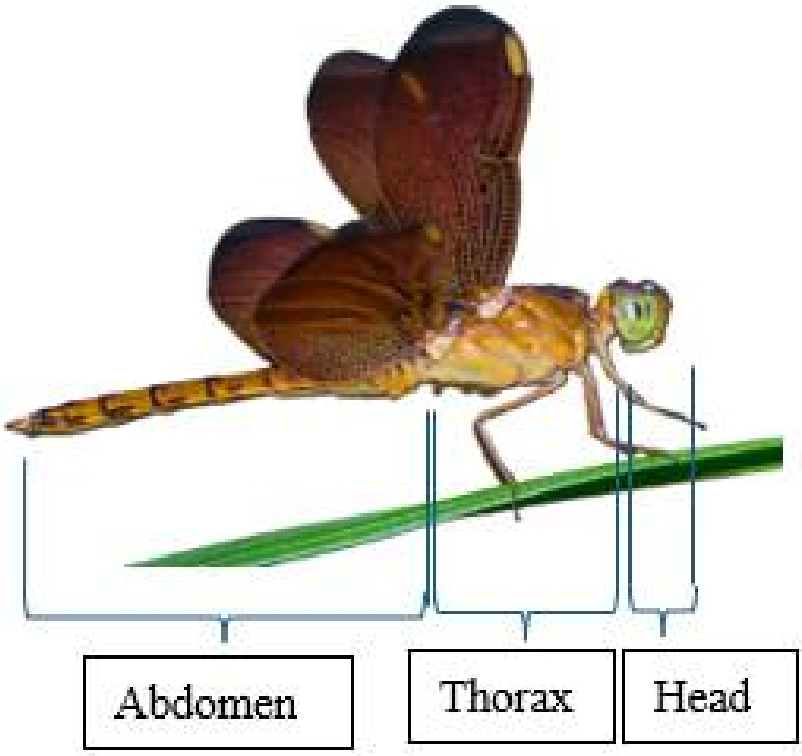
Table: Checklist of termites species collected

ODONATA OF SARAWAK

Empenit Empawi, Paulus Meleng, Mohamad Nafri Ali,
Mohd Yazid Hossman, Whillander Lawrence & Allen Patta Andrew Bundak

Introduction

Odonata are large insects with a very strongly toothed mandible, uniquely designed for capturing prey. Odonata have chewing mouthparts and very short antennae. Adults possess four long, many-veined wings of approximately equal size. They are extremely fast fliers and have large prominent eyes offering 360-degree vision.



DIVIDED INTO THREE MAIN SUBORDER:

1. Anisoptera [Dragonflies]

Dragonflies are larger than damselflies and hold their wings horizontally, like an airplane, when at rest

Anisoptera: *Libellulidae Neurothemis fluctuans*
Photo by: Whillander Lawrence

2. Zygoptera [Damselflies]

Damselflies either tilt up their wings, like butterflies, or hold them next to their abdomens when at rest.

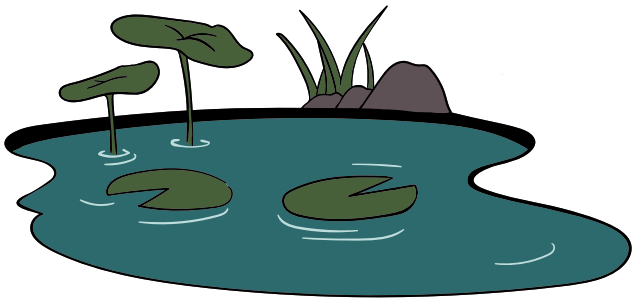
Zygoptera: *Megapodagrionidae Podolestes orientalis*
Photo by: Whillander Lawrence

3. Anisozygoptera.

In between of Anisoptera (Dragonflies) and Zygoptera Damselflies) suborders.
Smallest of the three suborders of dragonflies, comprising insects which are superficially similar to the Anisoptera, but whose wings have narrow bases (a feature of Zygoptera). The larvae also show features possessed by both the other suborders.

HABITAT

The nymphs of Odonata are found in water, and adults usually are nearby. Both the adults and nymphs feed on other insects. Sometimes the nymphs also feed on small fish. Different species of Odonata are active at different kind of water such as pond, riparian, clear stream and river area.



Why Odonata?

The removal of riparian vegetation by human activities such as logging activities can increase fine sediment inputs into the streams. The nymph phase of odonatan living in water and can act as a bio-indicator of water quality and environmental monitoring. Both the adults and nymphs feed on other insects. Known as mosquito hawks, adult odonata prey on so many mosquitoes, sandflies and flies, which humans consider pests. Meanwhile, nymphs feed on mosquito larvae in water. They are beautiful and unique which can attract tourist. They also as source of inspiration.

Insectarium Research and Development Division (RDD)

Currently RDD Insectarium house over 426 of Odonata specimens which can be divided into: 2 Sub-Order, 12 Families, 46 Genus and 72 Species.
The specimen was collected from various location in Sarawak since 1981. Currently the specimens are recorded and re-arranged according on collected date and locality.

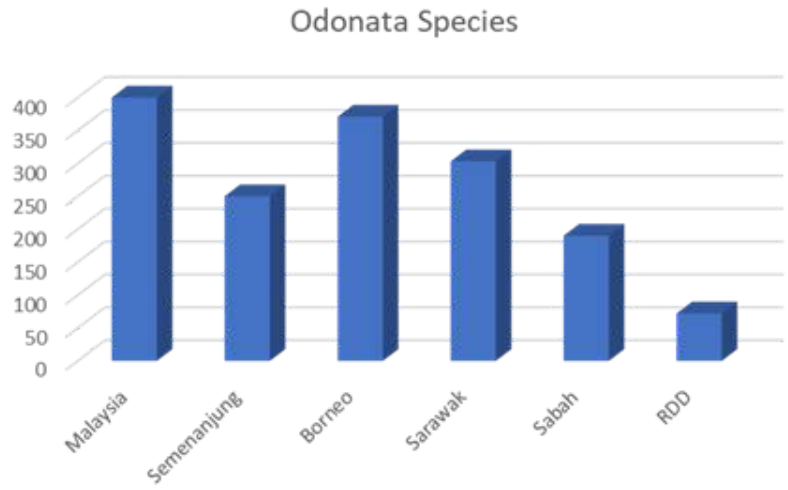
Processing of Odonata Specimens

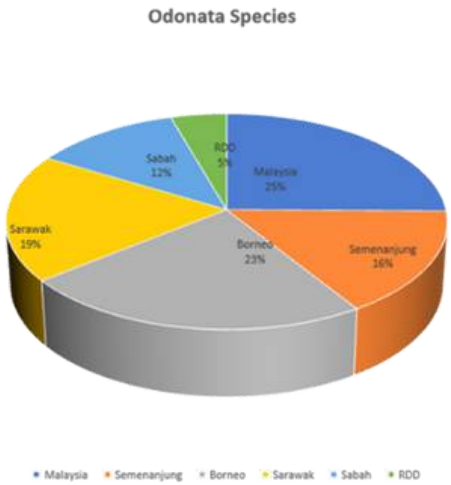
Most of the specimens were collected by general collection by using conventional insect net. Specimens were kept inside killing jar filled with Ethyl acetate as a killing agent. Specimens were pinned and dried under the sun for a few days. Some were put in triangular paper, kept inside the airtight container with silica gel. Taxonomy works were done by the Odonata specialists, and some are identified by the Entomology officer. All specimens were kept in RDD Insect Reference Collection (Insectarium).

