Heart of Borneo Series 7

TAMA ABU

Where the Beat Becomes Rhythm



Forest Department Sarawak

HEART OF BORNEO SERIES 7

TAMA ABU

Where the Beat Becomes Rhythm

A PUBLICATION
PROJECT HEART OF BORNEO INITIATIVE FOR SARAWAK

2020



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First published 2020,Reprinted 2023

Forest Department Sarawak. 2020.
Heart of Borneo Series 7: Tama Abu – Where the Beat Becomes Rhythm. Forest Department Sarawak, Kuching.
ISBN: 978-967-15227-8-3

Editorial Team:
Meekiong, K., Runi, S.P., Wasli, M.E., Salina, H., Hafsah N., Habibah, S., Shirley C., Sidi, M.B., Shabdin, Z. & Elias, H.

This publication is available from
FOREST DEPARTMENT SARAWAK
Level 15, (Left Wing)
Bangunan Baitulmakmur II
Medan RayaPetra Jaya
93050,Kuching Sarawak
Tel: 082-495111
Fax: 082-495200

Printed in Malaysia by
Sufra Qadry Holdings Sdn. Bhd.

PREFACE

This book is the seventh in the Heart of Borneo Series, publication under the Heart of Borneo Initiative for Sarawak. It gives us a sight on the findings of the Scientific Expedition to Tama Abu Production Forest in 2017, which organized by the Forest Department Sarawak.

Tremendous amount of data was collected by researchers and scientists from various government institutions, research institutes, universities and NGOs from Malaysia, Brunei Darussalam, Denmark, Australia and Taiwan. The area covered in the expedition is comparatively small, hitherto the biodiversity recorded is remarkably rich. Many flora and fauna have been recorded and compiled. Trees, orchids, begonia, palms, ferns and mosses are diverse. Great number of mammals, birds, aquatic life and insects is analogous to other places in the HoB areas. Apart from the flora and fauna, the forest landscape of Tama Abu itself also unique with beautiful sceneries.

Details of some reports have been compiled and published in the, "*Heart of Borneo Series 5: Proceedings of the Heart of Borneo Seminar – Tama Abu*", published in 2019.

EDITORIAL TEAM

MESSAGE

Bismillahir-Rahmannir-Rahim, Selawat dan Salam Ke Atas Nabi Muhammad SAW

Assalamualaikum Warahmatullahi-wabarakatuh

I am honoured to be given privilege of writing the message for this publication, *Heart of Borneo Series 7: Tama Abu – Where the Beat Becomes Rhythm*. I should, first of all congratulates the International Affair Division, the Heart of Borneo Initiative for Sarawak Project for successfully organised the Tama Abu Scientific Expedition in 2017. Secondly, to all parties who involved in the Tama Abu Scientific Expedition for their collaborations and commitments.

Part of the findings of the Tama Abu scientific expedition have been published in the book, "*Heart of Borneo Series 5: Proceedings of the Heart of Borneo Seminar – Tama Abu"* in 2019. This book covering part of the results from the expedition, that arrange in such beautiful pictorial form.

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 photos and inputs which concluded into meaningful publication.

Datu Hamden Bin Haji Mohammad
Pengarah Hutan
Jabatan Hutan Sarawak




Yazid Qalbi

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What is Heart of Borneo (HoB) Initiatiative?

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 three ASEAN nations cooperation was officially launched in Brazil on 27 March 2006. On 12 February 2007 the Minister of Natural Resources and Environment, Malaysia; the Minister of Forestry, Republic of Indonesia and the Minister of Industry and Primary Resources, Brunei Darussalam signed and jointly issued a Declaration in Bali, Indonesia.



Bali Declaration 2007

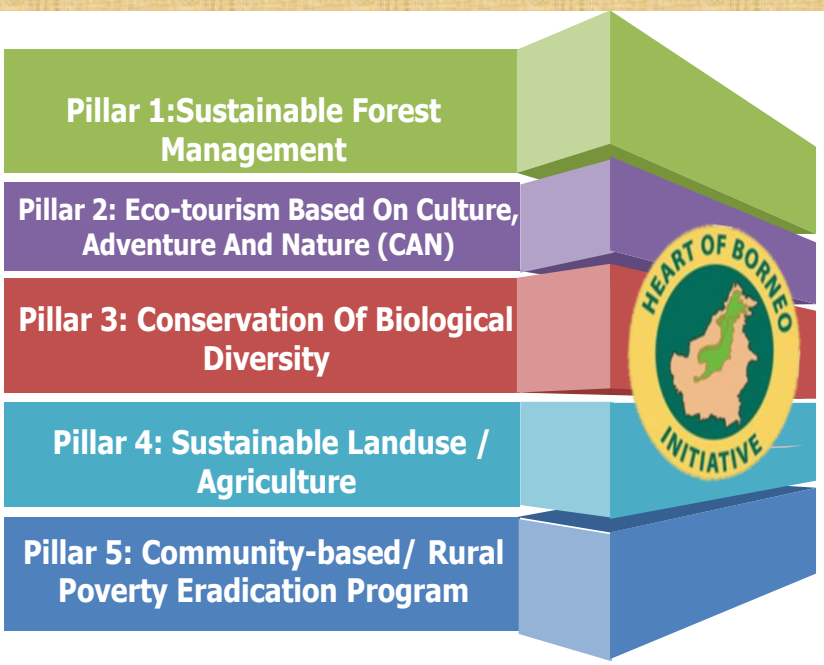
In view of the global concerns and controversy about the tropical forest development, the long term objective of the HoB Initiative, as enshrined in the Bali Declaration is as follows:

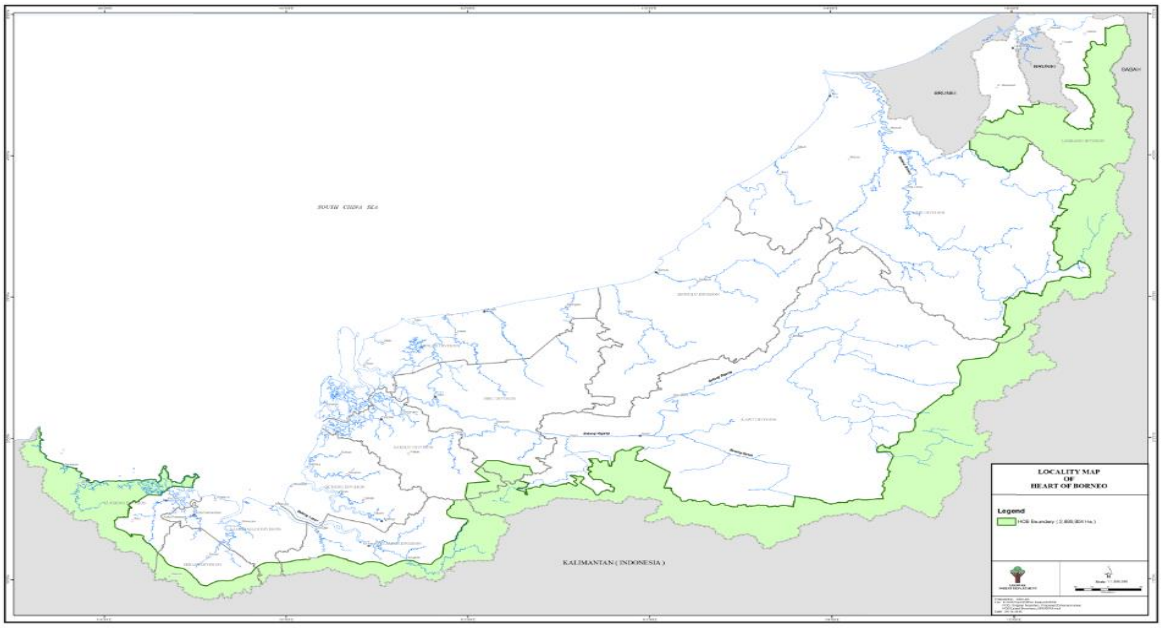
"With one conservation vision and with a view to promote peoples' welfare, we will cooperate in ensuring the effective management of forest resources and conservation of a network of protected areas, productive forests and other sustainable uses".



1	Represents the area designated as the Heart of Borneo area.
2	Represents the boundary of Heart of Borneo.
3	Represents the integrity of the forest which is crucially important. All in gold denoting under the good care of the 3 respective countries.
4	Represents the forest as the core element of the HoB initiative.
5	Represents the Global Earth
6	• Leaves representing the three pillars of sustainable development which are Economic, Social and Environmental requirements. • They are interlinked to represent the importance of forest connectivity for biodiversity conservation.

5 PILLARS OF THE HEART OF BORNEO





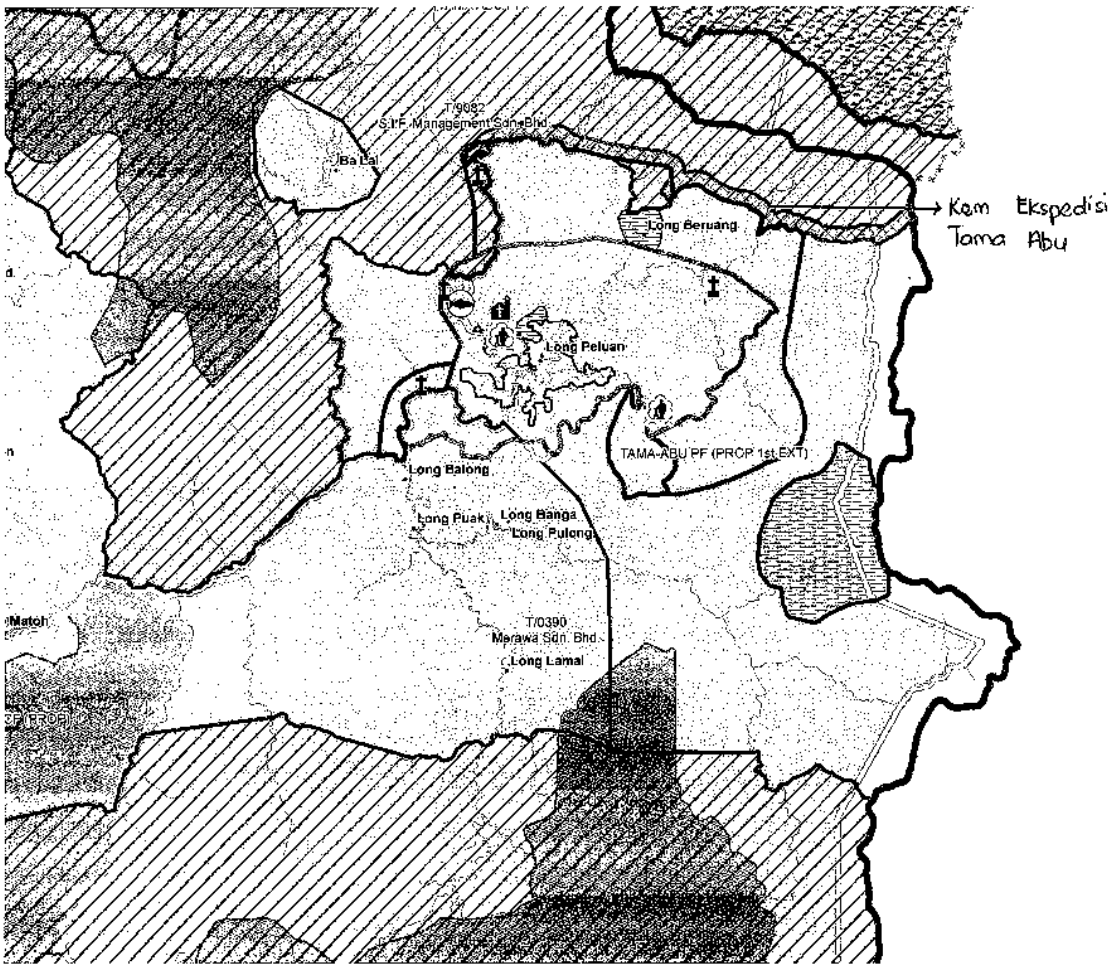
In Sarawak, the HoB covers 2.689 million ha over a contiguous block along Sarawak's boundaries with Kalimantan and with Sabah and Brunei. The HoB is fully in line with existing policies by both state and federal government.

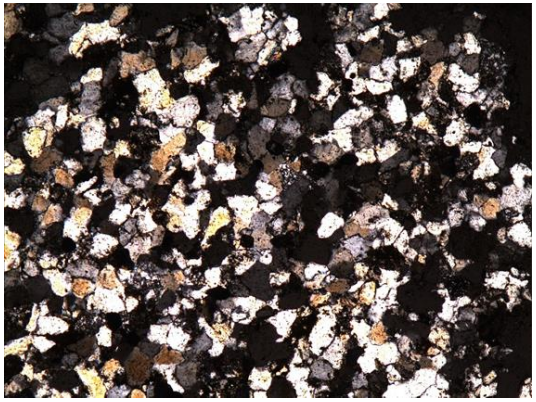
HoB Sarawak with the earliest total area of 2.1 million hectares is divided into three regions namely Northern, Central and Southern Regions. In 2018, the extension area of HoB Sarawak to 2.69 mil hectares was approved by the State Cabinet. The expansion involves the area from Batang Ai to the western region of Sarawak. This covers the Kelingkang Range, Gunung Apeng National Park, Bungo Range National Park, Gunung Pueh National Park, Kubah National Park, Gunung Gading National Park, Samunsam Wildlife Sanctuary, Matang Wildlife Centre, Kuching Wetland National Park, Bako National Park, Sampadi National Park,Santubong National Park and Tanjung Datu National Park.



Tama Abu

Tama Abu is a mountain range, located in northeast Sarawak with estimate terrain elevation above sea level 1818 metres. Variant forms of spelling for Tama Abu Range or in other languages: Penambo Range, Tamabo Range, Tama Abu Range, Banjaran Tama Abu and Tamabo Range.





