

Volume 4: Issue 3

September 2023

# IBEC BULLETIN

<http://ir.unimas.my/id/eprint/42877> E-ISSN: 2716-6422



## EDITORIAL BOARD

A.P. DR WONG SIN YENG

(EDITOR)

PROF. DR INDRANEIL DAS

(ADVISOR)

PROF. DR MOHD AZLAN JAYASILAN

(ADVISOR)

Interested to submit an article?

Email: [sywong@unimas.my](mailto:sywong@unimas.my)

## Events

Page 2-11

## Articles

Bats: The Unsung Hero

Amsyari Morni

Page 12-13

Squirrely Endothermy: Filling in a Tropical Gap

Eric Brown & Claudia Saldaña DeCamillis

Page 14-15

The 6th World Conference on Marine Biodiversity

Ernadia Elsie Lawrence Jaya and Cindy Peter

Page 16-17

Tourism Education and Training Program

Cindy Peter

Page 18-19

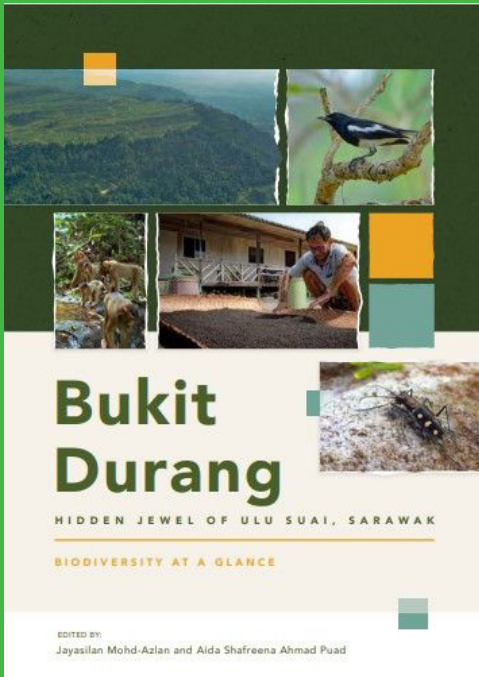
The Flora That Time Forgot

By Wong Sin Yeng

Page 20-25

## Publications

Page 26-30



Handing over the “Bukit Durang: Hidden Jewel of Ulu Suai, Sarawak: Biodiversity at a Glance” book to the Vice Chancellor Universiti Malaysia Sarawak by IBEC’s Director. Edited by Prof Dr. Mohd Azlan Jayasilan and Dr. Aida Shafreena Ahmad Puad, this incredible book resulted from a special collaboration between Wilmar Conservation Program, IBEC, Faculty Of Resource Science And Technology, and Unimas Publisher. Also present, Prof Ir Dr Siti Noor Linda bt Taib, the Deputy Vice-Chancellor (Research and Innovation) and Mr. Jay Walid from UNIMAS Publisher.

**Carrrom Month  
2023**  
**ARE YOU  
READY  
TO WIN?**

Open to all IBEC staff and students | RM 10 / person

SEPTEMBER - EVERY WEDNESDAY - 4 PM - IBEC OFFICE



## Carrrom Clash 2023: Where Unity Meets Strategy!

IBEC - much-awaited Carrrom Competition has kicked off! Our admin staff, academic staff, and postgraduate students are all in for some thrilling battles on the board. Who will emerge as the ultimate Carrrom King or Queen? Stay tuned to witness the epic showdown!



Congratulations to Professor Dr Mohd Azlan Jayasilan!

Prof. Dr Mohd Azlan Jayasilan was involved in a new research that indicates reserves improve the variety of birds within their boundaries. Moreover, sizable parks also contribute to greater diversity of both birds and mammals in nearby areas that are not protected.

These results show that having more protected areas, like the United Nations wants (30% of the land and oceans protected by 2030), can actually help save more different kinds of animals and plants, both

in the protected areas and in the areas around them.

First published in 1869, Nature is the world's leading multidisciplinary science journal. Nature is a weekly international journal publishing the finest peer-reviewed research in all fields of science and technology.