Records of Odonata

According to Choong et al. (2018), ~6000 species throughout the world. Malaysia: nearly 400 species of Odonata from 17 families were found. At least 180 species are dragonflies, and 210 species are damselflies. Peninsular Malaysia recorded more than 250 species while Borneo has at least 371 species. Sabah has recorded at least 190 species (Sabah Forestry Department, 2023). The first checklist of the Odonata (dragonflies and damselflies) of Sarawak was reported in Sarawak Museum Journal 81(101 special issue 10):313–422) where 303 species were recorded. So far, RDD Insectarium has recorded 12 families, 46 genus and 72 species of Odonata form al over Sarawak.

Distribution of Odonata According to Region





Discussion

Most of the specimens at RDD were collected from ITTO project in 1998 [Batang Ai & Lanjak Entimau] and Scientific Expedition 2022 [Jemoreng & Long Mekaba]. The number of species recorded for RDD was high [12 Family: 72 species] although sampling was limited. This were mainly because of limited type of aquatic habitat in the survey locations, less intensive survey for insect from order Odonata, more focus on termite survey during the expedition or field trip. We believe that many more common species have yet to be recorded for RDD.

Future Plan

- To develop a good Odonata reference collection for RDD.
- Odonata survey to support the implementation of Reduce Impact Logging [RIL] for Stream Buffer Reserve [SBR] in FMU area throughout Sarawak.
- Collaborate with Timber Licence to conduct Odonata surveillance inside SBR area at FMU throughout Sarawak.
- Secure budget to carry out field trip for intensive survey specifically for Odonata.

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The Wild Fungi of Sungai Selai Inah, Jemoreng Forest, Matu, Sarawak

Noorhana, M.S., Shirley, C., Sharifah Rohaidah, W.A., Abduk Ghani, Y., Abu Serah, A. & Junes, B

Macrofungi

The macrofungi or commonly known as mushroom is a group of saprophytic fungi that have large fruiting bodies which are visible to naked eyes, and responsible as forest litter decomposer. There is a great number and variations of wild fungi found in Jemoreng Forest. The variation in size, colour, texture, and shape are the obvious characters and important in identifying fungi.

a. *Stereum* sp.
b. *Microporus xanthopus*
c. *Xylaria polymorpha*
d. *Scleroderma* sp.
e. *Amanita* sp.
f. *Polyporus* sp.
g. *Ganoderma australe*
h. *Phellinus* sp.
i. *Gymnopilus* sp.
j. *Coriolus* sp.

Edible Fungi

Edible mushroom usually has certain aroma and flavour as well as good nutritional properties. In Jemoreng Forest, there are three record of edible fungi species. However, proper identification is important since quite often poisonous mushrooms resemble the edible ones in appearance.

a. *Lentinus sajor-caju*
b. *Auricularia auricula-judae*
c. *Schizophyllum commune*

Bioluminescent Fungi

A species of glow-in-the-dark fungi was found in Jemoreng Forest. All parts of this unique fungi glow at night in a greeny colour.

a. *Filoboletus manipularis*
b. Glow in a greeny colour at night or in dark surrounding.

Zombie Fungi

Cordyceps Fungi, also known as “Zombie Fungi” is a kind of parasitic fungi. Each species of cordyceps targets a specific insect only. Besides ants, other insects that can be infected by cordyceps are spiders, moths, and dragonflies.

Various spcies of zombie fungi (Cordycipitaceae) recorded in Jemoreng Forest, infected various type of insects/small animals.

TREE SPECIES DIVERSITY AND ADAPTATIONS IN JEMORENG

Aurelia Chung, Mohd Iskandar bin Sulong, Army Kapi, Stephen Gadoh anak Unting, Andrew Sures & Jerry Nunong Entinggi

INTRODUCTION

Jemoreng, situated within the Matu district of Mukah division, is covered by peat swamp forests, a unique ecosystem often found along the coastal hinterlands and extending inland along major river systems. These forests are not just a home for unique species; they also serve as a critical habitat for countless others. While peat swamp forests are often associated with low biodiversity, however within their boundaries, one can discover endemic, rare, and highly specialized flora and fauna. These remarkable adaptations allow species to thrive in the challenging peat swamp environment, showcasing the resilience and adaptability of nature.

Specialized aerial roots in certain types of plants, that help the plant obtain oxygen in waterlogged or muddy environments.

Peat swamp forest has low flora biodiversity and most of the trees are pole sized.

TREE SPECIES IN JEMORENG

Gonystylus maingayi (Ramin batu air)
Near Threatened (IUCN Red List)

Koompasia malaccensis (Menggris) Protected Species (Wild Life Protection Ordinance 1998)

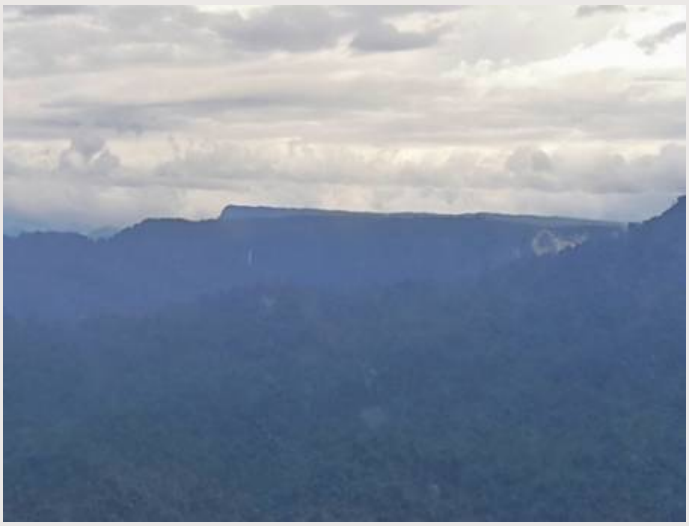
Madhuca motleyana (Sekiu). Protected Tree Species under (Wild Life Protection Ordinance 1998)

Dryobalanops rappa (Kapur paya)

Blumeodendron sp. (Empungan Ib)/Kelen (Mel)

VEGETASI DAN FLORA DI SG JULAN, EASTERN TABLELAND, TAMAN NEGARA USUN APAU

Oleh Yazid Kalbi



Dataran Tinggi Usun Apau

Taman Negara Usun Apau (TNUA) adalah dataran tinggi yang terbentuk daripada gunung berapi yang tidak aktif sejak berjuta tahun yang lalu. Dengan keluasan kira-kira 1,550 km persegi dan purata 1,000-meter ketinggian dari aras laut, TNUA merupakan antara dataran tinggi yang jarang diterokai oleh manusia. Dataran tinggi Usun Apau ini terdiri daripada tiga puncak utama, iaitu Selidang (1,370 meter), Kenawang (1,280 meter) dan Mabun (1,280 meter), dimana sebelah utara, timur dan barat merupakan cerun dengan ketinggian melebihi sehingga 300 meter. Terdapat tiga buah sungai yang mengalir disebelah utara yang membentuk Air Terjun Julan dengan anggaran ketinggian melebihi 245 meter.