Rock types and formations

Kelabit Formation;

- **Most dominant formation in the area**
- **Large parts of the low-lying area or bottom of hills within Tama Abu range**



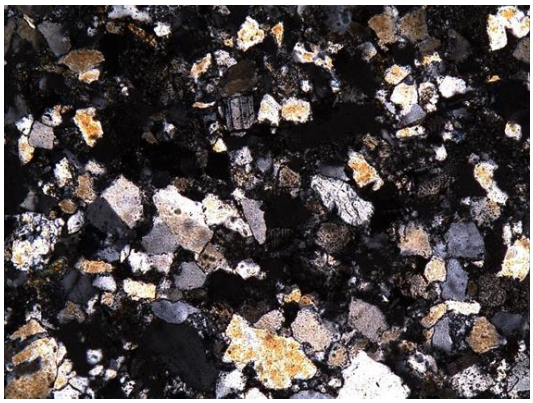
- **Comprised of predominantly mudstone interbedded with beds of siltstones and sandstone of variable thicknesses**
- **Sandstone dominant forms high ridges due to the more resistant beds.**
- **The sandstone beds is thickening upward trend.**
- **The base of the formation composed of grey or brownish mudstone passing up gradually to more arenaceous successions.**

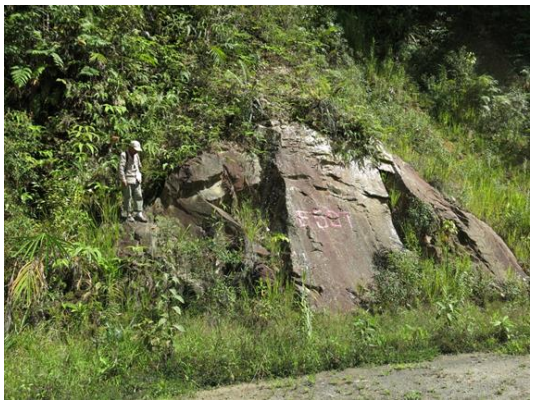








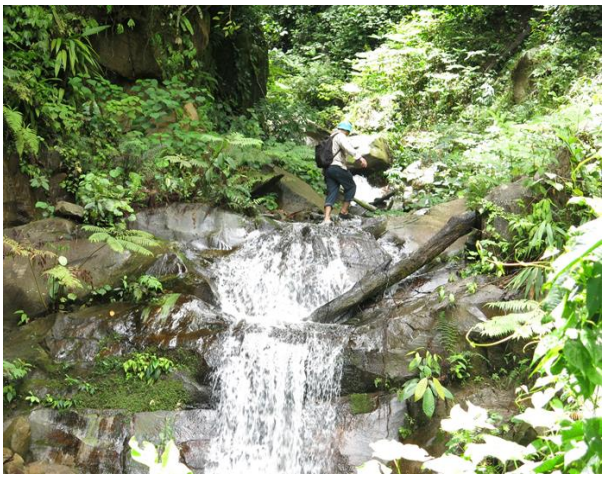




Meligan Formation;

- Forms the hills and plateau at the higher elevation
- Thick to massive sandstone beds
- Medium grained and well-sorted sandstones, subangular to subrounded & sometimes contain mudclasts of approximately 5 cm in diameter.
- Grains size 0.2-0.5 mm.
- Composed of predominantly quartz, with some feldspar, minor opaque, heavy minerals present are zircons and tourmaline.
- Some sandstones show parallel laminations.
- Fining upwards bedding.
- Classification, mostly subarkose.
- The age indicated from the fossils found within the sandstone Meligan Formation, Miocene (Te).
- Environmental deposition - delta front of a prograding delta system







Recent sediments;

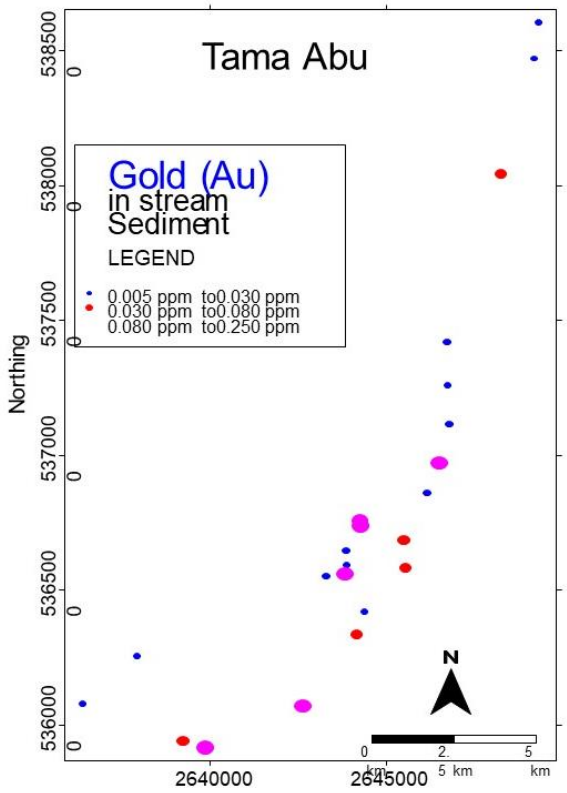
- **Young deposits composed of semi consolidated terrace, gravel, colluviums and alluvium.**
- **Deposited by river systems along the river, valley and lower slope within the area.**
- **Mostly sandstone boulder**

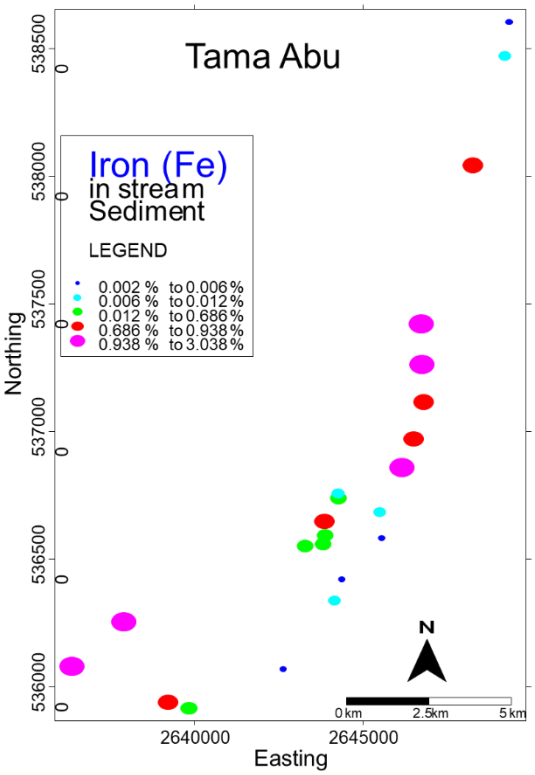
Mineral existing;

- **23 stream sediment samples collected for 32 elements analysis.**
  - **indicated very low existing of economic mineral resources in this area**
  - **Supported by none existing of igneous intrusion**
- **Very low grade of metamorphism due to regional tectonic.**











Geoheritage: Batu Ritong

A dolmen structure or megalithic monuments which still stands in an upright position. It consists of four standing slabs with average dimensions of 2 m long, 2.3 m wide and 0.5 m thick. The stone was erected as the secondary burial site for a Kelabit nobleman named Ritung. This structure has been listed as a historical monument in accordance with Part V of the Sarawak Cultural Heritage Ordinance 1993.

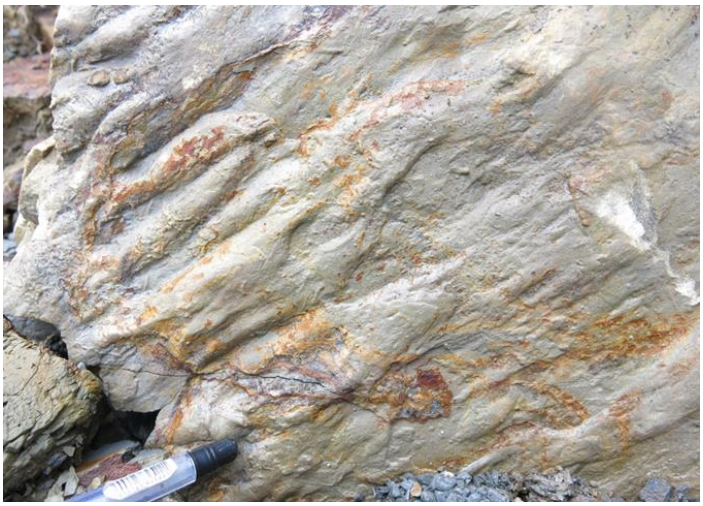
Ripple marks





Groove structures





Load cast





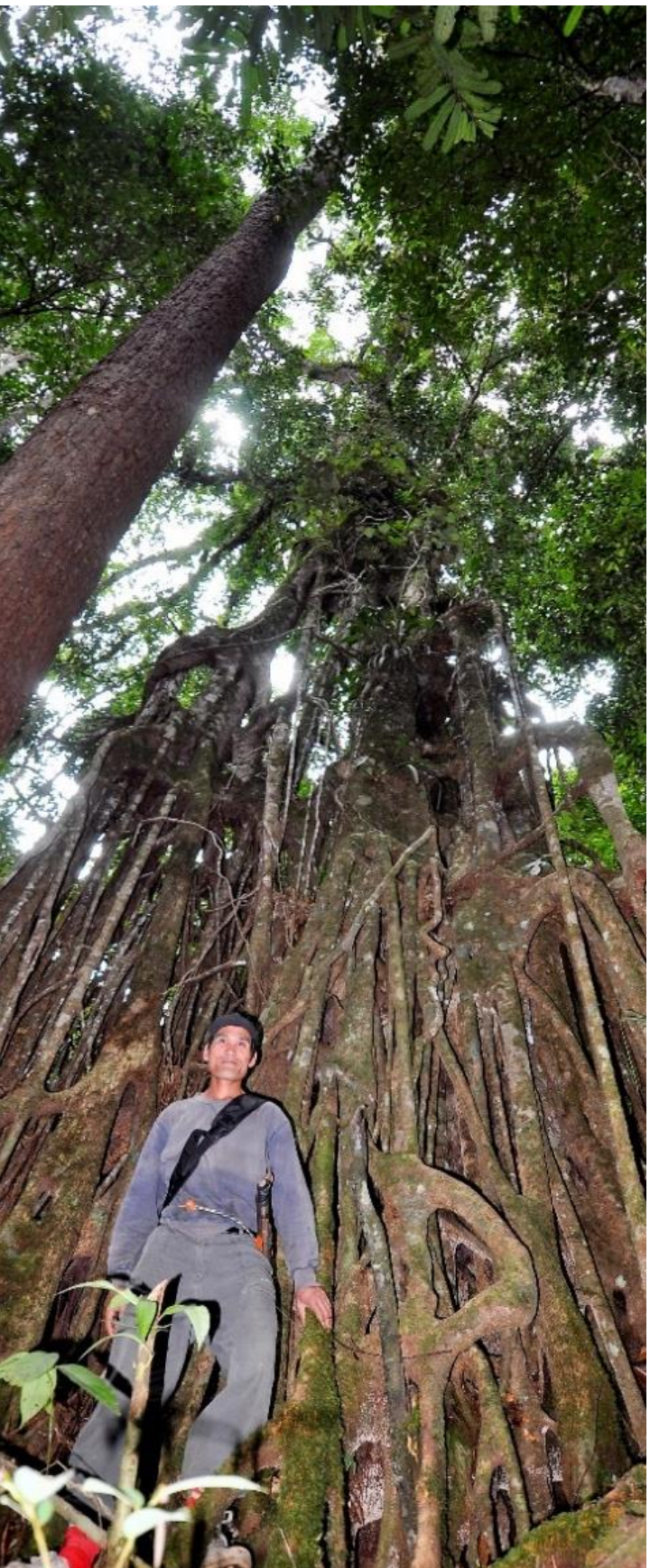




Geodiversity of Tama Abu area depends on the two existing sedimentary rock formations; Kelabit & Meligan Formation. No conflict between economic minerals and conservation effort to become a protected area. The geology and its geological evolution are fundamental for the integrated conservation of the nature (geodiversity & biodiversity) and cultural heritage.







The Nature Architectures

Amazing natural architectures of the forest. Straggling figs – conquers strategy for survival. The roots are sprawling and covering the host. They tighten and absorbing water from the trunk until the host slowly dying.





The Hanging Garden

One of the unique features in the tropical rainforest is the occurrence of many niches or microhabitats. Many plants can adapt to those microhabitats for endurances in the high competition for light and water. For example, the climbers and epiphytes are the plants that clinging or hanging for their survival.







The Streams

The drainages in southern Tama Abu Range are classified between 1st and 4th order streams, having narrow and shallow channels, high gradient, rocky substrates and fast-flowing water. The water is tea-coloured in appearance during the dry months but turns to muddy during heavy rain.







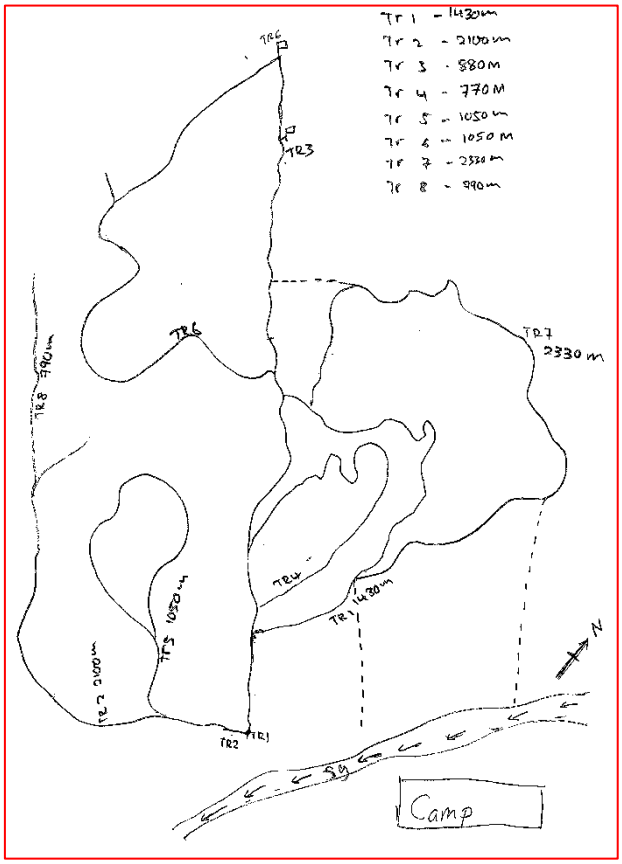
The Tama Abu Scientific Expedition

The Tama Abu Scientific Expedition is the 5th scientific expedition of Heart of Borneo (HoB) organized by the Forest Department Sarawak. Headed by Professor Emeritus Datuk Dr. Mohamed Abdul Majid, 93 scientists and researchers from various government agencies, universities, non-governmental organization (NGO) from all over the country, as well as participants from United Kingdom, Australia, China, Denmark and Brunei Darussalam. The Tama Abu expedition aims to document the variety, range and diversity of wildlife, particularly to confirm the existence of rhinoceros and wild buffalo (*Bos javanicus*) which reportedly roam in the area and to assess the future needs for conservation of the HoB. The expedition site (N03°18'37.1" E115°28'48.7") located about 130 km from the Miri City and is only accessible by Four-Wheel-Drive (4WD) vehicles and it took about 10 – 11 hours of a journey through muddy logging road.

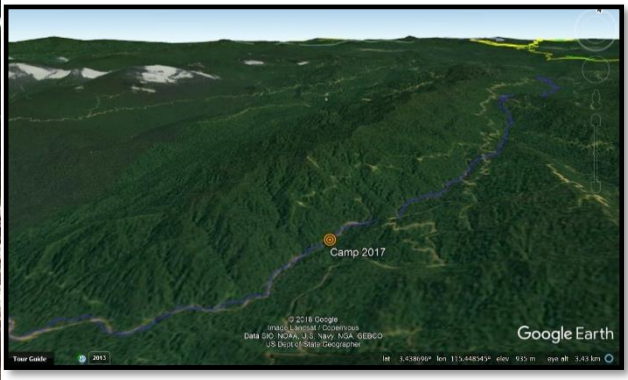


The Trails

Ten trails (including two riparian trails) have been prepared a month ahead of this scientific expedition by the Forest Department staffs and local peoples. The shortest trail distance was 770 m and the longest was 2320 m (map distance – actual distance was longer). All the trails are very challenging, where the participants need to climb up the terrains and descend the steep slopes.













crossing river



climbing up the terrain



Descending the steep slope



Struggling on the muddy logging road











The Camp

The camp was prepared two months ahead of the event, and it was located close to the Bale River. The camp includes lab, dining and meeting hall, clinic and prayer area (*surau*).