We are extremely proud of Professor Dr Mohd Azlan Jayasilan for the achievement of having an article published in this esteemed journal. To read the full article, please follow this link: <https://www.nature.com/articles/s41586-023-06410-z....>

**a** PAs aim to maintain habitat quality and vegetation structure while reducing hunting



**b** PAs assume that this will safeguard multiple facets of biodiversity

SR: The sum of unique species observed, regardless of their ecological function or taxonomy.  
 FR: Variety in phenotypic traits (for example, diet and body size) that affect species' ecological roles.  
 PD: Evolutionary breadth of the community. Phylogenetic diversity increases when many unique families are represented.



**c** Examples of possible wildlife community outcomes in PAs or adjacent unprotected forests



**Indo-Pacific Dialogue @ Sarawak**

**Ensuring Seamless Green Transition in the Indo-Pacific: Pathways for ASEAN-EU-Malaysia Cooperation**

📅 4 September 2023 (Monday) ⌚ 2:00 – 5:00 PM  
📍 Serindit Hall, DeTAR Putra, Universiti Malaysia Sarawak

**Programme Schedule**

2:00 PM Registration & Arrival of Guests  
2:30 PM Welcoming Remarks by Prof. Dr. Ahmad Hata bin Basit, Deputy Vice-Chancellor (Academic & International), Universiti Malaysia Sarawak.  
2:40 PM Special Remarks by Ms. Virgi Kukkonen-Laino, Counsellor, Delegation of the European Union to Malaysia – EU's Perspective  
2:50 PM Briefing and Introduction of Panelists by Moderator, Ts. Dr. Lidanya Baslan, Universiti Malaysia Sarawak.  
3:00 PM **Dialogue Session:**

1. Prof. Ts. Dr. Shanti Paridish binti Salleh, Director of Institute of Sustainable and Renewable Energy (ISURE), Universiti Malaysia Sarawak
2. Dr. Timothy Hatch, Senior Research Director & Partner, Mekong-Tropicale Sdn Bhd
3. Prof. Dr. Indraneil Das, Institute of Biodiversity and Environmental Conservation, Universiti Malaysia Sarawak
4. Mr. Rudzaimi Malek, Deputy Director (Community Services), Kuching North City Hall

4:00 PM Q&A session  
4:30 PM Closing remarks by Dr. Rahul Mishra, Director of Centre for ASEAN Regionism, Universiti Malaysia (CARUM)  
5:00 PM End of the session followed by Iftar-Tea

**Register at [bit.ly/ipdsarawak](https://bit.ly/ipdsarawak)**

Centre: Parasit, Mkn. Maniha +603 7967 822 (maniha.podium.edu.my)  
<https://carum.um.edu.my>

On 4th September, we had the privilege of having Prof. Dr. Indraneil Das, a distinguished Research Fellow from IBEC, as a key contributor to the Indo-Pacific Dialogue @ Sarawak, held at Universiti Malaysia Sarawak (UNIMAS). The dialogue's focus on 'Ensuring Seamless Green Transition in the Indo-Pacific: Pathways for ASEAN-EU-Malaysia Cooperation' was thought-provoking and insightful.

Prof. Das's expertise added immense value to the discussion, highlighting the critical role of cooperation for a sustainable future.







DR MOHD AZLAN JAYILAN

NICKSON JOSEPH ROSE

DR HALIZA ABUL RAHMAN

DAFUK LEN TALF SALLAN

berkesan penjagaan diaging tergolong memang sangat penting di Sarawak kerana kebanyakan pengaliran tangguling dalam kalangan mamalia kita adalah sebagai makanan ataupun sumber protein kadangkala pemuliharaan kawasan pedataran.

"Pegawai pinggir kuasa kita sangat penting menjengah diaging haiwan ini diaging di pasir-pasir bukan malahkan pasir-pasir tersebut ini juga boleh dijadikan salah satu indikator bahawa perubahan di Sarawak sudah-kah dan boleh mengesan status pemuliharaan haiwan ini."

"Siak tangguling dikatakan jika dicampur dengan herba Ferba serta bahan-bahan lain, boleh membantu untuk memendakkan seekor diaging, sama, leleh dan baik untuk itu yang betul-betul."