Pemandangan udara Hutan Separa Gunung

Vegetasi di atas dataran tinggi TNUA ini adalah jenis hutan pergunungan rendah dengan sulam sedikit hutan kerangas dan kerapa. Keadaan tanah yang tidak subur dan aliran air yang tidak begitu baik menjadikan kebanyakan tumbuhan di kawasan ini terbantut, dimana kebanyakan pokok adalah bersaiz kecil dengan batang yang berpilin. Antara spesies pokok yang dominan di kawasan dataran tinggi ini adalah Bindang (*Agathis*), Sempilor (*Dacrydium*) dan Rhu Bukit (*Gymnostoma nobile*). Selain itu, spesies pokok daripada famili Fagaceae, Elaeocarpaceae, Sapotaceae, Clusiaceae dan Melastomataceae serta beberapa spesies dipterokarpa (Dipterocarpaceae) seperti *Shorea* dan *Anisoptera* juga turut ditemui di kawasan dataran tinggi ini. Vegetasi di kawasan tebing atau cerun dataran tinggi TNUA ini adalah dikelaskan sebagai jenis separa pergunungan. Setakat ini tidak banyak maklumat penyelidikan tumbuhan yang dikongsi kerana tidak ada kajian yang pernah dijalankan disebabkan faktor persekitaran cerun yang curam.

Dirian hutan separa gunung

Dataran tinggi TNUA ini mempunyai kelembapan yang tinggi dimana kebanyakan pokok dan kawasan lantai hutan diliputi dengan kepelbagaian spesies lumut, tumbuhan memanjat dan epifit di batang dan dahan pokok. Tumbuhan pemanjat yang unik seperti periuk kera (*Nepenthes*) membri indikasi kepada keadaan tanah yang tidak subur di kawasan dataran tinggi ini. Selain itu juga, kumpulan pandan (*Freycinetia* dan *Pandanus*), anggerik tanah (*Calanthe*) dan Bakong (*Hanguana*) mendominasi di sesetengah kawasan lantai hutan. Kumpulan halia hutan juga menarik kerana kebanyakan spesies halia hutan yang dijumpai di dataran tinggi TNUA ini merupakan spesies yang endemik di Borneo. Di antara spesies halia endemik yang dijumpai adalah *Burbidgea schizocheila*, *Globba muluensis*, *Hedychium borneense* dan *Alpinia*. Spesies anggerik yang tumbuh dengan subur di antara spesies lumut di dahan dan batang pokok adalah seperti *Bulbophyllum* dan *Dendrobium*. *Dendrobium cinnabarinum* adalah spesies anggerik di tanah tinggi yang boleh dijumpai di kawasan hutan batu kapur dan merupakan endemik di kepulauan Borneo juga turut direkodkan di kawasan dataran tinggi TNUA.

Batang pokok yang dilitupi lumut

Sungai Julan

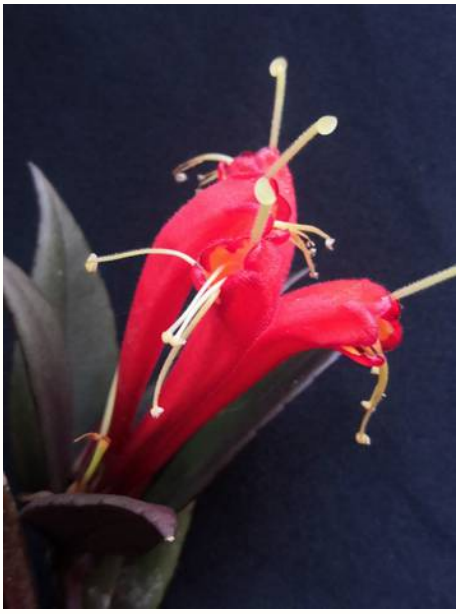
Base Camp di Usun Apau

TNUA merupakan antara lokasi yang sangat menarik di Sarawak namun maklumat berkenaan data tumbuhan di kawasan ini amat rendah dan terhad. Faktor persekitaran seperti tebingan curam di dataran tinggi Usun Apau merupakan salah satu faktor bagi kesukaran kawasan ini diterokai. Selain itu juga, tiada akses melalui jalan darat mahupun jalan pembalakan yang boleh menghubungkan kawasan tersebut dengan kawasan tanah rendah disekitarnya. Dataran tinggi Usun Apau ini sangat menarik bagi kajian tumbuhan kerana dirian hutan yang unik dan spesies tumbuhan yang menarik berdasarkan hasil pemerhatian yang telah dijalankan di lapangan. Tambahan pula, data yang terhad berkaitan dengan dokumentasi spesimen tumbuhan di dataran tinggi ini akan memungkinkan adanya penemuan baharu spesies tumbuhan yang akan menyumbang dalam senarai semak kepelbagaian flora di Sarawak.

Penghargaan kepada:

·Dr Meekiong Kalu (Fakulti Sains dan Teknologi Sumber, Universiti Malaysia Sarawak) untuk komen dan suntingan botani
·Dr Affendi Suhaili dan Kakitangan (Bahagian Teknologi Hutan dan Geospatial, Jabatan Hutan Sarawak) di atas jemputan dan penyediaan logistik kerjalapangan di Usun Apau
·Nur Safinas Jelani (Bahagian Penyelidikan dan Pembangunan, Jabatan Hutan Sarawak) bagi suntingan penulisan artikel
·Awang Ismail Awang Haron (Bahagian Penyelidikan dan Pembangunan, Jabatan Hutan Sarawak) dalam membantu semasa kerjalapangan dijalankan.

Burbidgea schizocheila Hackett



Gincu Monyet (*Aeschynanthus*)

Pokok *Agathis* dan *Pandanus* di batang pokok

Buah *Shorea* (Dipterocarpaceae)

Pelbagai warna dan bentuk spesies Gincu Monyet

Bulbophyllum cf. uniflorum

Dendrobium cinnabarinum (Orchidaceae)

Pasukan yang terlibat dalam kerja lapangan di Usun Apau

Penilaian Serpihan Kayu di Sungai Terpilih di dalam Hutan Simpan Kekal Sarawak

Relin Jim, Vilma Bodos, Lihos Ligo, Albert Danny Francis, Abdul Rani Bolhari & Bolhan Deli

PENGENALAN

Hutan Simpan Kekal meliputi 30% keluasan seluruh Sarawak. Zon pemampan sungai (RBZ – *river buffer zone)* adalah satu kawasan untuk pengurusan dan perlindungan dilaksanakan bagi mewujudkan jarak untuk memisahkan antara kawasan industri, pembalakan, perumahan atau ladang dari kawasan sungai. RBZ merupakan hutan di sepanjang sungai yang memainkan peranan penting bagi mengekalkan kesihatan ekosistem sungai dan air. RBZ adalah keperluan dan salah satu syarat yang perlu dipatuhi oleh pengurus hutan untuk mendapatkan pensijilan hutan bagi satu kawasan lesen pembalakan. Satu kajian mengenai serpihan kayu kayan di dalam sungai telah dijalankan di Kawasan hutan simpan kekal.