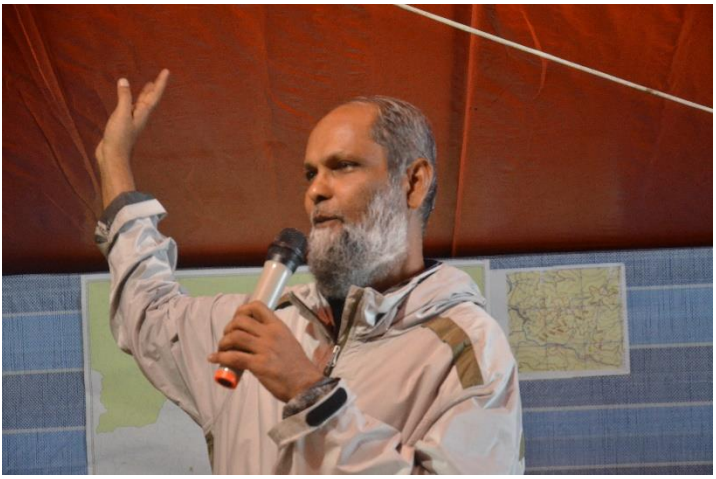


Plant general collection and inventory.

Measuring, discussing, recording and photographing











Knowledge Sharing

Every night, led by our scientific expedition's leader, Prof Emeritus Datu Haji Mohamed, we share our daily explorations and findings.











Trapping methods

Trapping methods to record the existing fauna in Tama Abu PF

Sherman trap



Cage trap



Harp trap



Mist net





Wallow for Wild Boar

Scratch marks – possibly Sun bear



The barking deer's droppings on the forest floor.





Barking Deer

Muntjak muntjak or known with many names according to their native area; Common muntjak, Red muntjak, Indian muntjak, but popularly known as Barking deer or in Malaysia as *Kijang.* They are common throughout Southeast Asia. They are omnivorous, feeding on fruits, leaves, seeds and bird eggs. Their calling sound is similar to barking or bark-like sound to make an alarm when danger is present.







Wild boar

The Bearded Pig (*Sus barbatus*) or *Babi Hutan* is one of the most common large animals recorded (*via* camera trapping) in Tama Abu, but hardly seen during the expedition. Easily recognized by the prominent beard, and feeds on everything. The populations have been to decline rapidly due to overhunting.



Sun Bear

Sun bear or locally known as *Beruang* is a family of Ursidae; scientific name *Helarctos malayanus.* It is the smallest bear, standing nearly 70 cm and weighing from 25 – 65 kg, occurring in the tropical forest of Southeast Asia.



Binturong

Binturong or bearcat with the scientific name *Arctictis binturong* is a member of the Viverridae family, native to the South and Southeast Asia. They are usually at the foothills and hills with good tree cover but less so in the forested plain. They are omnivore, feeding on small mammals, birds etc.



Hose's Leaf Monkey

The Hose's Leaf Monkey or scientifically known as *Presbytis hosei,* is a species in the primate group, Cercopithedae. This species is endemic to Borneo Island, in primary and secondary forests at an altitude between 800 – 1300 m above sea level. They are folivorous, but will also consume flowers, fruits and seeds. The populations are decreasing due to the demand for their bezoar stones and habitat loss.





Bornean Clouded Leopard

The Bornean Clouded Leopard or *Neofelis diardi* ssp. *borneensis,* is a member of the Felidae that is endemic to the Borneo Island. It was recorded from the mixed dipterocarp forest (MDF) at the elevations of 1000 to 1300 m above sea level.



Marbled Cat

The Marbled cat or *Pardofelis marmorata* is a small cat from the cat family, Felidae. They are similar to the domestic cat but has rounded ears and a very long tail that is as long as their body length from head to the posterior.





Other Animals

Short-Tailed Mongoose

Family: Herpestidae

Species: *Herpes brachyurus*



Banded Palm Civet

Family: Viverridae

Species: *Hemigalus derbyanus*



Masked Palm Civet

Family: Viverridae

Species: *Paguma larvata*

Yellow-Throated Marten

Family: Viverridae

Species: *Martes flavigula*



The Jungle Rats

At least five jungle rats species recorded during the expedition.



Chestnut-bellied Rat (*Maxomys ochraceiventer*)



Red Spiny rat (*Maxomys surifer*)



Brown spiny rat (*Maxomys rajah*)

Volant small mammals (Bats)

A total of five families of bats (Order Chiroptera) were documented; namely Emballonuridae, Hipposideridae, Pteropodidae, Rhinolophidae, and Vespertilionidae. The highest number of species was recorded from family Hipposideridae (four species), followed by Pteropodidae (two species). Family Rhinolophidae, Emballonuridae, and Vespertilionidae was recorded with one species each. *Hipposideros cervinus* (family: Hipposideridae) is the most abundant species followed by *Emballonura alecto* (family: Emballonuridae). There were three species recorded as singletons namely, *Hipposideros dyacorum*, *Hipposideros sabanus* and *Rhinolopus trifoliatus*. From the nine bat species listed, seven species were listed as Least Concern and two species as Near Threatened in the IUCN Red List.



Dayak Roundleaf Bat (*Hipposideros dyacorum*)



Fawn Roudleaf Bat (*Hipposideros cervinus*)



Cantor's Roundleaf Bat
(*Hipposideros galeritus*)

Roundleaf Bats.

This group of bats is commonly found at forest understory. They live in a colony and usually found roosting in caves or under rock crevices. They are insect-eating bats which use sonar to navigate and hunt.



Long-Tongued Nectar Bat (*Macroglossus minimus*). Common species that can be found in most habitat up to 1000 m elevation. Feeds on nectar from various types of plants include bananas, durian flowers, and coconut.



Spotted-Winged Fruit Bat (*Balionycteris maculata*). It is the smallest fruit bat that is commonly found in the forest understory. It usually lives in a colony. It is a generalist feeder which feeds on many types of plant including figs.





Small Woolly Bat (*Kerivoula intermedia*). This species is scarce and uncommon in primary and secondary forests. Only one individual was caught from this survey using harp trap set at the forest edge near the campsite.





Trefoil Horseshoe Bat (*Rhinolophus trifoliatus*). This species is common throughout Borneo that is mostly found in lowland forest and montane forest up to 1800 m. In Tama Abu PF, it was found roosting on a tree branch and was captured using hand-net.





The Greater Sheath-Tailed Bat (*Emballonura alecto*). It is a common species in both lowland and hill forests. It often roosts in caves mouth, rocky overhangs or fallen tree trunk. In Tama Abu PF, this species was caught in harp trap set at Trail 5 and a colony of *E. alecto* was found under rock boulders just nearby the campsite.

The record *of Hipposideros sabanus* is a highlight of this survey as it is a rare species in Borneo with very little information on its distribution in Sarawak. This species is also known as *Hipposideros doriae* (Peter, 1871) with the common name Bornean Leaf-Nosed Bat and can easily be distinguished from other species from the family of Hipposideridae, owing to lack of septa on the posterior noseleaf (Payne et al., 2007). This species has an extensive record throughout Borneo. Recent capture in Tama Abu PF proves that this species can be found in a less disturbed primary forest. Being a rare species of forest roosting bat, this mammal is believed to decline continuously due to logging activities, forest fires, and transformation of the forest into agricultural land. Since this species is showing diminishing population trend, attention should be given to manage and conserve this species as it is a forest-dependent bat.

The Legless Carnivours

The snakes or the legless carnivore reptiles from the suborder Serpents. They are common in the Tama Abu PF, sluggishly resting on tree branches waiting for preys.











Avifauna



Trapped on the mist net





You are too late...



Yellow-bellied Bulbul





Rufous-backed Kingfisher

Chestnut Capped Thrush



Rufous-Crowned Babbler

Hose's Broadbill





Bornean Banded Pitta

A sub-montane endemic species, a scarce resident of forested slopes and hills where it is locally common. This species has been recorded in Mulu National Park and the Kelabit Highlands (Phillipps & Phillipps, 2014). Feeds on the insect, including ants and cockroaches.

Bornean Forktail

A montane endemic species, inhabiting the primary forest. This species feed on insects along clear running rocky streams. It has been recorded in the Kelabit Highlands and Mount Dulit.



White Necked Babbler



A slope specialist inhabiting the understorey. This species feeds on insects, mainly small beetles, flies, caterpillars and small locust.

Hose's Broadbill

Characterised by the light blue abdomen and black spots on its wing. Sub-montane endemic species in Borneo. Common in the upper Baram Catchment of Kelabit Highlands.



The Great Argus

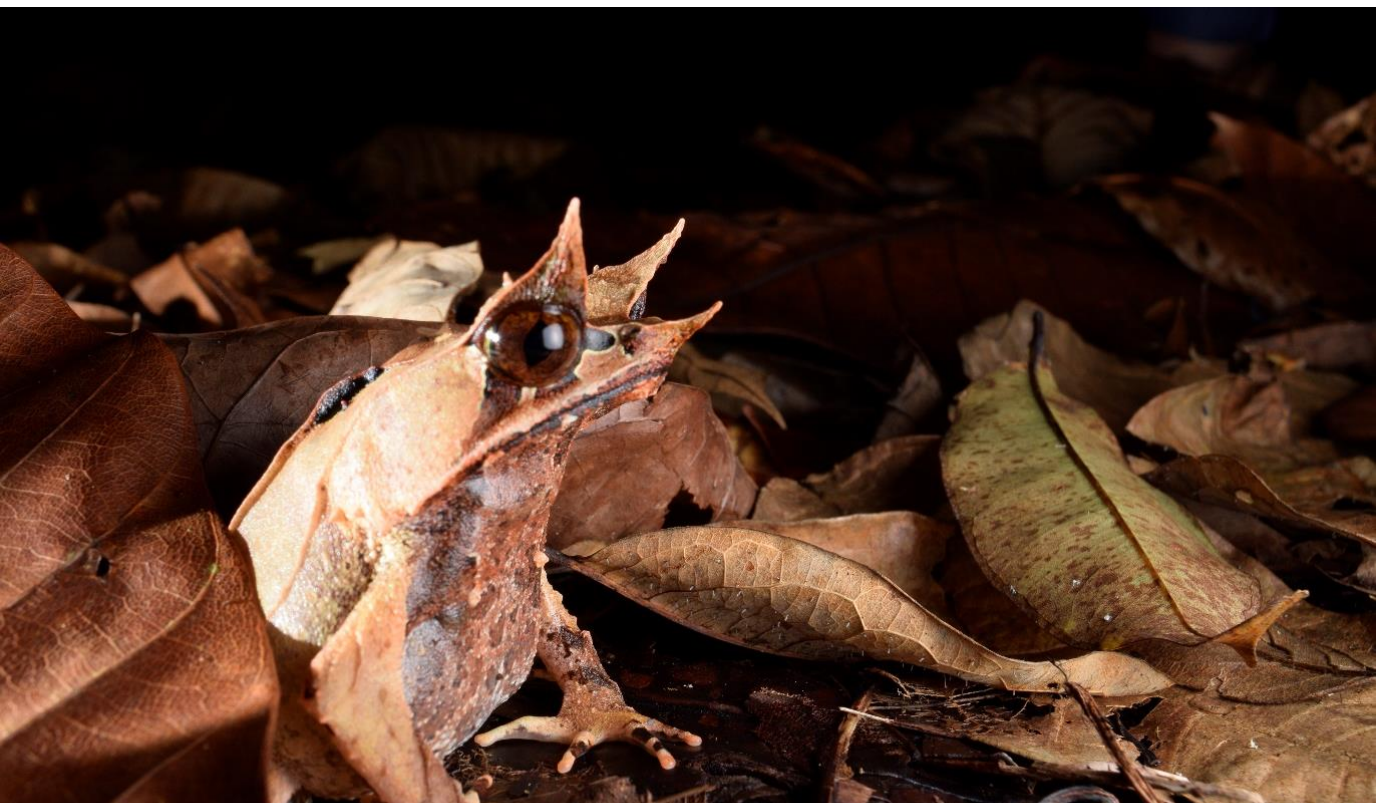
Argusianus argus is a species in the family Phasianidae. Vernacularly is known as Great Argus or *Burung Ruai* by the Iban people. They are native toSoutheast Asia. The Great Argus is not as colourful as other pheasants, but it displays the most remarkable behaviour. The male clears an open spot in the forest and prepares a dancing ground. Then, announces himself with loud calls to attract females. The *Burung Ruai* feeds on the forest floor in the early morning and evening.





Amphibian

The amphibians are ectothermic tetrapod vertebrates from class Amphibia that include frogs, toads, salamanders and caecilians. The word “amphibian” is derived from the Greek word, which means “both kinds of life”, the term was initially used as a general adjective for animals that could live on land or in water. There are approximately 8000 amphibians listed in the world of which 90% are frogs. About 150 species of frogs recorded in Borneo in six families. Current studies suggested that the number of frog species in Borneo might reached up to 200 species as many new species have been discovered and described in recent years. Distribution pattern of Bornean frog showed a dissimilarity form from other places in Southeast Asia. About 65% of Bornean frogs have never been reported elsewhere. The number of frog species in Tama Abu PF is still not known as this fauna group was not included in the survey during the Tama Abu expedition.















Trapdoor Spider of Borneo

Trapdoor, funnel-web and tarantula spiders are part of a large group of primitive spiders called 'Mygalomorphae', that occur worldwide Members of this group have large fangs that point and stab downwards as they bite down. These types of fang are considered as the primitive or ancient form that has been conserved through their evolutionary history. All other spiders have pincer-like fangs where the tips meet in the middle and are considered mo 'modern' spiders. Mygalomorph spiders a have burrows or silken retreats that they invest a lot of time and energy in maintaining. Burrows are important for mygalomorphs as they act as protection from predators, a place to brood their eggs and a trap for unsuspecting preys.







During the Tama Abu Scientific Expedition, two very different looking trapdoor spiders were found. One had a very sturdy burrow with a well-camouflaged lid lined with thick silk (left). Each burrow was only 3-4 cm deep so that the spider fit snuggly. Most burrows were found built into the sides of muddy stream banks (above). The spiders (above, left) have very long, hairy front legs and pedipalps (appendages near their fangs that look like smaller legs). Long hairy front legs and short, stout back legs make this species the perfect sit-and-wait predator to lunge out and ambush prey that passes by.

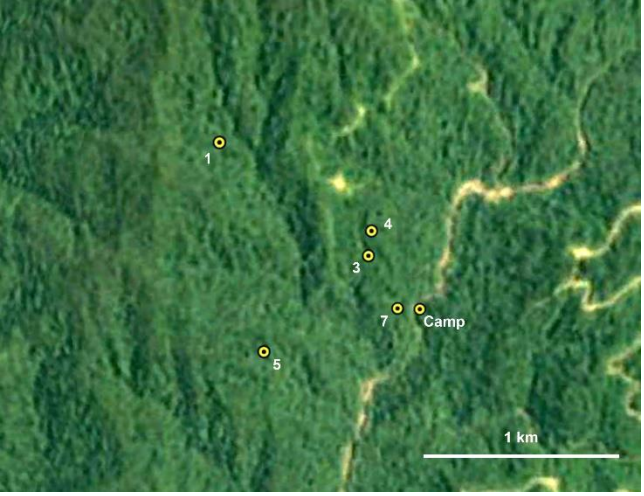




The second species was much smaller and faster. While still a sit-and-wait predator, this spider uses a large web to catch preys. Vibration on the web will signal the spider on the presence of prey.. The spider will then quickly run out and bite the prey before it can escape. This is why its legs are comparatively longer and thinner so that it can quickly run along with its web (below, left). As with all mygalomorph spiders, it will spend most of its time in its burrow. The burrow (below, right) is loosely lined with thin silk that radiates out into a web platform, lacking any lid.



More studies and specimens are needed before we can describe these spiders, but they are likely restricted to a very small area based on the traits of mygalomorph spiders generally.