"Kalau hajatan, ia lebih-penakir diikatkan dan bagi esakiti peralihan. Siak, tangguling sama dengan kata mannia. Memang silak haiwan ini sama seperti mamalia kita, ia dan baik kita sendir" kata beliau.

**UNDANG-UNDANG RETAK**

"Pihak berkuasa berkesan seperti Jabatan Pertindungan Haiwan Liar dan Taman Negara (JEPHLTAN) Sarawak, Malak, Jabatan Haiwan Liar Sabah dan SOP bertanggungjawab meningkatkan atau menangan-

tegi haiwan-haiwan lain yang termasuk dalam senarai Appendix A menyia spesies Appendix I dan II dalam Konvensyen Pendidikan Antarabangsa Spesies Flora dan Fauna Liar (CITES) serta."

Sementara itu, CITES merupakan perjanjian antara kerajaan antarabangsa yang ditaja oleh hasil result yang ditirama dalam Masyarakat Keutamaan Pemuliharaan Alam Antarabangsa (IUCN) pada 1973 bertujuan memajukan pengaliran spemim-spemim haiwan dan tumbuhan liar di peringkat antarabangsa tidak mengabaikan kemiskinan haiwan-haiwan berkenaan.

CITES memfokuskan agenda perdagangan antarabangsa terhadap 33,000 spesies haiwan dan tumbuhan.

Pada masa sama, Nickson memaklumkan bahawa tangguling Sundu akan dipergunakan tanpa peralihan kepada kategori haiwan 'Dilindungi Sepenuhnya' di Sarawak melalui senarai senarai Ordinan Pertindungan Haiwan Liar 1988.

Ini termasuk semua spesies tangguling yang terdapat di seluruh dunia. Senarai senarai Ordinan Pertindungan Haiwan Liar sedang berjalan dan akan melalui pengaliran proses penuliharaan sebelum baik dipinda semula.

Bagi memajukan habitat bagi haiwan liar seperti tangguling di

di Sarawak, namun dari segi pengaliran, SPC bersedia menggaru tangguling termasuk spemim-spemim haiwan liar hampir agas yang lain perlu diberi perhatian sama seperti haiwan liar yang dilindungi sepenuhnya.

"Kita akan senarai memajukan nasib haiwan liar ini ambedo dijaga dan memakir yang melangka undang-undang dikeluarkan tidak sempurna" jelasnya.

**USAHA UMMAH**

Jantara itu, Dr Mohd Azlan berkata, UMMAH melalui IBEC bakal memajukan perikanan bumano selain kegiatan lain berkaitan pemuliharaan flora dan fauna tundera haiwan haiwan yang terancam di negara dan negeri ini terus dilindungi.

IBEC ini kulanya, sedang dalam proses memajukan dana untuk memajukan halan genetika dan biologi tangguling di Sarawak sebagai usaha yang bertepatan dengan keadaan semasa yang agak mabaraka.

"Kita akan berkerjasama dengan tangguling tinggi pemuliharaan spesies haiwan terancam dan huan terancam tangguling oleh pihak yang tidak bertanggungjawab. Secara langsung ini memajukan pemuliharaan terhadap spesies ini masih berkesan."

"Perancangan jangka-pihak berkuasa bukan perkara

Talf Sallah, cadangan pemuliharaan semua SPC dan kebela-bela Sarawak (JHS) akan diminta Premier Datuk Paduka Tan Sri Abang Johari Tun Oney pada 2 Januari 2025, fungsi kedua-dua agensi diutamakan lain untuk lejan yang lebih mudah.

Di bawah Ordinan Pemuliharaan Haiwan Liar 1988 kulanya, haiwan haiwan liar diadepa dua kategori yaitu kategori haiwan terlindungi dan kategori haiwan terlindungi sepenuhnya.

"Antara haiwan terlindungi di Sarawak adalah hara, bera, leleh, buaya, kucing hutan, tangguling, burung leyang-leyang, burung hing, burung pekela, semua keledai dan vebra, burung rajawali, uku, sama, buaya tukuk dan banyak lagi."