OBJEKTIF

1.Untuk menilai keadaan zon penampan yang sedia ada di hutan simpan kekal

2. Untuk mengetahui jumlah sisa kayu kasar di sungai-sungai dalam hutan simpan kekal

3. Untuk membuat perbandingan keberkesanan lebar zon pemampan sungai yang berlainan untuk mengurangkan kesan-kesan pembalakan

KAEDAH

1. Pembinaan garisan transek

- Panjang garisan transek – 1 km (lebar berdasarkan lebar sungai yang dikaji i.e., 20m, 25m, 30m, 50m) Titik permulaan dan tamat
- transek ditanda dan koordinat GPS dicatat. Setiap jarak 20 m disukat, ditanda dengan
- flagging dan jarak ditulis pada label flagging. Terdapat 100 kuadrat untuk penilaian CWD.
- Keadaan sungai, lebar sungai dan maklumat lain
- juga direkod.

2. Penilaian garisan transek

- Hanya kayu atau buluh yang mempunyai panjang ≥ 1m sahaja yang diukur. Setiap data yang
- diambil direkod dalam borang data lapangan. Parameter yang diambil:

i. Pengelasan CWD
ii. Diameter CWD
iii. Panjang CWD
iv. Kedudukan CWD di sungai
v. Proses CWD (semulajadi atau
vi. *man-made*)
vii. Arah alur sungai
Kecerunan alur sungai




PENEMUAN

Rekod yang diperoleh menunjukkan lebar zon pemampan sungai tidak memberikan pengaruh yang besar terhadap jumlah serpihan kayu (CWD). Keputusan yang diperoleh adalah tidak sama dengan jangkaan bahawa lebih besar zon pemampan akan memberikan jumlah CWD yang lebih sedikit (Jadual 1).

Jadual 1: Ringkasan rekod CWD untuk sungai-sungai yang dikaji

Lokaliti	Nama Sungai	Pengelasan hutan	Saiz Zon Pemampan	Jumlah CWD
Gunong Pueh FR	Sg. Sebat	Tiada pembalakan	T erlindung	388
Raplex FMU	Sg. Lily	Ada pembalakan	20 m	347
	Sg. Mia	Ada pembalakan	25 m	139
	Sg. Lemai	Ada pembalakan	30 m	1,963
AnapMuput FMU	Sg. Kebalang	Ada pembalakan	30 m	630
	Sg. Ayam	Ada pembalakan	50 m	1,164

CABARAN DAN KEKANGAN

- Merupakan kajian yang jarang dijalankan di Sarawak.
- Sentiasa basah.
- Lebih sukar sekiranya sungai adalah besar, dalam dan mungkin mempunyai buaya.
- Penilaian garisan transek tidak dapat dijalankan sekiranya hari hujan kerana;
    1. Paras air sungai tinggi dan deras – faktor keselamatan
    2. Air sungai keruh – kebarangkalian CWD tidak disukat adalah tinggi kerana terlepas pandang
- Longgokan CWD yang terlampau banyak – memakan masa yang lama dengan kurangnya kapasiti kakitangan ke lapangan

KESIMPULAN

Keadaan zon penampan yang sedia ada di hutan simpan kekal telah dinilai bedasarkan kajian dari penilaian CWD sebagai salah satu penunjuk untuk kesihatan ekosistem sungai. Jumlah sisa kayu kasar di sungai-sungai tertentu dalam hutan simpan kekal telah ditentukan. Faktor lain yang menyebabkan jumlah CWD yg tinggi di kawasan sungai yang mempunyai saiz zon pemampan yang lebar perlu dikaji dgn lebih teliti.

Conservation Efforts on *Agathis* species in Ravenscourt Forest Management Unit (FMU), Lawas and Gerenai FMU, Ulu Baram

By Vilma Bodos, Relin Jim, Ophelia Eda Treang, Jawi Malih and Wilfred Sedau

INTRODUCTION

Agathis species locally known as Bindang and globally known as Kauri are from the Araucariaceae family.Several trips have been carried out to look for the species group at Ravescourt FMU and Gerenai FMU with two main objectives;
(1) To verify and identify occurrences of Bindang species and (2) To assess the Bindang population in the FMUs.

The FMUs recognized and listed *Agathis* species as threatened, and some populations of the tree are in their conservation area.

APPROACH

Ravenscourt FMU and Gerenai FMU had allocated some areas with *Agathis* as their protected area and demarcated them as high conservation value areas (HCVA). Trees in HCVA are to be protected and some species of concern that are tagged are to be monitored. The FMUs have established plots for Bindang tree assessment and monitoring. The plot size is 240min length with 20m width (0.48 ha size). Establishment of plots for the FMUs are with details as follows;

FMU	Num. of pl ot s	Assessment year
Ravenscourt	3	2022
Gerenai	1	2022

Only trees with a diameter at breast height (DBH) ≥ 10cm were enumerated and tagged. Leaf specimens were collected for further identificationattheSarawakHerbarium.

AGATHIS PLOT ASSESSMENT

Species of *Agathis*

Two species of Agathis were identified in the FMUs: *Agathis borneensis* (Ravenscourt & Gerenai FMU) and *Agathis lenticula* (Ravenscourt FMU). *A. borneensis* is more common than *A.lenticulata*.

Agathis Distribution in the FMUs

Enumeration of the Bindang for both sites revealed that Gerenai FMU has a higher stand density of *Agathis* (Table 1). However, the volume and basal area of Bindang population in Ravenscourt gives a higher reading. Ravenscourt recorded most stands with 84% in diameter classes from 30-50 cm DBH while Gerenai recorded most stands with 78% from 10-30 cm DBH. This shows that Ravenscourt consists of higher large size Bindang trees as compared to Gerenai FMU. No record trees with DBH 10-20 cm DBH were found in Ravenscourt indicating that the diameter class distribution of their Bindang is not in reversed-J curve pattern.

Table 1: The FMUs tree density, basal area, and volume

	Ravenscourt	Gerenai
Stand density (trees per hectare)	15	19
Basal area (m2 per hectare)	2.76	2.27
Volume (m3 per hectare)	28.37	23.16

Left photo: Bindang plot signboard in Gerenai FMU
Right photo: Habitat of Bindang population in Ravenscourt FMU

GLOBAL DISTRIBUTION OF SARAWAK *AGATHIS*

Agathis has economic importance, as the wood is highly valued for its fine grain, making it useful for furniture, veneer, and other high-quality timber products (Whitmore, 1980). The tree is also valued for its medicinal properties and domestic use by local communities based on traditional knowledge (Adam *et al.*, 2017). All *Agathis* species in Sarawak are under the threatened category in the IUCN Red List of Threatened Species (Table 2). Three Sarawak *Agathis* are endemic to Borneo and are not commonly found within its distribution.