Dragonflies and Damselflies (Order Odonata)

Odonata is insects with aquatic larvae; representatives of the order can be found at almost all freshwater habitats. They are carnivorous as both adults and larvae, and are not vectors for any human diseases; indeed, they play at least some role in keeping mosquito populations under control. Although present on every continent apart from Antarctica, the order is the most diverse in the world's tropical regions. In the wet tropics, many species are forest-dwelling and may be particularly sensitive to environmental disturbance; for this reason, they are considered to be good candidates for ecological indicator species.



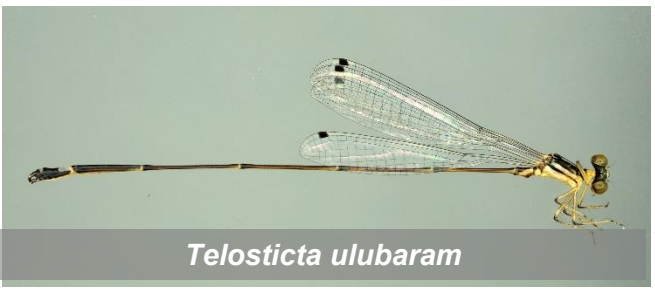
Lyriothemis biappendiculata



Orthetrum pruinosum schneideri



Drepanosticta actaeon



Telosticta ulubaram



Matronoides cyaneipennis



Rhinoneura caerulea

Thirty-two species of Odonata from 12 families were collected or observed during this expedition; of this, only one species was found away from the main expedition site. Many noteworthy species found during the expedition including some species worthy of special attention from a conservation viewpoint. The damselfly family Platystictidae was by far the best-represented family at the expedition site, with seven species recorded; this is not unusual in steep forested terrain in the interior of Sarawak.

Of the 31 species recorded at the expedition site, all are forest-dependent species. Twenty-two of the 31 species found at the expedition site are endemic to Borneo, this is approximately 74% of the species found during the expedition, and significantly higher than the overall percentage of Odonata found in Borneo that is endemic to Borneo (approximately 50%). For the Zygoptera, every species found at the expedition site is endemic to Borneo.





Diversity of insects in the Tama Abu PF is tremendous, Lepidoptera, Coleoptera, Phasmatodae, Odonata, Arachnida are commonly encountered everywhere, on the forest floor, on the trees etc.











The jungle war: a battle for the twosome



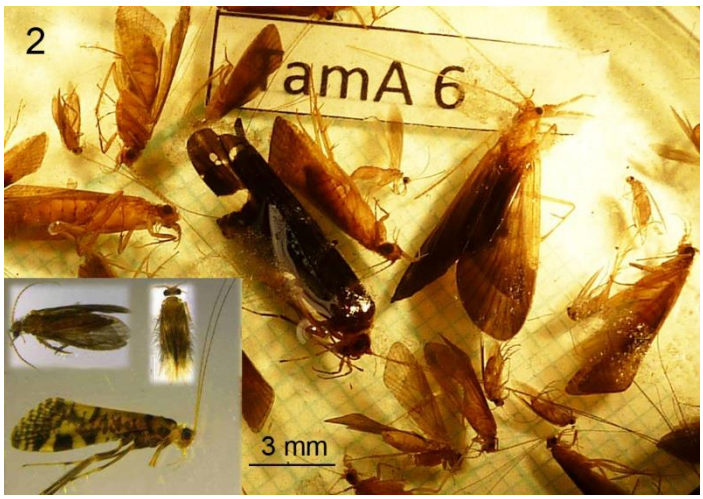






Caddisflies

Caddisflies (Trichoptera) provide food for fishes, bats, birds and some stream invertebrates, and are often used as indicators of clean, and safe water needed for healthy communities, and good stocks of fish. Caddisflies have aquatic larvae, usually collected by netting or hand-picking, and winged adults, most of which can be collected using light trap at night. To date around 354 species of caddisfly have been described for Borneo. This is a very low figure when compared to the number described for the smaller landmass of Thailand — more than 1000 species. Morse in Yong & Yule (2008) predicted a figure nearer 600 species for Borneo.



Caddisflies collection from Tama Abu PF



1



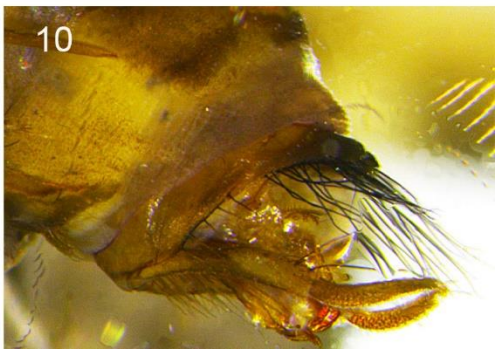














Thrips

The Thysanoptera, commonly known as thrips, contains more than 6000 described species, classified into two suborders, the Terebrantia and Tubulifera. Adults thrips have small bodies ranging in size from 0.5–15.0 mm, asymmetric mouthparts, and narrow fringed wings. Most thrips are phytophagous or fungivorous, although a few are carnivorous as predators of other small insects. These insects inhabit a wide range of environments, living in flowers, or on leaves and dead plants. Although some thrips species are important as pests of agriculture, many play crucial roles in the ecosystems of tropical forests as pollinators of Dipterocarpaceae (Appanah & Chan 1981) and as well as providing food for other animals including birds, lizards and spiders.



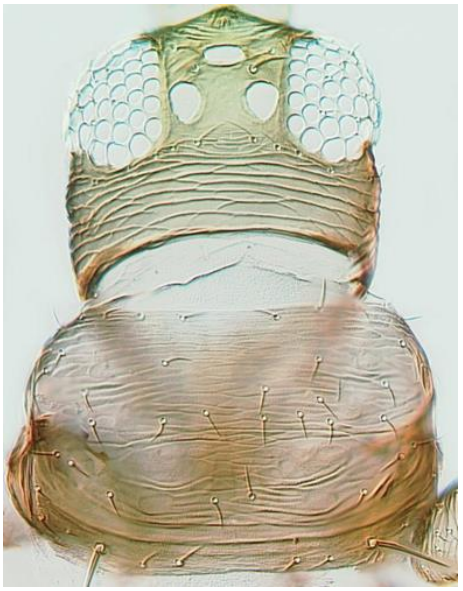
Aorathrips tenuis



Collected on *Ficus* leaves. This species was described from Java, Indonesia and Thailand. It is a new record for Sarawak (Borneo).

Dichromothrips smithis

Also called orchids' thrips. It has very specific host, only collected on orchids. This species becomes a widespread species through world trade of cut flowers.


Thrips parvispinus

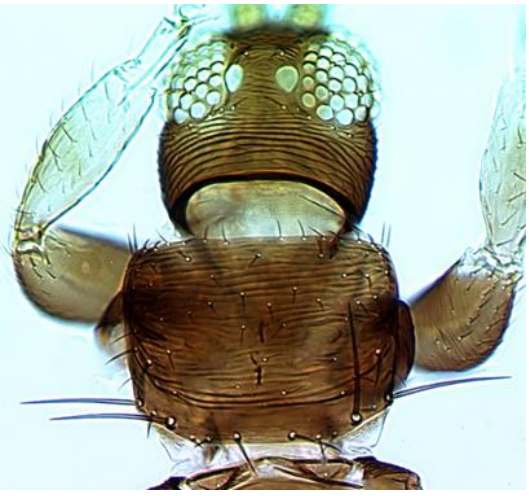
This species is the most commonly found thrips in Southeast Asia, especially in the lowland. It is a pest of *Capsicum, Carica, Citrus, Cucumis* and *Hibiscus.* The species was described from Thailand and now is spread to Solomon Island and northern Australia.




Thrips orientalis

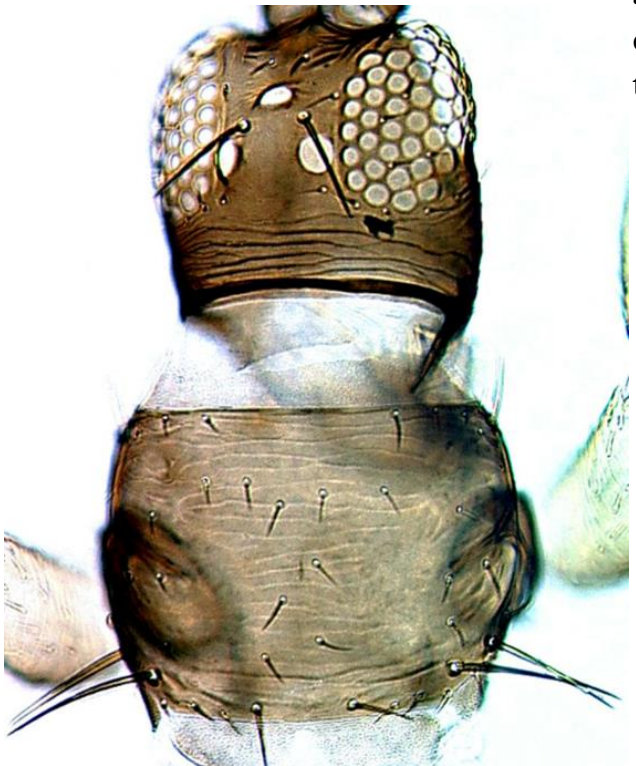
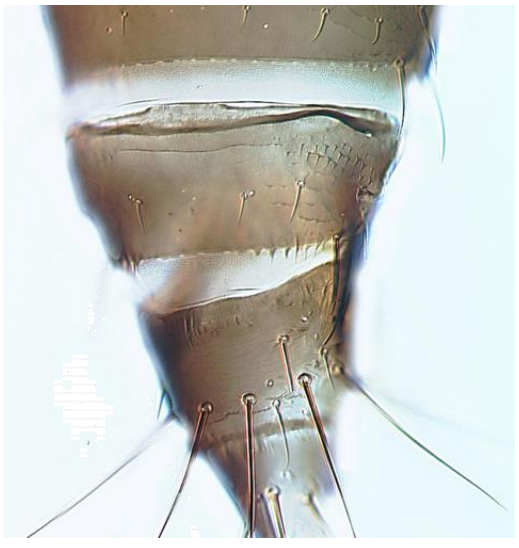
This species was described from Sarawak in 1915. Widespread in Asia tropics from India to Japan, and Australia. Feeding and breeding in white, scented flowers.





Megalurothrips typicus

This species was first described from Sarawak in 1915. Widespread in oriental. Occasionally found feeding and breeding in various plants, particularly Fabaceae family. Members of *Megalurothrips* are commonly associated to crop damage of beans,through feeding in the flowers.

Stream Fauna

Forty-five species of stream fauna comprising fish, crabs, shrimps, snails and larvae of aquatic insects were recorded during the expedition. *Tor douronensis, Lobocheilos bo, Barbodes sealei, Gastromyzon borneensis, Gastromyzon barrio* are among the fish fauna recorded.



Tor douronensis

Ikan Peluan (*Tor douronensis*) is an important source of protein to local communities. Streams of southern Tama Abu Range serve as a spawning site for the fish.





Lobocheilos bo



Barbodes sealei



Gastromyzon borneensis



Gastromyzon bario





This crab (*Sundathelphusa tenebrosa*) is a montane species and its distribution range is restricted to upper reaches of Baram basin.



Isolapotamon borneense is an endemic to upper reach of Baram River, especially high-altitude streams in the Pulong Tau National Park.



A dragonfly nymph, *Macrimia* sp. (Corduliidae), lives in sandy substrates of stagnant water. They are abundant in the pocket of water of the waterfall.



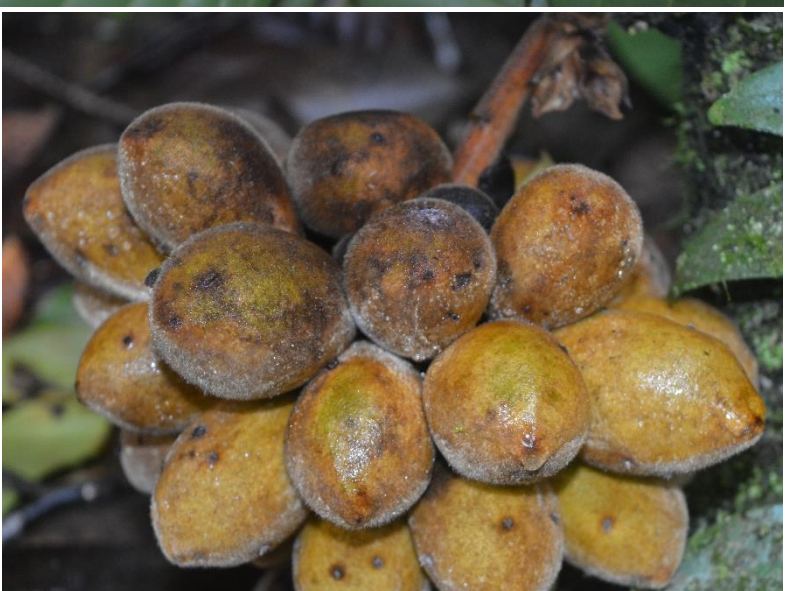
Stonefly nymphs (Perlidae) are commonly found in leaf-packs.



Annonaceae

The soursop family or custard apple family; Annonaceae is the largest in the order Magnoliales. With 230 genera, consisting of about 2500 species, this family is distributed throughout the world, with the majority in the tropics. Annonaceae is diverse in life forms, from shrub or treelet to big tree, up to 60 cm in diameter and many are creepers or climbers. *Artobotrys, Mitrephora, Goniothalamus* and *Polyalthia* are the common genus in Tama Abu PF.







Madhuca (Sapotaceae)



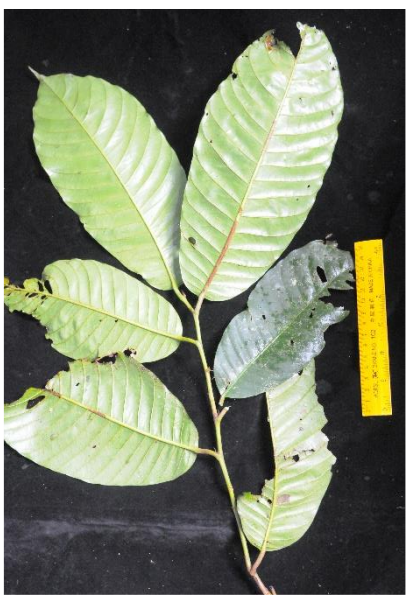
Madhuca is a genus in the family Sapotaceae, first described in 1791. It is native to the south, east and southeast Asia and Papuasia (from India to China, to New Guinea). The genus is moderately large with approximately 100 species recorded.



Four Madhuca species were recorded during the Tama Abu Expedition including one unidentified taxon. *Madhuca sandakanensis* is an endemic to Borneo, recorded from Sabah and Sarawak. In Sarawak, this species was recorded from Kuching, Kapit, Sibut and Bintulu division. The specimen recorded from Tama Abu PF is a new locality for Sarawak.

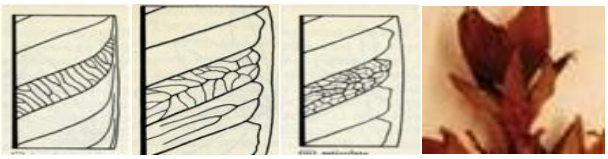


Another two taxa, *Madhuca* cf. *sepilokensis* and *Madhuca* cf. *dubardii* are new records for Sarawak. Previously, *M. sepilokensis* was recorded only from Sepilok, Sabah.