"Semantan haiwan terlindungi sepenuhnya termasuk orang utan, badak, rambutan, enggang, leleh hara, kucing manak, kucing dihan, hara, kucing hara, burung laut, semua anyu laut, ciak gua mala, ciak gua puha dan lain-lain."

"Ordnin Pertindungan Haiwan Liar 1988 tidak membolehkan penjualan haiwan liar termasuk siak tidak dilindungi yang diambil dari hutan."

"Senarai haiwan liar yang dilindungi sepenuhnya telah direvisikan dan dikemaskini dalam Bahagian I Jadual Pertama dalam Ordinan tersebut, membolehkan semua haiwan liar yang dilindungi dan ditetapkan dalam Bahagian I Jadual Pertama

melalui kerjasama pihak berkuasa dengan komuniti setempat dalam pengaliran papak tangguling.

"Untuk program jangka panjang, Kementerian Khasa kita akan mamuliharaan banyak bagi kawasan terlindungi sepenuhnya. Dalam usaha itu, Sarawak menawan untuk mamuliharaan Central Sundu Nasional Park memajukan kawasan seluruh lebih kurang 300,000 hektar dan berfungsi melindungi habitat haiwan liar termasuk habitat tangguling" kulanya.

Pada masa sama jela Lon, pengaliran haran tangguling tidak terkah dalam negeri mahupun pengaliran antarabangsa Jantara SPC bekerjasama dengan Pangkalan Pemuliharaan Haiwan Liar ASEAN (ASEAN-HWC).

Pemula ASEAN-HWC penting bagi memajukan kerjasama perbagi negara untuk memajukan pemuliharaan haran tangguling, baik di dalam atau luar pulau. Berada selenggara itu pengaliran antarabangsa.

"Tindakan pemuliharaan dan pemuliharaan hara diikatkan dengan kadar segera untuk mamuliharaan dengan baik haiwan haiwan antara perbagi-pagi Negara Hadiran dan negara pengaliran Hai Inquran ini, langkah-langkah bagi mamuliharaan dapat diikatkan untuk pemuliharaan senetapak dan berterusan."

“Insights Straight from the Expert!”

As we conclude the enlightening journey into the world of Sunda pangolins, Prof. Dr Mohd Azlan Jayasilan, Director of the IBEC - Institute of Biodiversity & Environmental Conservation, leaves us with thought-provoking closing remarks.

The final series on the article on Suara Sarawak delves deep into the behaviour, diet, reproduction, habitat, adaptation, threats, and vital conservation efforts concerning these incredible creatures.

Prof. Dr. Mohd Azlan Jayasilan’s expert insights bring to light the intricate web of challenges and solutions that revolve around the survival of Sunda pangolins. Let’s come together to champion their protection, support conservation initiatives, and ensure a brighter future for these remarkable animals.

Read the full article to gain a comprehensive understanding and be inspired to take action for wildlife conservation!



Congratulations to Silver Award Winners of InTEX'23 from IBEC - Institute of Biodiversity & Environmental Conservation Research Fellow

1. Cindy Peter, Jongkar anak Grinang, Ernadia Elsie, Andrew Alek Tuen, Gianna Minton.

Title: Extrapolation of marine Mammal prey sizes based on selected otolith length of coastal fishes in Sarawak.

2. Wong Sin Yeng and Ng Win Seng.

Title: Phenology and pollination of *Calamus*. A study process.





24 August 2023. At the INTEX'23 Closing Ceremony, a symbolic Mock Cheque was exchanged between the Universiti Malaysia Sarawak (UNIMAS) and the Malaysian Palm Oil Green Conservation Foundation by Datuk Abd Rasyid bin Idris@Adir.