The branching of *Agathis*

Table 2: Agathis species global conservation status and the distribution

Species	Conservation Status in IUCN Red List	Global Distribution	Distribution in Sarawak
Agathis borneensis	Endangered A4cd	Sumatra, Peninsular Malaysia and Borneo	Lundu, Kuching, Mukah, Song, Marudi, Tatau, Belaga, Miri, and Lawas
Agathis kinabaluensis	Endangered B1ab(ii,iii,v)+2ab(ii,iii,v)	Borneo	Mount Murud
Agathis lenticula	Vulnerable B1ab(ii,iii,v)-2ab(ii,iii,v)	Borneo	Mount Murudand Lawas
Agathis orbicula	Endangered B2ab(ii,iii,v)	Borneo	Usun Apau

CONSERVATION EFFORTS

In Sarawak, the *Agathis* species is not listed in the Wildlife Protection Ordinance. All *Agathis* species of Sarawak are categorized as threatened in global assessment, therefore actions in managing *Agathis* to ensure its population sustainability are crucial. The population within the Totally Protected Area is safe, but the population at other localities is susceptible to forest degradation. As aware of this scenario, Ravenscourt and Gerenai FMU had taken the initiative to conserve some of the *Agathis* populations in their management area and demarcated them as HCVA. Plots were also established by the FMUs for monitoring and to carry out a detailed study of the *Agathis* species.

CONCLUSION

Conservation efforts of *Agathis* are increasingly important due to habitat loss and forest degradation overthe years.*Agathis* trees are partofSarawak's unique biodiversity and play anessential roleinthelocal ecosystems.Continuousresearchinto the ecology, distribution, and population dynamics of *Agathis* species by Ravenscourt and Gerenai FMU could help inform further conservation strategies for the state.

A straight trunk of *Agathis borneensis*

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• Whitmore, T. C. (1980). Utilization, Potential, and Conservation of *Agathis,* a Genus of Tropical Asian Conifers. Economic Botany, 34(1), 1–12. http://www.jstor.org/stable/4254132

Special Features of Wood Identification

By: Siti Hanim Binti Sahari, Teng Xin Yao, Nungah Liang, Mohd. Zainuddin Bin Mohd. Kameri & Melvin Brown

Timber identification is not an easy task to master, it will take a lot of patience to study and experience to become a reasonably expert at identifying commercial species available

This article provides relevant methods of timber identification and highlights the main characteristic features used for timber identification as well as different classes of timber belonging to specific species group.

Methods of timber identification

- Macroscopic - using no optical aid, by looking at characteristics include colour, lustre, odour, taste, texture, grain, figure, weight, and hardness of wood
- Low magnification – using hand lens (10X or 20X) or magnifier
- Higher magnification – using microscope

These are the main characteristic features that are used for timber identification:
a)Vessels or pores:
The size and arrangement of pores or vessels can often be a helpful guide. The pores are crowded or abundant in timber with small pores and sparsely distributed in timber with large pores. In some timber the pores are solitary or almost exclusively solitary. In others, the pores patterns are dominated by radial chains or multiples of three or more and in some species the pores are arranged in oblique.
b)Wood parenchyma or soft tissue- its sizes, what type, arrangement, colour.
c)Rays or Ray Parenchyma- Apotracheal & Paratracheal; its formation; present/absent
d)Other features- which may be present in some woods and are thus important in the identification:
(i) Included Phloem: eg. as in Tapang, Menggris & Gaharu- in form of Island
(ii) Latex traces canals: present in Jelutong & Pelai,
(iii) Intercellular canals:
(a) Vertical canals: as in Selangan batu & Red Meranti
(b) Horizontal canals: as in Terentang, Light Red Meranti or Rengas
(iv) Oil canals: as in Sepetir
(v) Ripple marks: as in Keranji

Equipment Required for Identification

X10 Hand Lens

NT Cutter

Notebook

Pen/Pencil

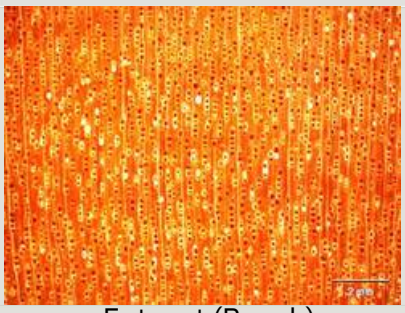
7 Timber Groups

Based on its common characteristics, Sarawak timbers can be divided into seven (7) groups. These 7 timber groups are:

I. Chain Porous Group
II. Parenchyma surrounding the pores (Vasicentric)
III. Wood Parenchyma – Apotracheal
IV. Wood Parenchyma short strands between the rays
V. Wood Parenchyma diffused or indistinct
VI. Resin Canals Group
VII. Softwood (wood without vessels or pores)

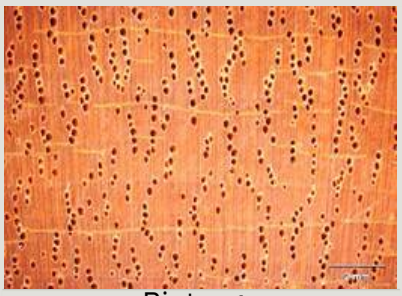
I. Chain Porous Group

Nyatoh Batu (Bitis)
Madhuca utilis

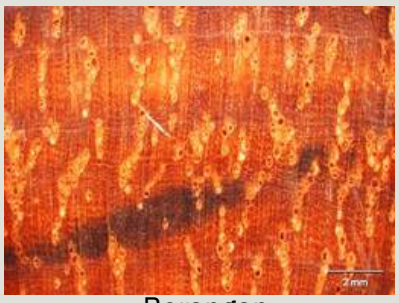


Entuyut (Punah)
Tetramerista spp

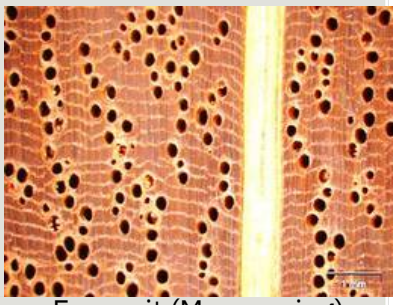
Nyatoh
Palaquium spp.



Bintangor
Calophyllum spp.

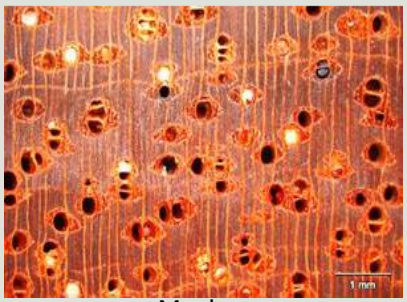


Berangan
Castanopsis spp.

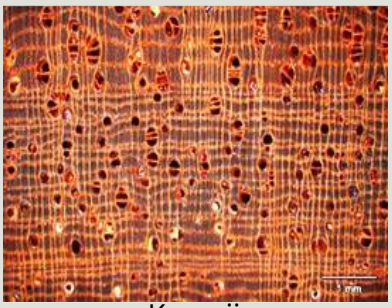


Empenit (Mempening)
Lithocarpus spp.