Palaquium (Sapotaceae)



A moderately large genus with more than 110 species has been described, ranging from India, throughout Southeast Asia and towards the Pacific Islands. Most of the species found in Southeast Asia, with Borneo and the Philippines as the epicentre of the species. Locally known as *Nyatoh* (preferred name), *Njotu* (Bid.), *Nyatu* (Bid., Kay.) and *Pulut* (Mur.). Six species have been recorded in Tama Abu PF.



***Palaquium seriaceum* H.J. Lam**

- Endemic to Borneo



***Palaquium kinabaluensis* P. Royen**

- Endemic to Sabah and Sarawak



***Palaquium hexandrum* (Griff.) Baill.**

- Common in southeast Asia



Palaquium dasyphyllum **Pierre ex Dubard**

Known as *Nyatoh Sidang* by the Dusun people in Sabah, this large tree of *Nyatoh* is a new record for Sarawak.



Palaquium gutta **(Hook.f.) Baill.**

One of the most important trees in early 1930s as of gutta-percha latex. Known with many names, *Nyatoh Taban Merah* (Mal.), *Nyatoh Rian, Jangkar,* and *Jangkar Merah* (Ib.). Fairly common in Sumatra, Peninsular Malaysia and Borneo. Frequently found in MDF, kerangas and limestone forest. A new record for Tama Abu PF.



Palaquium leiocarpum **Boerlage**

Locally known as *Nyatoh Tembaga* in Sarawak due to the colour of underneath leaf surface. Distributed in Sumatra, Peninsular Malaysia, Borneo and Sulawesi.





Payena (Sapotaceae)

Payena (synonym: *Ceratophorus*) is a flowering plant genus in the family Sapotaceae. The genus was first described by Alphonse Pyramus de Candolle in 1844. The distribution is restricted to Southeast Asia and Borneo as a centre of species distribution.









Payena microphylla (de Vriese) Pierre

Payena microphylla is endemic to Borneo that can be found throughout the island. It is an upper canopy tree up to 46 m tall and can reach over 100 cm in diameter. Locally known as *Nyatoh Hitam* or *Nyatoh Pulut*.



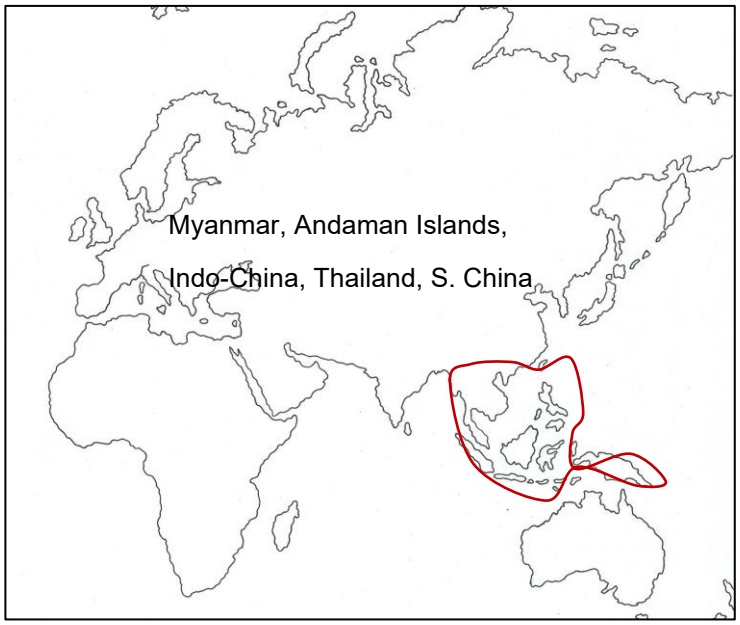


Payena obscura Burck



Ridsdalea (Rubiaceae)

The Asian genus, *Ridsdalea* Pereira & Wong is a member of tribe Gardenieae, subfamily Ixoroideae belonging to the family Rubiaceae (Coffee family). This genus is distinguished from the African genus, *Rothmannia* by its corolla lobes contorted to the left while the lobes in *Rothmannia* are contorted to the right. The genus name is given after the late Colin Ridsdale, a botanist who worked on the Rubiaceae family (e.g. revision of the genus Uncaria)





which consists of 30 spp. Distributed in mainland Asia and the Malay Peninsula into East Malesia (Wong & Pereira, 2016). There are four species in Borneo and three of them are recorded in Sarawak. During this expedition, only one species was recorded in Tama Abu areas; *Ridsdalea pseudoternifolia.*





Sterculia **(Malvaceae)**

The genus *Sterculia* or locally known as *Kembang Semangkok,* is a genus in the Mallow family, Malvaceae. It is a moderately large genus with more than 90 species have been described with mostly are moderate to large tree. At least four species have been recorded in the Tama Abu PF.



Clerodendrum (Verbenaceae)

Moderately large genus about 150 – 450 species, distributed throughout tropics. *Clerodendrum* is a genus of flowering plants in the family Verbenaceae, commonly known as a bleeding-heart flower or *Bunga Pagoda.* Most of the members in this genus are shrubs, treelets or lianas, usually growing up to 1 – 3 m tall and 30 m long for climbing species. The inflorescence is usually terminal, pagoda-like shaped with bright coloured flowers. About seven species are recorded in Sarawak and two species have been recorded in Tama Abu PF.





Litsea (Lauraceae)

Litsea is a genus of evergreen or deciduous plant belong to the Lauraceae family. There are approximately 135 species in the genus with majority are found in the tropics and subtropics. Among the species that found in Sarawak are *Litsea cubeba* and *Litsea graciae.* There are five *Litsea* species were recorded during this expedition.



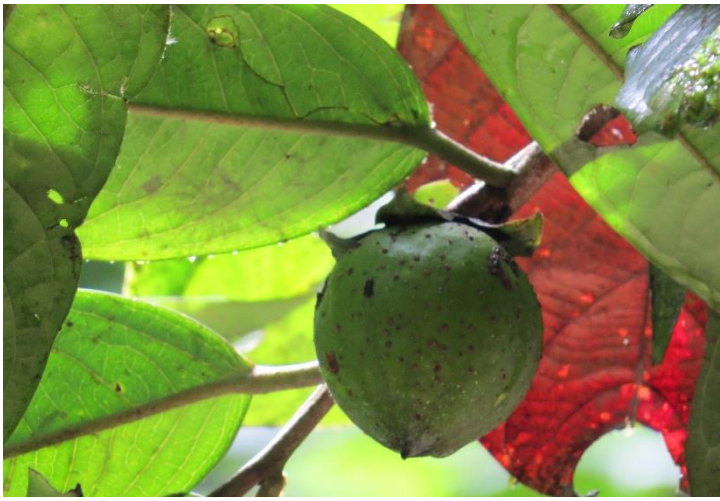


Aphanamixis (Meliaceae)

Aphanamixis is a genus of 36 species belonging to the Mahagony family, Meliaceae. This genus occurs in the tropics and subtropics of Southeast Asia, the Pacific Islands and northern Australia. Some are important as a medicinal plant and few with edible fruits. One unidentified *Aphanamixis* species was recorded during the expedition.



Diospyros (Ebenaceae)



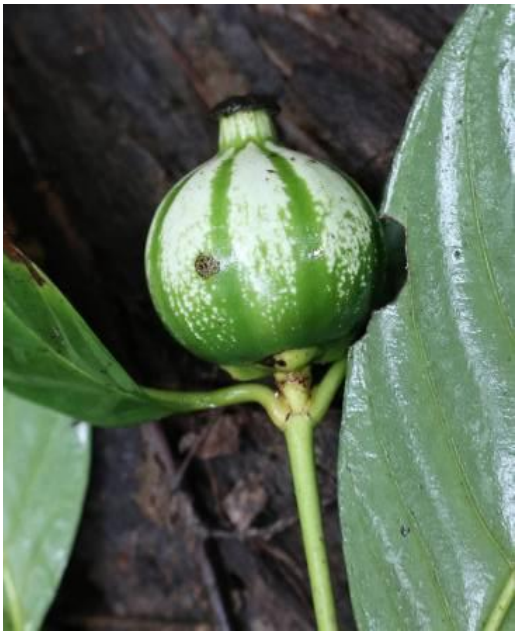
Diospyros is a large genus in the Ebenaceae family, with more than 1000 names have been recorded (including synonym). Known as *Ebony* or locally as *Kayu Malam*. Most of the species are native to tropics. At least eight species were recorded in Tama Abu PF.



Octomeles sumatrana (Tetramelaceae)

The genus *Octomeles* is a monotypic genus of the family Tetramelaceae. *Octomeles sumatrana* is the sole species in the genus that is found in Borneo, Papua New Guinea and the Philippines. The tree is dioecious and large, reaching up to 75 m tall. It is a pioneer species that occupies disturbed habitats such as secondary and logged-over forest. Locally known as *Benuang,* this tree species has a great potential as a plantation tree in the future.

Garcinia myristicifolia (Clusiaceae)



Garcinia is a large genus in the family Clusiaceae that is native to the tropical and Polynesia region with approximately 400 species have been described. Most *Garcinia* species are eaten locally. *Garcinia myristicifolia* is an endemic species to Borneo, recorded from the north east part of the island.

Ixora (Rubiaceae)



Ixora is the only genus in the tribe Ixoreae in the family Rubiaceae. There are about 562 species in the world with many of them now become a popular ornamental plant. Locally known as *Bunga Siantan* or *Bunga Jarum.* At least four species of *Ixora* were recorded in the Tama Abu PF.







Ficus (Moraceae)

Ficus, with more than 850 species throughout the world, is the most complicated genus in the Moraceae family. They are varied in lifeform, mostly are woody tree, but some are shrubs, epiphytes, hemi-epiphytes or struggling vines. Collectively known as “fig tree” or in Malaysia and Indonesia, it is known as “ara” or “kara”. They are native to the countries of the tropics and extending to semi-warm temperate zones. The most common species is *Ficus carica* or known locally as “*Buah Tin”*, planted in many countries for economic purposes.





The specific identification of many species in this genus can be difficult, but the genus is relatively easy to identify. Many of the species have aerial roots and a distinctive shape or habit, and their fruits can distinguish them from other plants. The fig fruit is a syconium fruit type, where the inflorescence is enclosed by the fruit.

The fruit of most of the species are edible, usually only local economic importance are eaten as bushfood. However, they are extremely important food resources for wildlife. In Sarawak, all the *Ficus* species are protected under the National Park and Wild Life Ordinance 1998.





At least 15 *Ficus* species were recorded in the Tama Abu PF during the expedition. The number, however, is considered low compared to its nearby site, Long Banga with about 25 species recorded.





Mapania (Cyperaceae)

The family Cyperaceae comprises two subfamilies, Mapanioideae and Cyperoideae. Two tribes are assigned under Mapanioideae, namely Hypolytreae and Chrysitricheae. *Mapania* Aubl., a genus in tribe Hypolytreae contains a group of mostly forest-dwelling sedges which are widely distributed throughout the tropics. Borneo and Peninsular Malaysia are considered to be centres of diversity for *Mapania* with 25 and 16 species recorded, respectively and new species continue to be discovered. The number of *Mapania* in Sarawak has drastically increased to 43 taxa with many new species discovered in recent years.



Mapania wallichii





Possibly a new *Mapania* sp.

Locally known as *Ieee* by the Saban people of Long Banga or *Ra'ah* by the Penan of Tama Abu, *Mapania* species is not a popular plant collected by botanists or plant collectors due to its unattractive appearance or due to the difficulty in handling the plant (leaf with sharp prickles), as well as the hardship of preparing the plant for herbarium specimen (due to its bulkiness). Tama Abu is considered fairly rich in *Mapania* species. Nine taxa were identified from the collection, including one unusual taxon.





Mapania squamata





Mapania debilis

Nepenthes reinwardtiana

Nepenthes reinwardtiana is a tropical pitcher plant native to Borneo and Sumatra. Occupying in a wide altitudinal distribution from sea level up to 2200 m above sea level, particularly as terrestrial on infertile soils or as epiphyte or scrambling on the trees. Being both lowland and highland dweller, *N. reinwardtiana* has many different colour forms, from light green to dark green. The key character for this species is the presence of two glandular "eye spots" inside the surface of its pitchers.







WILD ORCHIDS

Borneo is one of the world's great centres for orchid diversity that grow epiphytically, lithophytically, terrestrially, or saprophytically in the forests. Concentrated on the highland forest of Borneo, there are more than 1,700 species of orchids, all of which have a very high economic value and some are being used medicinally. These species are endangered and may have not yet been found or discovered, because of the loss of habitat attributed to progressive anthropogenic forest destruction in the lowland and hill forest areas in the central region of Borneo.



The scientific expedition had collected a total of 129 orchid specimens. These specimens were identified to 117 species and 47 genera, represented mostly by Epidendroideae subfamily (115 species, 98.3%), where this also portraits the high abundance of epiphytes (111 species, 94.9%). The remaining 15 species (12.8%) were found living terrestrially, including six species (5.1%) were saprophytes that lived on decaying organic matter or humus.

Aphyllorchis pallida (mycoheterotrophy orchid)





Dendrobium bancanum



Dendrobium rosellum



Dendrobium tetrachromum



Dendrobium villosulum



*Dendrobium appendiculatum**

*new record to Tama Abu PF

Tania scapigera



The genus *Tania is* commonly known as the "Ribbon orchid", is a small genus of about 30 species, distributed from India, China, Japan and Southeast Asia. *Tania scapigera* is one of the endemic species to Borneo.







Phaius indigoferus

Terrestrial or lithophyte in the hill to montane forests. Distributed in Thailand, Java, and Peninsular Malaysia (unspecified). **Notes:** This species has also been found in Long Banga (unpublished).