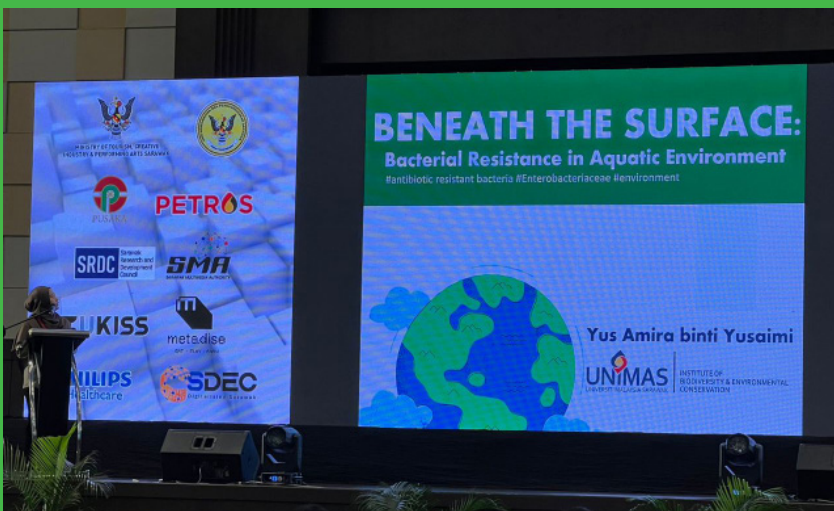




23 - 24 August 2023 - UNIMAS Innovation Technology Expo 2023 (InTEX23).

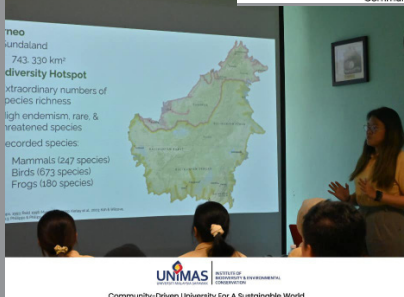
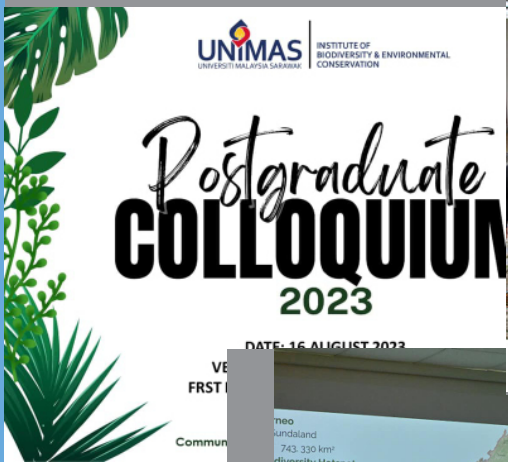
Day 1 - Professor Dr. Indraneil Das enlightened the audience about "The Significance of Postage Stamps for Environmental Conservation and Public Education."

Day 2 - Dr. Yus Amira Yusaimi, Post-Doctoral from IBEC as 3rd presenter in slot UNIMAS TechTalk enlightened the audience about "Beneath the surface: Bacterial resistance in Aquatic Environment"





Our Postgraduate Colloquium was held on 16 August 2023! It was a great platform for our postgraduate students to share their ideas and latest research updates.





*Hipposideros ridleyi*

Photo credit Nor Al-Shuhada

## Bats: The Unsung Hero

Amsyari Morni

Imagine the night sky filled with stars and shadowy silhouettes. These silhouettes belong to bats, incredible nocturnal creatures which play a crucial part in maintaining the equilibrium of nature, even as they remain shrouded in mystery and often undervalued. In this article, we'll venture together into the captivating world of bats, debunk prevailing myths, highlight their ecological significance, and discuss the challenges they face. We will also underscore our shared societal duty to conserve these marvelous animals.

### Understanding Bats

Belonging to the Chiroptera order, bats are the only mammals naturally capable of sustained flight. With over 1,400 distinct species scattered worldwide, bats exhibit a staggering range of sizes, shapes, and behaviors, making them one of Earth's most diverse mammalian groups. The smallest bat, the bumblebee bat, is no bigger than a bumblebee, while the largest, flying foxes, boast impressive wingspans. To navigate the darkened sky, bats have developed an intricate system known as echolocation, which involves producing high-frequency sounds and decoding the returning echoes to locate

obstacles and prey. As for non-echolocating bats, they possessed a pair of highly efficient eyes that perceived images with minimal lights.