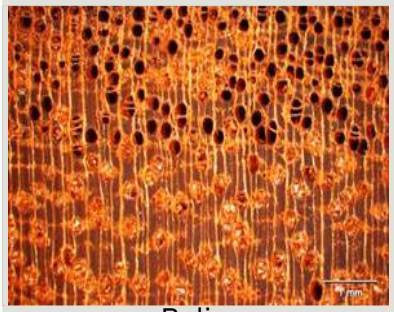
II. Parenchyma surrounding the pores (Vasicentric)



Merbau
Intsia palembanica, Intsia bijuga



Keranji
Dialium spp



Belian
Eusideroxylon zwageri

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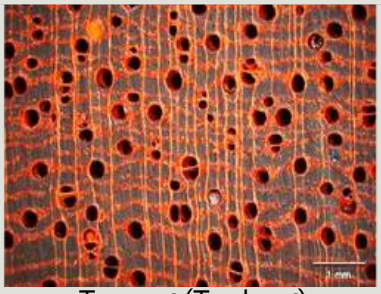
Sepetir
Copaifera spp.

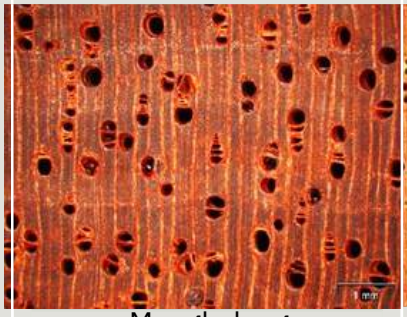


Tapang (Tualang)
Koompassia excelsa

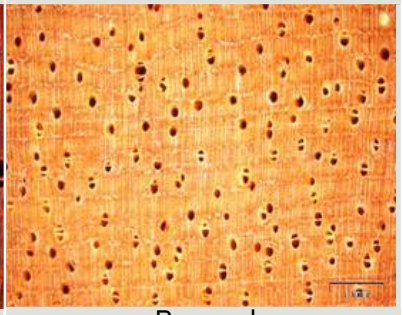
Menggris (Kempas)
Koompassia malaccensis

III. Wood Parenchyma – Apotracheal

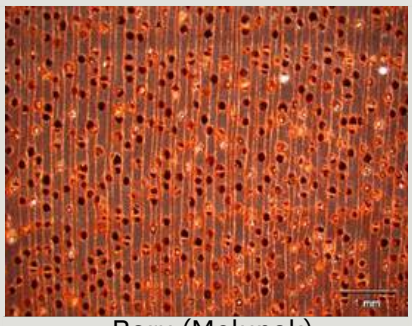
Bajan (Mata Ulat)
Kokoona spp.



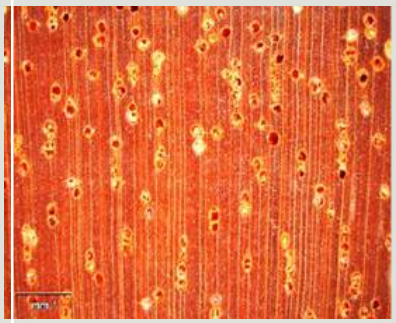
Mengkulang
Heritiera spp.



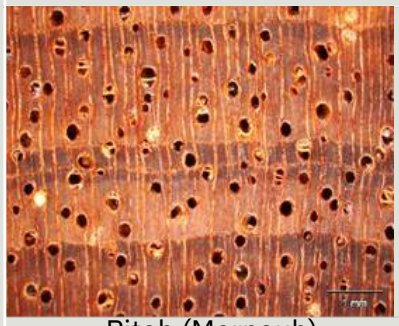
Perupok
Lophopetalum spp.



Baru (Melunak)
Pentace spp.



Geronggang
Cratoxylum spp.

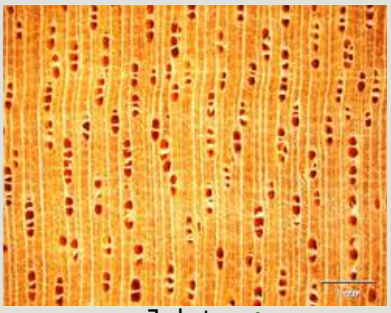


Pitoh (Merpauh)
Swintonia spp.

IV. Wood parenchyma short strands between the rays

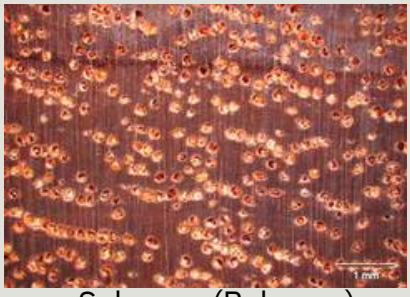
Bawang Hutan (Kulim)
Scrodocarpus borneensis

Durian
Durio spp.



Jelutong
Dyera spp.

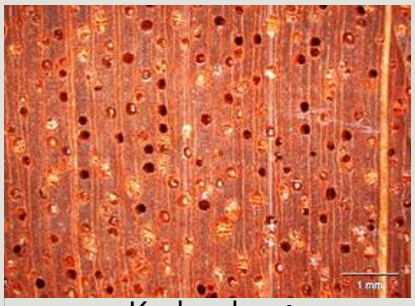
V. Wood Parenchyma diffused or indistinct



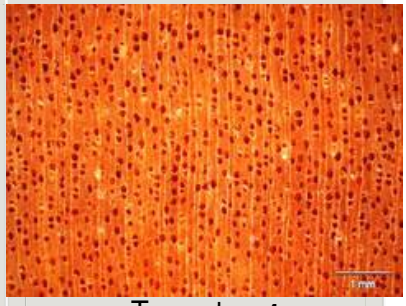
Selunsur (Pelawan)
Tristania spp.

Simpoh
Dillenia spp.

Medang
Cinnamomum spp.

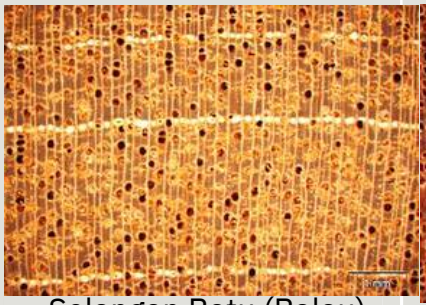


Kedondong
Canarium spp.

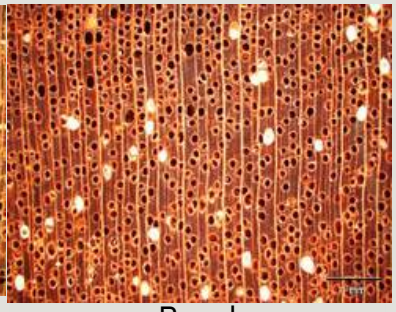


Terentang
Campnosperma spp.

VI. Resin canals group

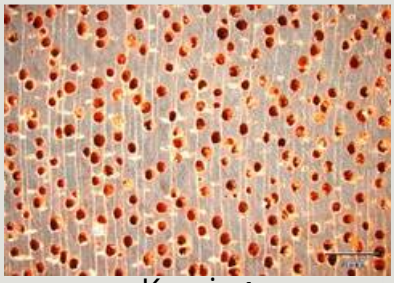


Selangan Batu (Balau)
Shorea spp.