Appendicula anceps



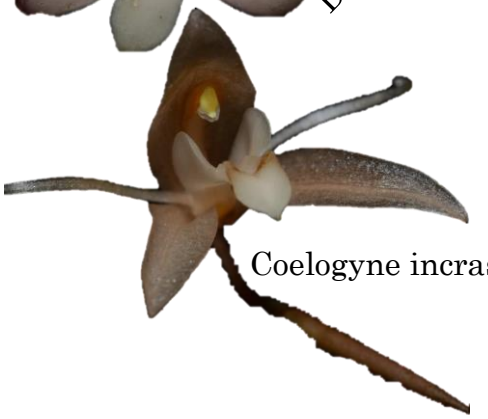
Appendicula torta



Appendicula pendula



Dipodium scandens



Coelogyne incrassata



Bromhedia rupestris



Cleisostoma discolor







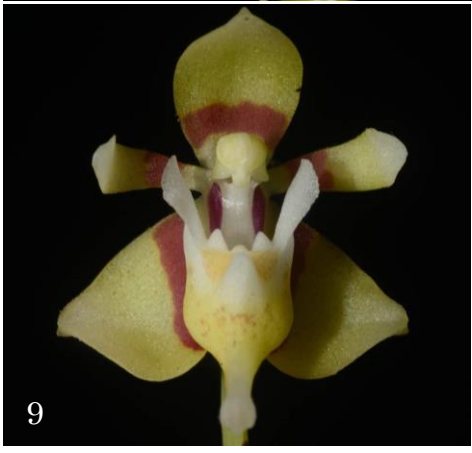




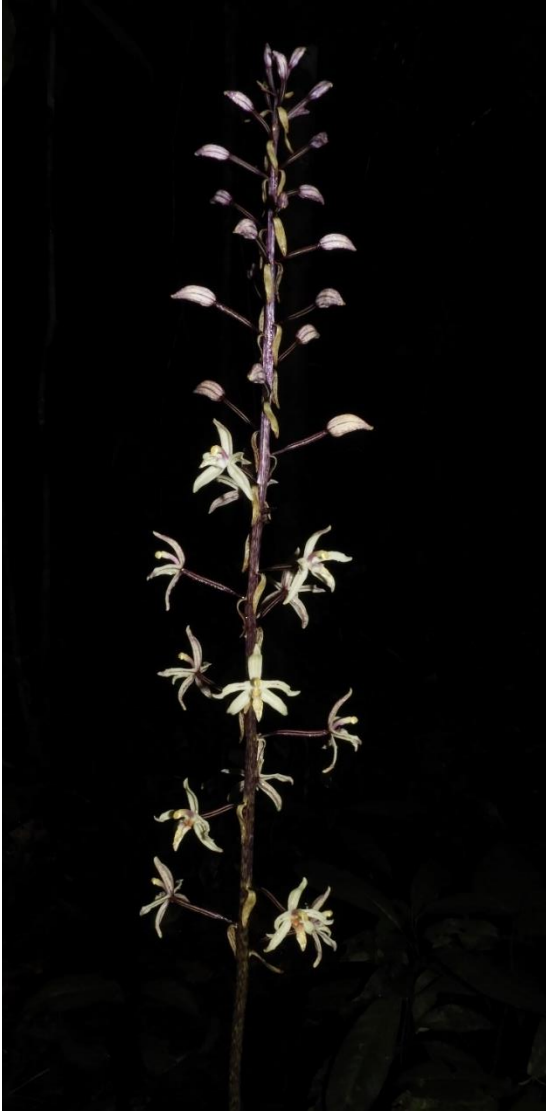








1. *Trichotosia brevipedunculata*; 2. *Robiquetia transversisaccata*; 3. *Cleisostoma racemiferum;* 4. *Plocoglottis javanica*; 5. *Liparis cespitosa*; 6. *Liparis condylobulbon*; 7. *Tropidia saprophytica*; 8. *Cystorchis variegata* var. *variegata*; 9. *Pteroceras fragrans*





Aphyllorchis montana

A small mycoheterotrophic orchid on the forest floor, about 45 to 85 cm (rarely more than 1 m). This is species is solitary (rarely in clump), having a whitish stem with purple stripes. The inflorescence has over 30 flowers (± 10 flowers open at a time), and bloom in succession. The lowers are large and showy, about 2.5 cm wide when open white in colour with purple marked and stripes on sepals and petals. It can be found on the damp and wet forest floor with full leaf litters. Wide distribution, from Assam, India, Sri Lanka, Indo-China, China, Japan, Taiwan, throughout Southeast Asia and New Guinea.



Aphyllorchis palida

A mycoheterotrophic orchid usually grows in clump and small, not more than 30 cm tall. Its inflorescence is on top of the plant, with more than 20 flowers (opening 1–3 at a time) which open in succession. The flowers are small, 5 mm wide, white in colour with purplish stripes on sepals and petals. A common species found in Tama Abu. It has wide distribution in Southeast Asia.





Cystorchis saprophytica

A small mycoheterotroph orchid, about 10 cm tall, with a brownish stem. Its inflorescence is closely arranged on top of the plant, with 4-flowers open at the same time. The flowers are brownish and yellowish colour. Found on damp and wet place, but not common. This species is endemic to Borneo. The specimen collected from Tama Abu is a second record for Sarawak. The very first collection was from the nearby location, collected during the Long Banga HoB scientific expedition.

Lecanorchis multiflora

A small mycoheterotrophic orchid, about 50 cm tall with very slender black stem and branching. The inflorescence is on the upper part of the stem, with few to many flowers opening in succession. Flowers are about 1 cm wide, with white hairy lip, and the other parts are brownish. Grows on damp and humid place, especially near streams or riverbank. This species is widely distributed in China and throughout Southeast Asia.



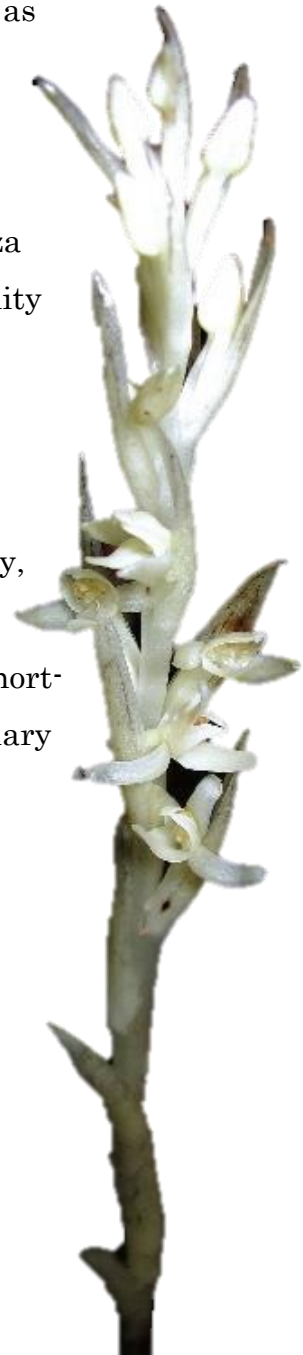




MYCOHETEROTROPH PLANTS

The flora of Borneo is very diverse in mycoheterotroph plant species due to its rich vegetation, high precipitation and high temperature, however, these plants are very small and easily over-looked.

Mycoheterotroph plants are sometimes mistakenly called as saprophyte, but only fungi are true saprophyte as they can utilize dead organic material directly.
Mycoheterotroph plants are partly or entirely non-photosynthesis plants that parasitise food from mycorrhiza fungi that grow on its roots (Merckx et al. 2009). This ability to obtain food from associated fungi (the host) is termed mycoheterotrophy. It is a symbiotic relationship.





Many plants are capable of mycoheterotrophy, including liverworts, lycophytes, ferns, and angiosperms. These interesting plants are tiny, short-lived, above ground and thrive well in lowland primary rainforest (mainly near water sources).



BURMANNIACEAE

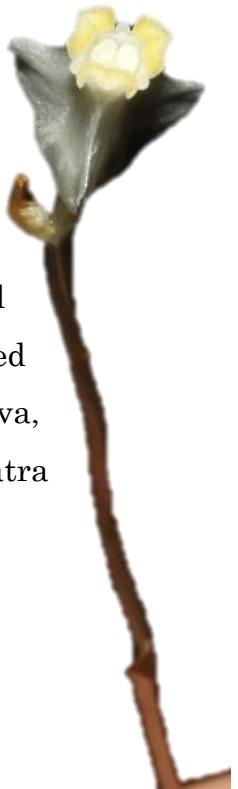
Burmannia championii

A small mycoheterotrophic plant, *c.* 10 cm, whitish in colour. The inflorescence is arranged at the apex of the stem, with eight flowers. This species grows on damp and wet place, near the stream. Only one specimen was collected from Tama Abu. This species is widely distributed, from India, Sri Lanka, Nicobar Island, Indo-China, Taiwan, China, Japan, Korea, New Guinea and throughout Southeast Asia.

Burmannia lutescens

A small mycoheterotrophic plant, about 9–15 cm tall. Its inflorescence has 1–4 whitish flowers with yellowish outer tepals. Usually found abundant in pristine MDF or highland kerangas forest, with high humidity. Frequently found near to the water sources. This species is common and widely distributed throughout Borneo. Also recorded in Bismarck Archipelago, Java, New Guinea, Sulawesi, Sumatra and Peninsular Malaysia.





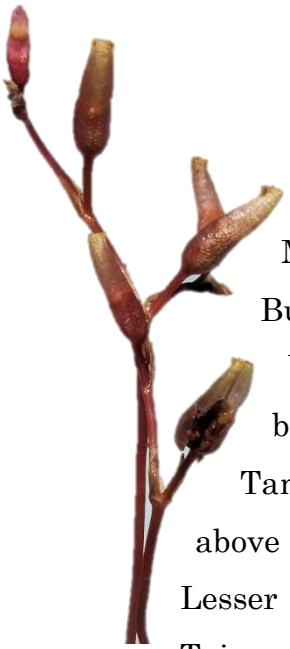


Genus Thismia

A small genus, *Thismia* is among the poorly-known mycoheterotrophic plant on the forest floor of Borneo. Placed under the family Burmaniaceae (some botanists maybe still treated it as Thismiaceae), the *Thismia* are achlorophyllous herbs, where the leaves are much reduced and they are not green. Only seven species have been named from Sarawak.

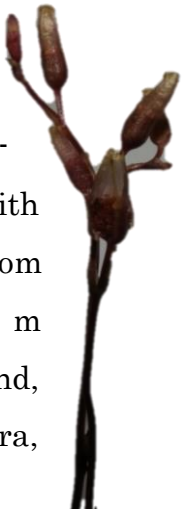
Undescribed Thismia species.





Gymnosiphon

Mycoheterotroph plant from the family Burmanniaceae, small, about 10 cm tall, with a red-brown stem. Inflorescence on top of the plant, with brownish-red flowers. Only one specimen collected from Tama Abu in Kerangas forest at an elevation of 1000 m above sea level. Distribution recorded in Caroline Island, Lesser Sunda Island, New Guinea, Sulawesi, Sumatra, Taiwan, Thailand, Peninsular Malaysia and Borneo.





POLYGALACEAE

Epirixanthes confusa

Leafless tiny plant, up to 15 cm tall with branching purple stem. Bract development persist even after fruit maturation, no bracteole and having pointed inflorescence apices. Flowers are small. Grows mainly on damp and wet places near to water sources or large boulders and steep slopes. This species was first described from Imbak Canyon Conservation Area of Sabah, and it is endemic to Borneo. Frequently found in abundant and this species is one of the common species in Tama Abu.





Epirixanthes elongata



Small mycoheterotroph, about 15 cm tall with purple branching stem. The inflorescence is compact, imbricate on top of the plant. The floral bract is caducous, dropped when flowers turned into fruits. Flowers are white. Abundant in Tama Abu PF. Wide distribution from India, Indo-China, China and throughout Southeast Asia.



Epirixanthes kinabaluensis

Small plant, about 10 cm tall (rarely more than 15 cm) above ground with branching stem. The inflorescence is compact, imbricate, with yellowish brown flowers. Flowers are small, less than 1 mm wide when open. Distribution is restricted to Sumatra and Borneo. Common in Tama Abu. This species can be found grows side by side with *E. confusa.*







Epirixanthes papuana

A tiny species, about 10 cm tall above ground, with yellowish brown stem and branching on top. The inflorescence is short, compact andimbricate. Flower bracts are caducous, yellowish brown in colour with tiny white flowers. This is the first record for Sarawak. It is distribute in Southeast Asia and Solomon Island.

TRIURIDACEAE

Sciaphila winkleri

Small mycoheterotrophic plant, about 12–15 cm above ground, with purplish stem, branching on top. The inflorescence is on top of the stem, with purplish female flowers below and male flowers at apex. Female flower's carpel is about 2 – 3 mm wide, with 6 purplish tepals. The male flower is smaller, with three anthers. Fruits are about 4 mm wide, berry-like, pinkish in colour. Recorded from mossy kerangas forest at an elevation of 1200 m above sea level. This species, so far, is only recorded from Borneo and New Guinea.

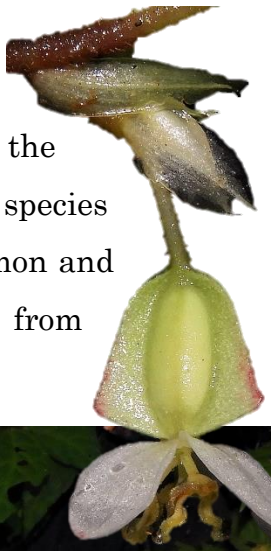




BEGONIACEAE

Preliminary result identified eight species of *Begonia* from Tama Abu PF. These include *Begonia fuscisetosa* Sands, *B. papyraptera* Sands, *B. magentifolia* Kiew & S.Julia and five unnamed taxa.





Begonia fuscisetosa

Begonia fuscisetosa is one of the most common and widespread species in Borneo. It is the most common and abundant species recorded from Tama Abu PF.



Begonia magentifolia

Begonia magentifolia was first described from Gunung Mulu National Park where it grows in lowland forest at the elevations up to 140 m. At Tama Abu PF, the species can be found in hill forest up to 900 m elevation. Two colour forms of *B. magentifolia* were observed; one with leaf colour green above and pale green below; the other bronzy green above and magenta below. Its fruit is commonly found with three well-developed wings and three small wings. This is unusual in Bornean *Begonia* that usually has three wings but it is known from a very few species.







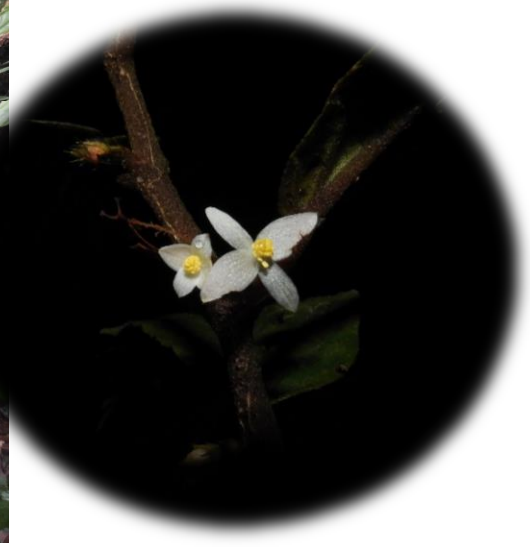


Begonia papyraptera

This species is previously only known from Brunei, but recently discovered from Long Banga and Tama Abu PF. It is a beautiful *Begonia* with a robust, succulent and angled stem. The juvenile usually has whitish or silvery spots on the stem??? that sometimes disappear on adult individuals.







Begonia sp.4





Begonia sp.5





Begonia sp.6

Arisaema filiforme (Araceae)

The cobra lilies plant or locally known as *Keladi Lidah Naga* (Penan) is a widespread species in Southeast Asia. There are approximately 180 species throughout the world. *Arisaema filiforme* is the most common species in Sarawak, frequently found as lithophytic on the rock surface or thick humus in wet forest.





Schismatoglottis (Araceae)

A moderately large genus of Araceae family with more than 110 species has been described. Borneo is the epicentre of the species with 80% of the total number recorded. Small to large, usually terrestrial (sometimes rehophytic) evergreen herbs. At least more than 10 species of *Schismatoglottis* were recorded in Tama Abu PF.







Hexatheca (Gesneriaceae)

A small genus in the Gesneriaceae family, most is a terrestrial shrub or lignescent herbs. The name *"Hexatheca*" refers to the curious organisation of the androecium: the anterior stamens are bithecous, the posterior one monthecous; thus the androecium as a whole has six thecae. One unidentified species was recorded from Tama Abu PF.





Loxocarpus (Gesneriaceae)

A small genus in the Gesneriaceae family, consisting of about 20 species distributed in Sumatra, Peninsular Thailand, Peninsular Malaysia and Borneo. Most of the species in this genus are previously placed in the genus *Henckelia.* This genus is the most diverse in Sarawak with seven species (out of nine for Borneo) recorded, including three recently described species.





Elatostema (Urticaceae)

Elatostema is a large genus containing about 350 species native to the tropics forest of Asia, Australia and Africa. This genus is one of many little-known forest's dwelling-herb in Borneo. They are commonly found on the forest floor or lithophyte on the rock surfaces, in damp and wet places particularly near to the water sources.