### Public Misconceptions about Bats

Unfortunately, bats have been misunderstood for centuries, frequently associated with evil and darkness in folklore and mythology. This misrepresentation fuels fear and confusion about these generally harmless creatures. The reality is that most bats are insectivores, consuming a variety of insects, including agricultural pests and mosquitoes. This natural pest control is invaluable to farmers and ecosystems alike. Vampire bats, famous for their blood-feeding habits, represent only a tiny fraction of all bat species, typically feeding on birds and other animals, not humans.

Promoting education and awareness is vital to breaking these misconceptions and encouraging appreciation for bats' vital role in our ecosystems.

## Ecological Contributions of Bats

Bats are ecological superheroes, delivering benefits to both the environment and human society. As natural pest controllers, insect-eating bats help keep insect populations in check, significantly reducing reliance on chemical pesticides for agriculture. Without bats, insect populations could become unmanageable, leading to potential crop damage and disease transmission.

Moreover, many bats are essential players in pollination and seed dispersal. Fruit-eating bats help disperse seeds by eating fruits and excreting seeds during flight, contributing to forest regeneration and plant diversity. Nectar-feeding bats serve as vital pollinators for many plant species, aiding in the survival and propagation of many plants, including economically significant crops. They are the hero for our Durian, Rambutan and many other tasty fruits!

## Threats to Bats

Despite their importance, bats face multiple threats that endanger their existence. Habitat destruction, mainly due to deforestation and urbanization, is one of the most significant challenges. Many bat species are reliant on specific roosting sites like caves, hollow trees, and abandoned structures, which are rapidly disappearing due to human activities.

Additionally, in some parts of Malaysia, bats are consumed as a delicacy. This practice, however, has provoked controversy due to potential health risks, given that some bats can carry zoonotic viruses. Eating bat meat can increase the risk of disease transmission from bats to humans, heightening the possibility of outbreaks. It is important to address these health concerns and advocate for safer and sustainable dietary alternatives.

Chemical pollution and light pollution also pose considerable threats to bats. The former can directly harm bats and reduce their food sources, while the latter can disrupt bats' natural navigational and foraging behaviors.

Climate change introduces further challenges. Changes in temperature and rainfall can impact



*Balionycteris maculata*

Photo credit Nor Al-Shuhada

insect availability, disrupt bat breeding cycles, and affect the timing of plant flowering and fruiting, thereby affecting bats' food resources.

## Conservation of Bats

Protecting bats calls for a concerted effort from every level of society - individuals, communities, and policymakers alike. Essential steps include raising public awareness about bats, preserving roosting sites, implementing sustainable practices, promoting research and monitoring, and advocating for policy changes favoring bat conservation and habitat protection.

## Conclusion

As unsung heroes of our natural world, bats play an indispensable role in the intricate fabric of life. Their ecological contributions, as pest controllers and pollinators, significantly promote environmental balance and human well-being. Despite facing threats that jeopardize their survival, we, as a united public, can change the narrative. By embracing knowledge, dispelling myths, and taking proactive conservation measures, we can secure a brighter future for bats, and in turn, our planet.

# Squirrely Endothermy: Filling in a Tropical Gap

Eric Brown & Claudia  
Saldaña DeCamillis

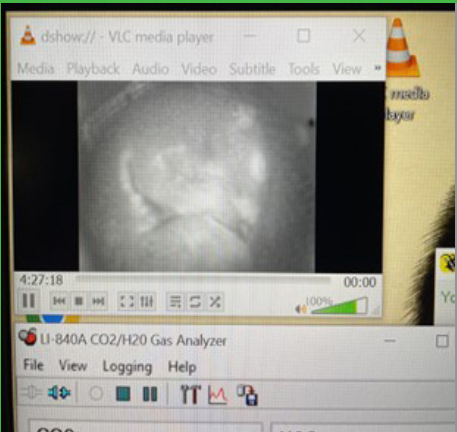


A female *Sundasciurus lowii* investigates her respirometry chamber before overnight O<sub>2</sub>, CO<sub>2</sub>, H<sub>2</sub>O, and body temperature measurements.



A female *C. notatus* reflects on her life choices while being weighed after her respirometry trials have been completed.