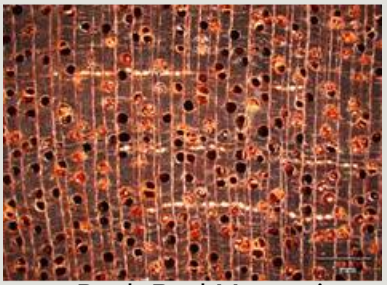
Resak
Vatica spp.

Kapur
Dryobalanops spp.



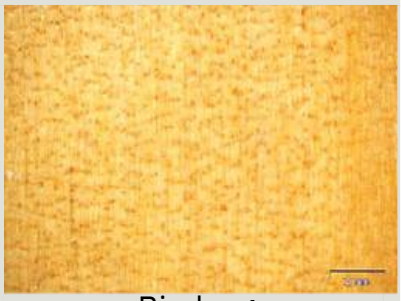
Keruing
Dipterocarpus spp.

Mersawa
Anisoptera spp.

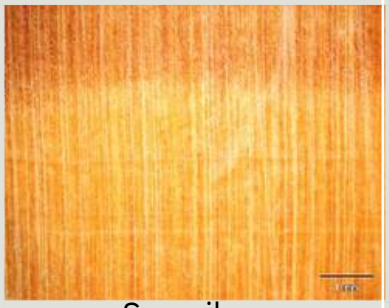


Dark Red Meranti
Shorea spp.

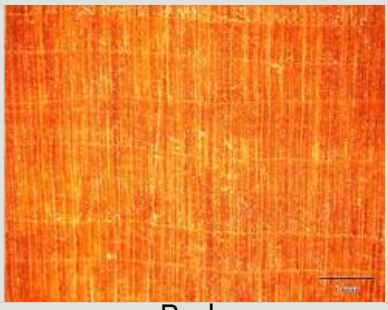
VII. Softwood (wood without vessels or pores)



Bindang
Agathis alba,
Agathis macrophylla



Sempilor
Dacrydium spp



Podo
Podocarpus spp.

At first sight, it may appear to be comparatively easy to identify timber species but soon we will learn that there are many pitfalls as most timbers may eventually look alike (especially tropical timbers) after having been exposed to the weather for some time. Therefore, the identification of timber should be based on the examination of features that are known to be reliable such as the macroscopic features, as well as the anatomical features visible with a hand lens, including porosity, vessel arrangement and grouping, parenchyma arrangement, ray size etc.

KEPELBAGAIAN SPESIES CENDAWAN DI SARAWAK.

Cendawan tergolong di dalam keluarga kulat dan mengandungi zat makanan dan vitamin yang tinggi. Tumbuhan hijau yang dapat menghasilkan makanannya sendiri melalui proses fotosistensis, tetapi cendawan mendapatkan sumber makanannya daripada bahan organik yang reput sama ada daripada tumbuhan, serangga, dan haiwan yang hidup atau mati. Oleh kerana itu, cendawan boleh didapati di pelbagai jenis substrat seperti di dahan pokok hidup, dahan kayu reput, habuk kayu, bangkai atau najis haiwan, dan bahan buangan pertanian.

Cendawan mempunyai pelbagai bentuk yang berbeza. Pada kebiasaannya cendawan mempunyai batang atau tangkai dan tudung (cap) yang berbentuk payung, serta beberapa bentuk yang lain seperti bulat (puffball), jeli (jelly), cawan (cup), karang (coral), dan keras berkayu(woody). Kebanyakkan cendawan liar yang dijumpai di hutan tidak selamat untuk dimakan. Ini kerana terdapat beberapa spesies cendawan yang beracun mempunyai rupa dan bentuk yang sangat menyerupai cendawan yang boleh dimakan. Perbezaan umumnya cendawan yang boleh dimakan mempunyai saiz yang lebih kecil daripada saiz cendawan yang tidak boleh dimakan. Oleh demikian, memakan cendawan liar adalah tidak digalakkan dan perlu berhati-hati bagi mengelakkan risiko keracunan cendawan.

CIRI-CIRI CENDAWAN UNTUK PENGECAMAN

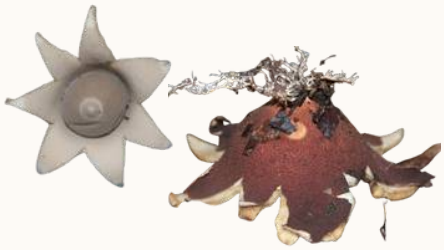
WARNA
Mempunyai pelbagai warna. Kebanyakan cendawan di Hutan Sarawak amnya berwarna putih, kehitaman dan coklat.

BATANG (STIPE/STEM)
Besar, kurus, kecil, panjang, pendek, lembut, keras, berbulu, bengkok, lurus dan terdapat juga yang tidak berbatang, mudah pecah atau patah apabila disentuh.

CAP (ATAS)
Berbentuk payung, bulat, kipas dan sebagainya. Bahagian ini amat penting untuk mencantikan spesies cendawan. Terdapat yang licin, rata, lembut , tidak rata, mudah pecah, bergaris , berbulu dan keras dan sebagainya.

CAP (BAWAH)
Berbentuk seperti berlubang halus atau kasar, insang halus atau kasar dan ada gill lurus dan bercabang (fork), licin dan sebagainya.

KOLEKSI CENDAWAN



Famili : Geastraceae
Genus/Spesies: *Geastrum sp.*
Habitat : Daun–daun buruk yang lembab (Debris)
Sifat-sifat semulajadi : Berbentuk bintang dan bersayap.
Lokaliti : Gunung Gading NP. Lundu
Fungsi : Tidak boleh dimakan
Diameter : 1.5cm – 5cm
Tingg i: 3cm – 5cm
Warna : Putih, Kelabu dan keperangan
Catatan
Spesies ini agak banyak dijumpai pada tempat landai hutan yang lembab selepas hujan, tumbuh di atas daun yang telah rebut, karakternya agak mudah pecah. Spesies ini juga di kenali sebagai *earthstar fungi.*

Famili : Auriculariaceae
Genus : *Auricularia sp.*
Spesies: Auricularia auricularia-judae
Nama Tempatan : Kulat bibir
Habitat : Tumbuh pada kayu buruk
Lokaliti : Matang Wildlife
Sifat-sifat semulajadi : Lembut,Licin
Warna : Merah keperangan
Fungsi : Boleh dimakan
Diameter : 0.5cm – 8cm
Tingg i: 1cm – 3cm
Catatan
Kulat ini amat mudah dijumpai di hutan, tidak berbatang dan tumbuh bergantung pada dahan, batang kayu buruk atau reput. Spesies mudah dipasarkan untuk dimakan. Enak dimasak bersama sayur.