Piper (Piperaceae)

Piperaceae is a large family of flowering plant with approximately 3600 species from 13 genera. The majority of the members in this family are from the two genera; *Piper* with about 2000 species and *Peperomia* with 1600 species. Commonly known as "pepper" or "*Lada Hutan*". Members of Piperaceae are small trees, shrubs and herbs.

The best-known species is *Piper nigrum,* which yields peppercorns that are used as spice. In Borneo, it is estimated about 200 species of wild *Piper* with the majority of them are vines or climbers, only a few species are shrub or small trees (e.g. *Piper aduncum*). The number of wild *Piper* in Sarawak is still unknown, although this group is the most common plant species found in the forest. At least 15 species were estimated in the Tama Abu PF.







ZINGIBERACEAE

Genus Etlingera

The genus Etlingera is an Indo-Pacific genus, commonly found from sea level to 3000 m altitudes and occupying in many types of habitat. For example, mangrove forest (e.g. epiphytic ginger - *Hedychium borneense* and *Amomum borneensis*), peat swamp forest, kerangas, limestone, secondary forest, montane and sub-montane forest etc.

The genus *Etlingera* has been extensively worked on recently, with over 30 new species identified from Sulawesi alone and probably between 150 and 200 species altogether within the genus (Poulsen, 2012). Borneo is also exceptionally rich for this genus, with 40 species have been documented and 30 species are found in Sarawak.



Etlingera longipetiolata



Etlingera brevilabrum



Etlingera brachychila



Etlingera otiolophos

Most of the *Etlingera* species are ethnobotanically important. *Etlingera elatior*, the torch ginger or locally known as "Kantan" or "Kenchala" is the most common *Etlingera* used by many ethnic in Sarawak as a food flavouring.









Genus Globba

Globba is a member of gingers family and is considered as an important understory plant in the tropic forests. They are unlikely to be misidentified because they are small herbs on the forest floor with strange-looked flowers. The inflorescence of *Globba* is terminal on the leafy shoot. However, sometimes also encountered at the terminal on a separated leafless shoot. The filament and style are long exerted and arched like a bow and at the end of anthesis, the style becomes free, forming a bowstring. The generic name is based on Indonesia's word, *galoba* - a spice from Ambon (but some said that *galoba* might be referred to genus *Etlingera*).

Globba atrosanguinea and *G. muluensis* are the two most common species found in the Tama Abu PF.





Genus *Plagiostachys*

A small genus in the family Zingiberaceae with approx. 25 species have been estimated in Borneo. Ten species have been recorded from Sarawak and four species in Tama Abu PF. *Plagiostachys corcydocalyx* is common in the secondary forest and along the logging road to the HoB expedition site. *Plagiostachys strobilifera* is found dwelling in the deep shaded forest, and two unidentified species were recorded. The Latin word "*plagiostachys*" means inflorescence borne from lateral, is one of most projecting characteristic for the species in this genus.











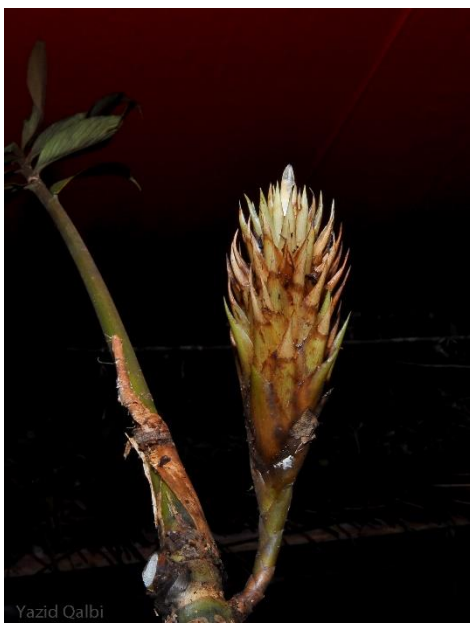


Amomum complexes

Amomum, as previously perceived, was diverse in morphology, habit, inflorescence and capsule.hylogenetic studies have shown the genus to be paraphyletic (Xia et al. 2004; Kress et al. 2007; De Boer el at. 2018). Based on molecular analysis and field characteristics, the genus *Amomum* and its allies are now have been resolved. *Conamomum, Meistera* and *Wurfbainia* were resurrected and three new genera *Epiamomum, Lanxangia* and *Sundamomum* were described to accommodate the species in the *Amomum* complexes. At least six *Sundamomum* species, three *Sulettaria* species, two *Amomum* species (previously under the genus *Elettaria*) and one undescribed *Epiamomum were* recorded from the Tama Abu PF.

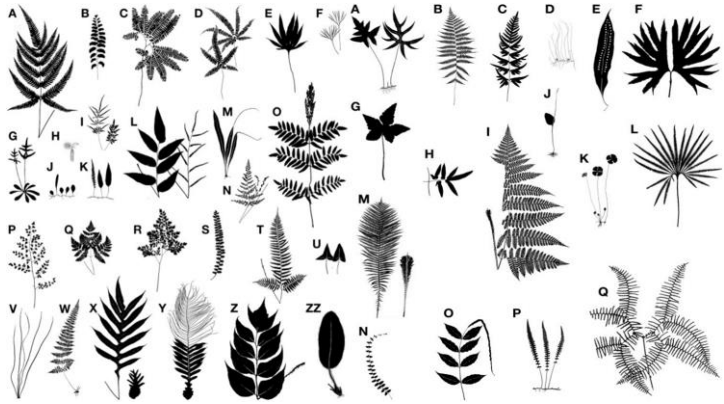


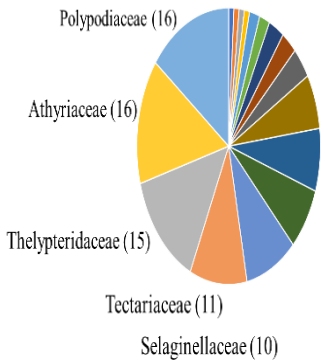


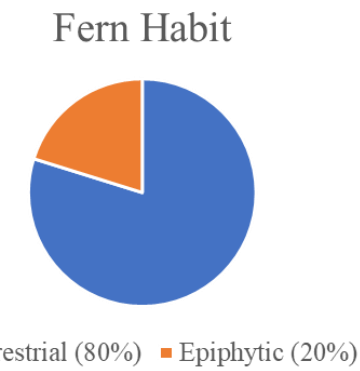


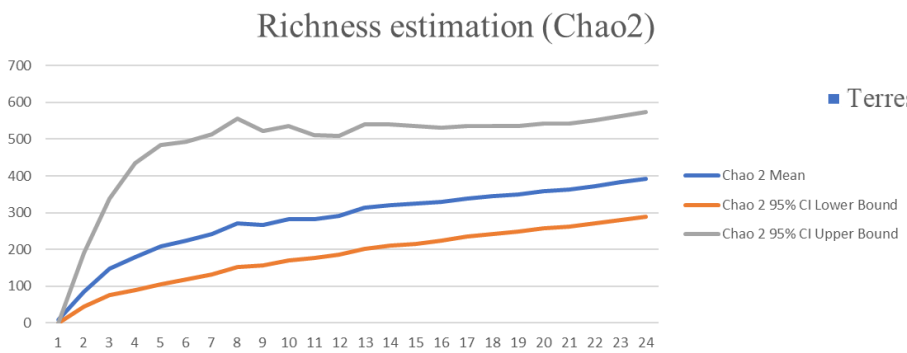
Ferns and Fern-allies

Total species diversity: 109
Total Family diversity: 17





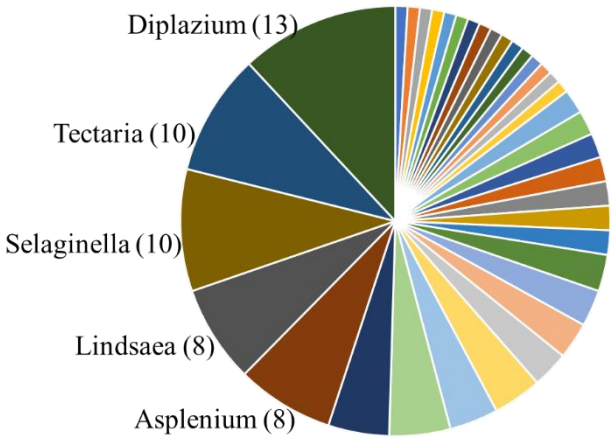




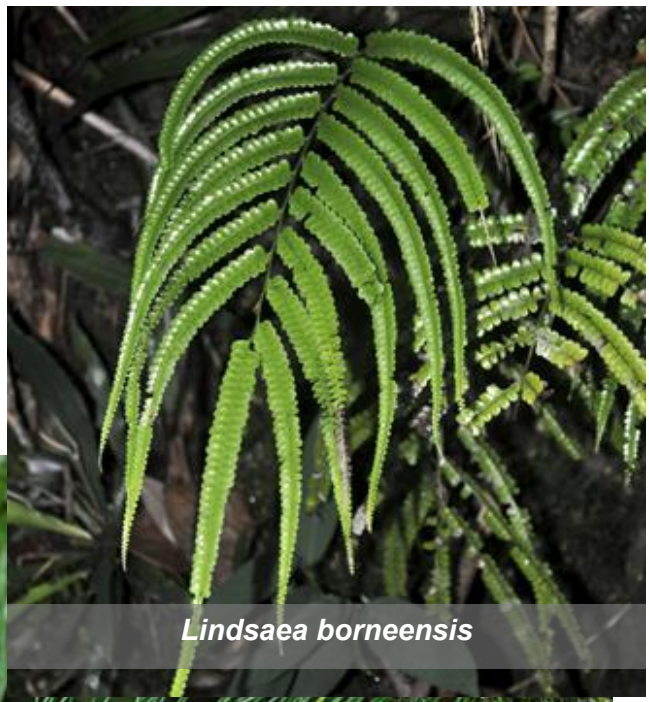

Terrestrial fern

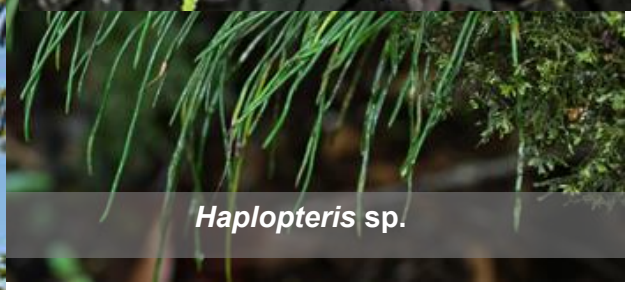

Epiphytic fern

Fern Genera diversity: 36




***Diplazium* sp.**


Lindsaea borneensis


***Haplopteris* sp.**


***Cyathea* sp.**

Mosses

This is the first-ever bryological excursion to this area. A total of 130 species in 66 genera and 26 families of mosses were collected during the Tama Abu Scientific Expedition, a Heart of Borneo (HoB) Sarawak Project. Four major moss families were recorded viz. Calymperaceae (22 spp; 16.92%), Sematophyllaceae (21 spp.; 16.15%), Hypnaceae (15 spp.; 11.54%) and Hookeriaceae (13 spp.; 10%). Off the total, two species were reported as a new record to Borneo and 5 species as a new record for Sarawak.



New Record for Borneo

Microctenidium levelleanum

Distribution: Java and Peninsular Malaysia

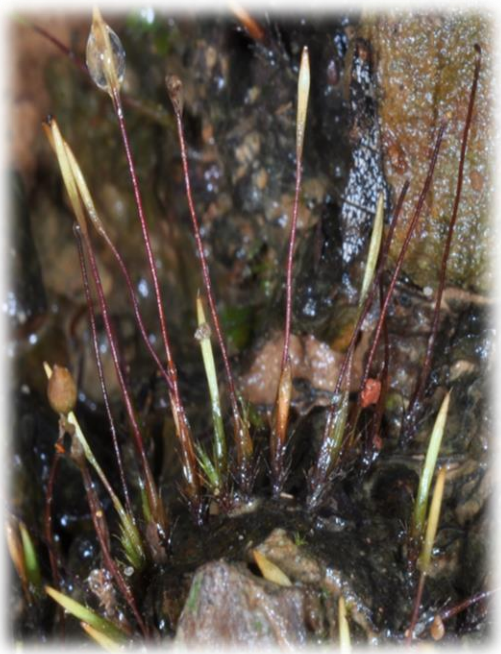
Habitat: Tiny plant growing on the branches

Note: This handsome species is characterized by having pinnate branches that are neatly arranged on the creeping stem.

Pogonatum petelotii

Distribution: Vietnam and Thailand

Note: The first-ever collection outside mainland Asia. Characterized entire leaves with round apices.

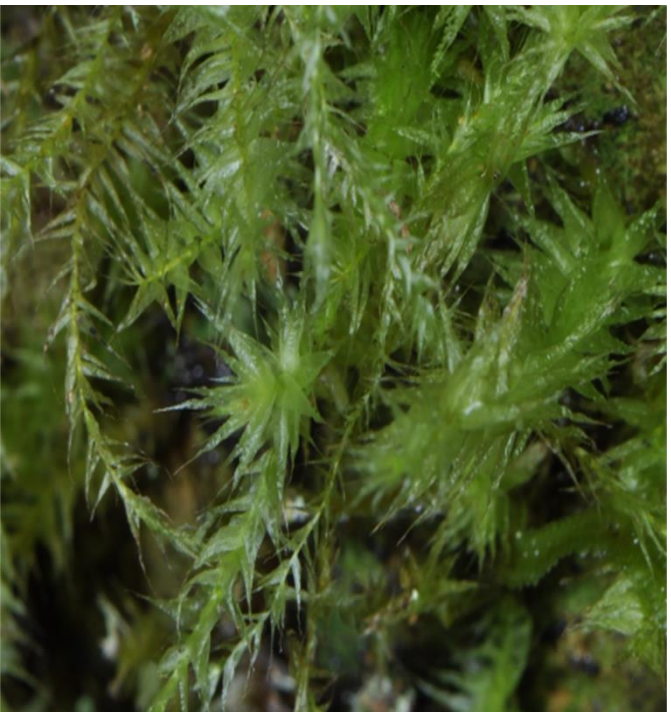




New Record for Sarawak

Barbella convovens

Distribution: Sri Lanka, India, Sikkim, Thailand, Laos, Sumatra, Java, Sulawesi and Borneo.



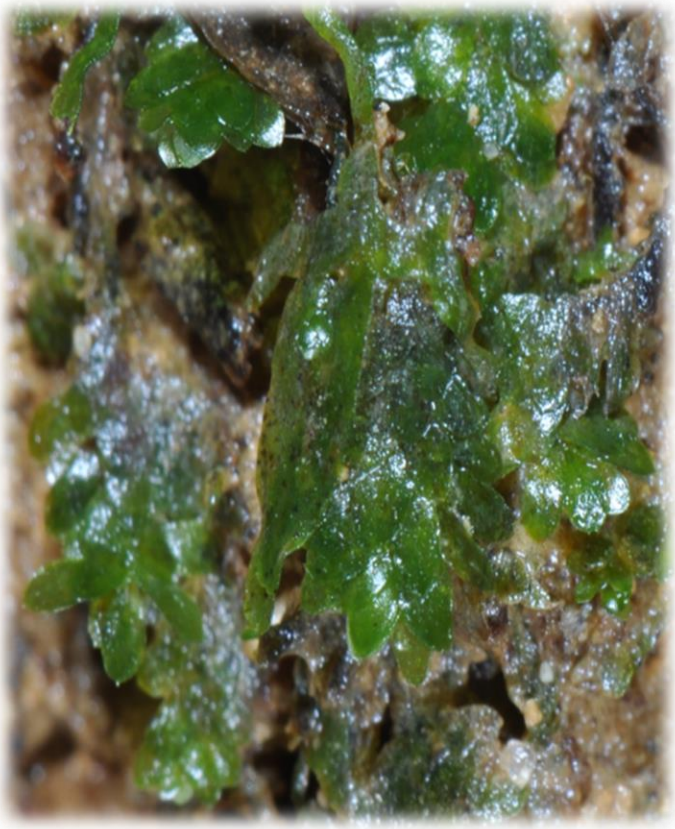
Barbella flagellifera

Distribution: Sri Lanka, India, Myanmar, Thailand, Vietnam, Taiwan, Japan, the Philippines, Papua New Guinea and Borneo.
Note: pendulous, hanging on branches.