Historical and contemporary investigations into the evolution and character of mammalian endothermy – internal regulation and maintenance of body temperature by metabolic means – are heavily biased toward holarctic species. This greatly impedes our attempts to understand the “Whys” and “Hows” of endothermy (e.g. Lovegrove 2019; Nowack et al. 2023). A glaring hole exists in available ecophysiological data for many tropical mammal species and as a result we know little about the thermoregulation and energetics of mammals in relatively aseasonal environments. Given that mammals have been evolving in a tropical-like climate from the Middle Jurassic through much of the Cenozoic, investigations of tropical mammals may uncover thermoregulatory characteristics more representative of ancestral mammals than those in novel environments such as the Arctic.



A male *Callosciurus notatus* rests while a LICOR gas analyzer measures the CO<sub>2</sub> and H<sub>2</sub>O output of his respirometry chamber.

Respirometry setup in Kampung Tanjung Bowang, Bau District. Respirometry chambers are placed inside the blue cooler box which is fixed with a temperature controller. The chamber is connected to incurrent air flow controllers and excurrent gas analyzers.



A quick literature search regarding squirrel ecophysiology (family Sciuridae) typifies the disparity highlighted above: most concern temperate, highly seasonal species, and most investigate torpor or hibernation. Much is left to be desired regarding the normothermic physiology (i.e. non-torpid metabolism at normal ambient temperatures) of squirrels—particularly those from highly biodiverse regions such as Southeast Asia. Squirrels are a common subject of torpor and hibernation research because of their ecological and physiological diversity (Rocha et al. 2016; Menéndez et al. 2021) and relative ease of use in experiments. Sciuridae emerged from a warm Late Eocene North America (approximately 36mya; Emry and Korth 2007) and quickly dispersed to a variety of biomes, including the tropical and subtropical forests of Southeast Asia. Focusing research on their tropical descendants as opposed to those adapted to cold, seasonal environments presents a novel opportunity to reveal more about ancestral squirrel and ancestral mammal phenotypes.

To begin filling in this tropical gap, much time must be spent and many banana-equipped cage traps deployed to lure in the critters of the forest. This year we conducted trapping over ~3500 trap-days in UNIMAS and Bau District forests with about 4% capture success, of which ~26% produced squirrels. All species we caught were beautiful squirrels in the Callosciurini tribe of the Callosciurinae subfamily (callo = beautiful, sciurus = squirrel): two species of the genus *Callosciurus* (*C. notatus* and *C. prevostii*), one of *Lariscus* (*L. insignis*), and one of *Sundasciurus* (*S. lowii*). We chose non-reproductive, mature individuals in good health for respirometry—a standard method for approximating resting metabolism at various ambient temperatures by measuring an animal's O<sub>2</sub> consumption and CO<sub>2</sub> and H<sub>2</sub>O production (Figures 1–4). As these squirrel species are diurnal, gas and body temperature measurements were conducted during individuals' rest phase overnight. Over the course of the experiment, body temperature was recorded from an implanted Passive Integrated Transponder and gas leaving the respirometry chamber and a control chamber was measured. Once our sleepover concluded between 0600-0700, our lucky guest would

be gifted an additional banana and released at their capture site. Analysis will reveal each participant's Resting Metabolic Rate (RMR) based on the rate of oxygen consumption (VO<sub>2</sub>), rate of CO<sub>2</sub> production (VCO<sub>2</sub>), and Evaporative Water Loss (EWL).

It is still too early to draw any conclusions about the ecophysiology of Bornean squirrels, and additional methods such as biologging and radio telemetry are yet to be deployed. Additional field seasons are to come to ensure a more statistically significant dataset and robust analyses. We are hopeful that these data will contribute to our overall understanding of not only tropical squirrel physiology, but also that of Sciuridae, tropical mammals generally, and the evolutionary history of mammalian thermophysiology. These insights will further contribute to our knowledge of the resilience of Bornean squirrels and their ecological dependents to global climate change and ecological disturbance and degradation.