Famili : Lentinellaceae
Genus/Spesies : *Lentinus strigosus*
Nama Tempatan : Kulat bulu
Habitat : Kayu,Batang dan dahan buruk
Sifat – sifat semulajadi : Cap berbulu
Lokaliti : Pasar tamu Sg. Tengang Sri Aman
Fungsi : Boleh dimakan
Diameter:
Cap: 1cm – 8cm
Tinggi: 4cm – 13cm
Warna : Merah darah ketika masih muda, keputih–putihan dan kelabu
Catatan
Kebanyakan spesies ini mudah dijumpai di mana sahaja,

Famili : Tramellaceae
Genus /Spesies : *Tramella sp.*
Habita t: Batang, dahan dan kayu buruk
Sifat-sifat semulajad i: Lembut dan licin
Lokalit : Matang Wildlife Kuching
Diameter: 0.3cm – 0.5cm
Tinggi: 1.5cm – 4cm
Warna: Tranparent, seperti warna agar-agar

Famili : Polyporaceae
Genus /Spesies : *Tremetes sp.*
Habita : Dahan,batang dan kayu buruk
Sifat-sifat semulajadi : Bracket
Bawah Cap : Berlubang kecil (Pore)
Lokaliti : Taman Lee Ling ,Matang
Diameter : 2cm-6cm
Ketinggian : 0.5cm-1.5cm
Warna : Coklat, brown buff dan berzonate(berbelang)

Catatan
Spesies ini adalah salah satu spesies yang mudah dijumpai seperti batang, dahan atau kayu kayu yang buruk disekeliling rumah, taman-taman perumahan dan hutan.

Famili : Polyporaceae
Genus /Spesies : *Grifolia sp.*
Habitat: Daun-daun kering (Debris),kayu buruk
Sifat-sifat semulajadi :
Lokaliti : Pulong Tau,Bario
Diameter : 15cm-25cm
Ketinggian : 15cm-35cm

Famili : Polyporaceae
Genus /Spesies : *Lignosus rhinoceros*
Nama Tempatan : Kulat susu Harimau
Habitat : Tanah
Sifat-sifat semulajadi : Berbatang keras, tinggi, ada lingkaran bulat di atas capnya dan berubi
Lokaliti : Pakan, Julau
Fungsi ubi : Untuk perubatan
Diameter : 5cm-8cm
Ketinggian :10cm-20cm

TERIMA KASIH.

ABDUL GHANI BIN YUSUF

HIGHLIGHTS

Sambutan Tahun Baru Cina 2023


Certificate Is


PREMIER

Gotong Royong RDD

2023

Courtesy Visit Timor Leste Delegation
7 March 2023


FOREST DEPARTMENT
SARAWAK

Sambutan Hari Raya Aidilfitri RDD

Program HR Turun Padang
12-13 Julai 2023

LPPKN TALK 2023

Bengkel Perancangan RDD
23 November 2023

Perkongsian Ilmu RDD 2023


TATACARA TUNTUTAN

Malam Penghargaan RDD 2023

RETIREES IN 2023

Mdm Puluni anak George

Mr Akui anak Juwang

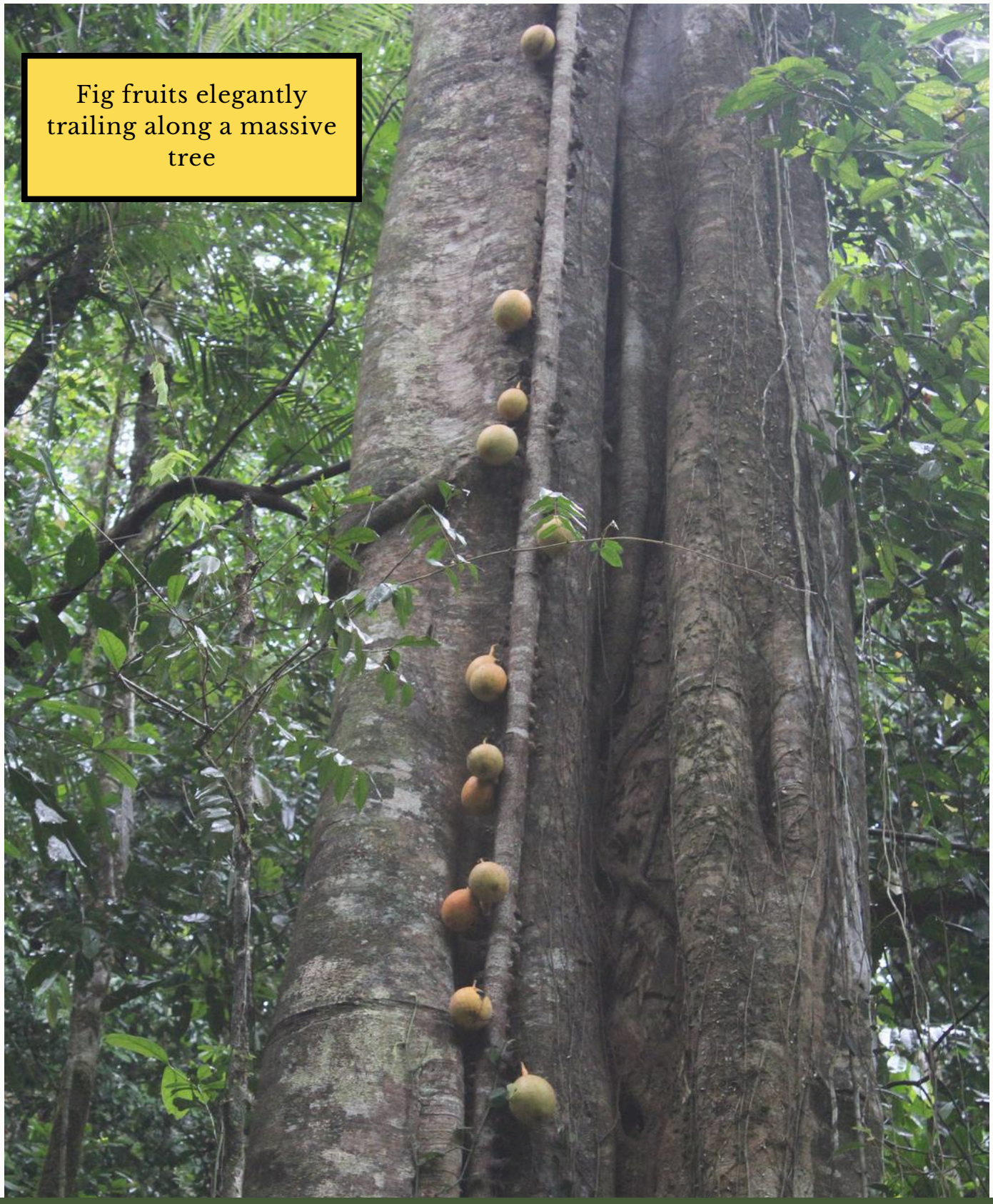


Fig fruits elegantly trailing along a massive tree

Forest Department Sarawak Headquarters
Level 15, East Wing,
Bangunan Baitul Makmur II,
Medan Raya, Petra Jaya,
93050 Kuching, Sarawak

Tel: 082-495 111
Fax: 082-495 200
Email: webmaster@forestry.sarawak.gov.my

Research and Development Division
Forest Department Sarawak
KM10, Jalan Datuk Amar Kalong Ningkan
93250 Kuching, Sarawak

Tel: 082-615887
Fax: 082-615127