Distichophyllum angustifolium

Distribution: Sulawesi, Borneo and Peninsular Malaysia
Note: gregarious, often on wet rocks or boulders, by the fast-running stream.



Distichophyllum nigricaule

Distribution: Thailand, Java, Peninsular Malaysia and Borneo

Note: often growing on wet soil. Characterized by the tan or black coloured stem and branches.



Mitthyridium fasciculatum **subsp. *cardotii***

Distribution: Borneo, Peninsular Malaysia and the Philippines

Note: an epiphytic, collected on the trunk of an emergent tree.

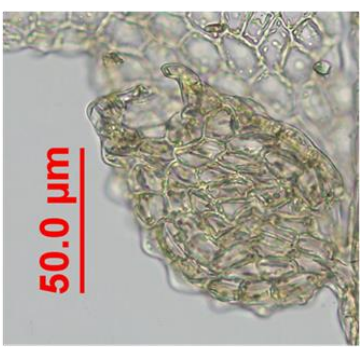
Liverworts: Genus *Drepanolejeunea*

Fifteen days were spent at Tama Abu lowland forest during the expedition. Nine locations from the scientific sites were explored. The locations include trail 2, 5, 6, 7, 13 and other three sites (Long Peluan, Sebu'ah river, and the base camp). During the exploration, 177 liverworts specimens (23 hepatic species and 1 hornwort; other specimens were identified to generic level) were collected. The specimens were collected from tree bark, tree trunk, and leaves. Only three *Drepanolejeunea* species were collected during the expedition.



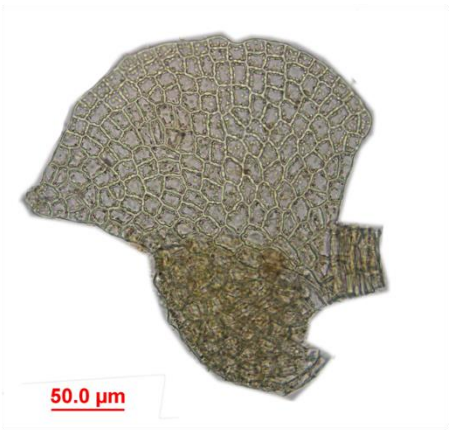


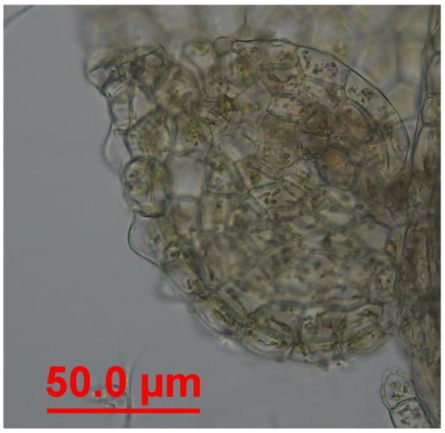


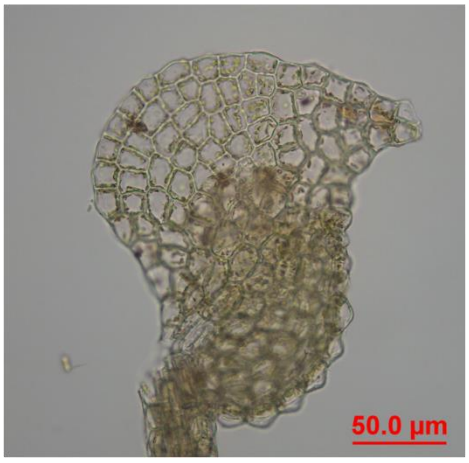


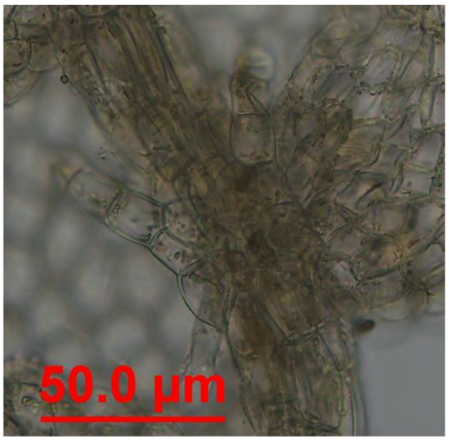
Drepanolejeunea ternatensis. A. Ventral plant (left); (from top to bottom) B. Dorsal lobe. C. Ventral lobe. D. Lobule.





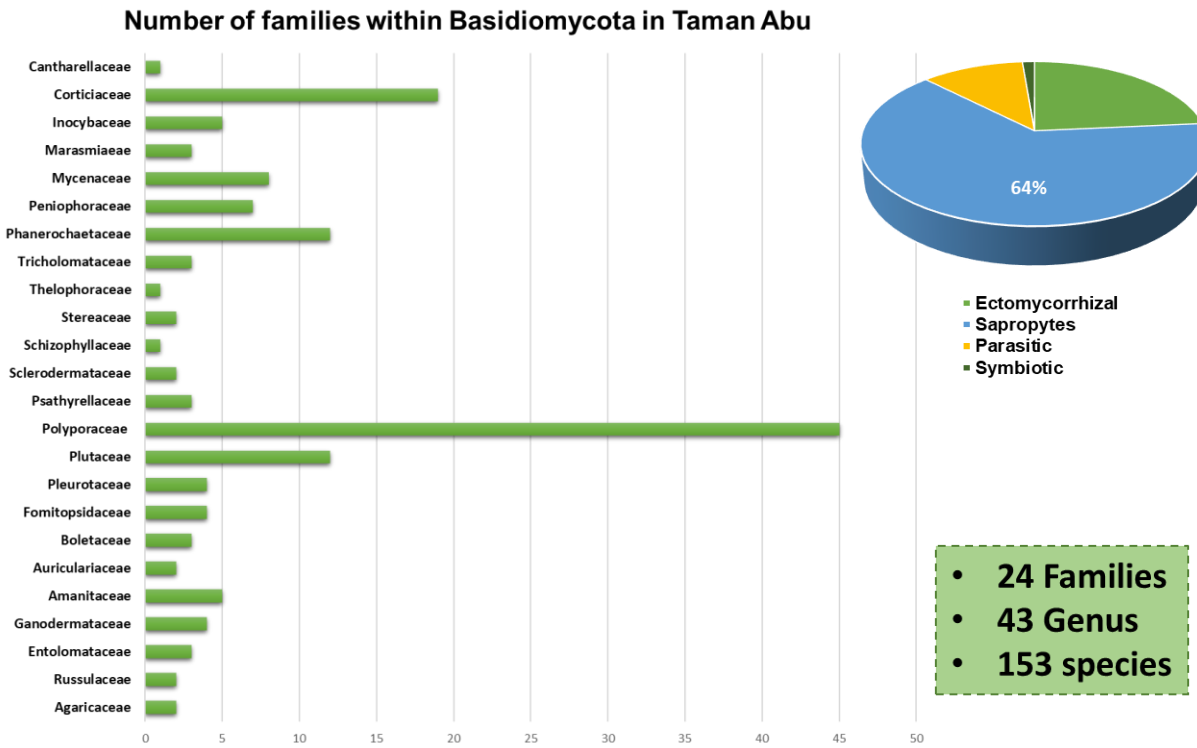






Drepanolejeunea vesiculosa. (left top to bottom) A. Ventral plant. B. Dorsal lobe. (right top to bottom) C. Lobule. D. Ventral lobe. E. Under leaf.

Macrofungi


Number of families within Basidiomycota in Taman Abu
Cantharellaceae
Corticiaceae
Inocybaceae
Marasmiaeae
Mycenaceae
Peniophoraceae
Phanerochaetaceae
Tricholomataceae
Thelophoraceae
Stereaceae
Schizophyllaceae
Sclerodermataceae
Psathyrellaceae
Polyporaceae
Plutaceae
Pleurotaceae
Fomitopsidaceae
Boletaceae
Auriculariaceae
Amanitaceae
Ganodermataceae
Entolomataceae
Russulaceae
Agaricaceae
0
5
10
15
20
25
30
35
40
45
50
64%
Ectomycorrhizal
Sapropytes
Parasitic
Symbiotic
• 24 Families
• 43 Genus
• 153 species


















11/28/2011





Sarcoscyphaceae: *Cookeina* in Borneo

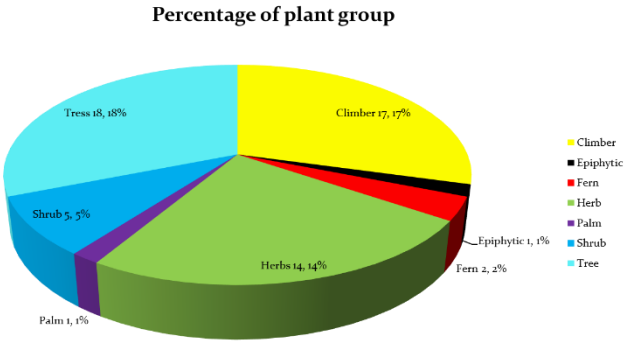


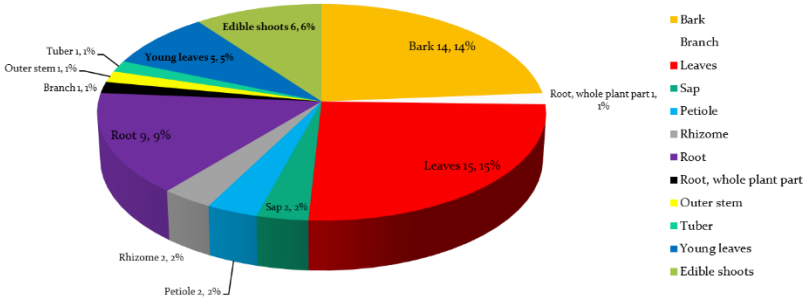
Medicinal Plants - Penan Community

Objective: -

- To document the medicinal plants at Tama Abu Permanent Forest that are used by the Penan community of Kampung Long Beruang.

A total of 58 specimens from 35 plant families and 15 genera were recorded. Among the plant families recorded were Arecaceae (5 genera), Zingiberaceae, Araceae and Lauraceae with 4 genera each, Piperaceae and Rubiaceae (3 genera), Asteraceae, Gesneriaceae Fabaceae, Menispermaceae and Olacaceae (2 genera), and the rest of families recorded with only a single genus. Most of the plants recorded were for internal used, e.g. internal illness, stomachache, gastric, high blood pressure and diarrhoea.









Bauhinia semibifida



Myrmecodia platytyrea



Artocarpus sericicarpus



Kadsura borneesis



Baccaurea lanceolata



Callicarpa longiflora



Arcangelicia flava



Anadendrum sp.



Piper ridleyi



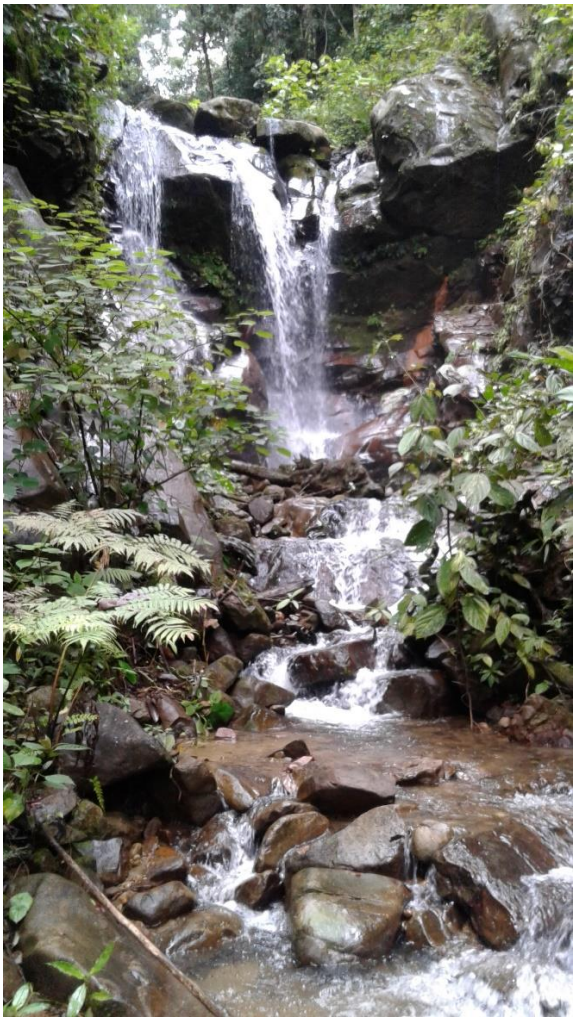
Dillenia excelsa



Saurauia sakoembangensis



Litsea caulocarpa



WAYS FORWARD

The Tama Range area is very rich in flora and fauna and should be considered among the richest forest in the Heart of Borneo (HoB) Initiative Project Areas. The State Government of Sarawak (*via* Forest Department Sarawak) has taken the right step to initiate comprehensive documentation of Tama Abu for further consideration. However, more such study and research need to be conducted in Tama Abu as this expedition only covered the southern part of the Range. It is believed that more interesting biodiversity treasure will be unveiled from the Tama Abu Range.



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Acknowledgements

Many people have made contributions to this 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 the contributors from the Tama Abu Scientific Expedition 2017. Details of the scientific reports are available in the book, "*Heart of Borneo Series 5: Proceedings of the Heart of Borneo Seminar – Tama Abu*"

We wish to record our appreciation to:-
Professor Emeritus Datuk Dr Haji Mohamed Abdul Majid, Dr Choong Chee Yen, Dr Ng Yong Foo, Forest Department Sarawak, Forest Department Sabah, PERHILITAN, Sarawak Biodiversity Centre (SBC), FRIM, Universiti Kebangsaan Malaysia, Universiti Malaysia Sarawak, Universiti Putra Malaysia, Universiti Malaysia Sabah and Universiti of Brunei Darussalam. Also to the local peoples of Long Beruang and Long Banga.

Photos Credit

A — Aimi Syazana Sedek; Alice Wells; Andrew Alex Tuen; Andi Maryani Andi Mustapeng; Ang Lee Ping

B — Boyd Simpson

D — Dana Badang; Daniele Cucuzza; Dome Nikom

E — Edward Entalai

H — Haji Mohamed Majid

I — Ivy Geralyn

J — Jauris Doris; Jaya Seelan Sathiya Seelan; Joan Teresa Pereira; Jongkar Grinang; Julia Sang

L — Leanda Denise Mason; Ling Chea Yiing

M — Meekiong Kalu; Mohammad Shahfiz Azman; Muhammad Fadlli

N — Nur Ezzawanis Abdullah Thani; Norfahana Mazlan; Nur Syauqina Syasya Mohd Yusoff; Ng Yong Foo

R — Rory Alisdair Dow

Y — Yazid Kalbi

Z — Zinnirah Shabdin


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