#### Citations

- Emry RJ, Korth WW. 2007. A new genus of squirrel (Rodentia, Sciuridae) from the mid-Cenozoic of North America. *Journal of Vertebrate Paleontology* 27:693–98.
- Lovegrove, B. G. 2019. *Fires of Life: Endothermy in Birds and Mammals*. Yale University Press.
- Nowack J, Stawski C, Geiser F, Levesque DL. 2023. Rare and Opportunistic Use of Torpor in Mammals—An Echo from the Past? *Integrative And Comparative Biology* 0:1–11.
- Menéndez I, Gómez Cano AR, Cantalapiedra JL, Peláez-Campomanes P, Álvarez-Sierra MÁ, Hernández Fernández M. 2021. A multi-layered approach to the diversification of squirrels. *Mam Rev* 51:66–81.
- Rocha RG, Leite YLR, Costa LP, Rojas D. 2016. Independent reversals to terrestriality in squirrels (Rodentia: Sciuridae) support ecologically mediated modes of adaptation. *J Evol Biol* 29:2471–79.



# Ernadia Elsie Lawrence Jaya and Cindy Peter

## The 6th World Conference on Marine Biodiversity

The highly anticipated 6th World Conference on Marine Biodiversity (WCMB), held under the theme “Marine Biodiversity Challenges in the Anthropocene,” successfully took place from the 2nd – 5th July 2023 at the Jen Hotel in Georgetown, Penang. Hosted by the renowned Centre for Marine and Coastal Studies (CEMACS), Universiti Sains Malaysia (USM), the conference brought together a diverse group of scholars, scientists, and experts deeply committed to understanding and safeguarding marine ecosystems. The event encouraged rigorous discussions, the examination of established and emerging ideas, the exchange of knowledge, and the fostering of collaborations. It emphasized an unwavering dedication to marine biodiversity, aligning closely with the United Nations Sustainable Development Goals, particularly Goal 14: Life Below Water.

The conference program was undeniably captivating, showcasing an impressive array of presentations and posters that unveiled pioneering research efforts. Cindy Peter, Research Fellow, and Ernadia Elsie, a postgraduate student, both representing IBEC, had the privilege of sharing their research insights during the conference. Their active participation in the conference allowed them to present significant research findings, contributing to the body of knowledge in their respective fields.

Cindy delivered a compelling presentation titled “Extrapolation of Marine Mammal Prey Sizes Based on Selected Otolith Length of Coastal Fish in Sarawak” within the thematic symposia of Fisheries and Food Security. Meanwhile, Elsie presented her research, titled “Stomach Content Analysis Revealing Insights into the Feeding Ecology of Small

Cetaceans in Sarawak, Malaysia,” within the thematic symposia of Biogeography and Distribution. Their contributions added depth and significance to the conference’s discussions, shedding light on critical aspects of marine science in Sarawak.

Recipient of The WCMB 2023 Travel Grants for Young Scientists (Fee Waiver Grant), the grant reduced the financial constraint and enabled Elsie to attend the conference. The Grant not only represents a personal milestone but also signifies a broader recognition of the significance of Elsie’s Masters research. This acknowledgment of contributions is genuinely humbling and serves as a motivating force to continue dedicating efforts to advancing our understanding of marine ecosystems. Heartfelt appreciation is extended to the conference organisers for their support and encouragement in nurturing emerging talent within the field.

An excursion to CEMACS was held after the conference ended. The event kicked off with a gracious welcome and an insightful introduction to the Centre by Prof. Dato’ Dr. Zulfigar Yasin from USM. This excursion afforded participants a unique opportunity to gain first-hand insights into the cutting-edge research and innovative developments within the realm of marine and coastal sciences. The visit to CEMACS gave an opportunity to participants to explore their research initiatives, including in-depth visits to marine hatcheries, the national marine reference collection and museum, and CEMACS Gallery on Biodiversity and Climate Change. This experience not only deepened understanding of marine science but also left an indelible impression of the pivotal work being undertaken in this critical field.

Moreover, the decision to visit CEMACS was underpinned by USM’s impressive global ranking as the 4th top institution in the Times Higher Education Impact Ranking 2023 SDG performance. The centres research initiatives have been steadfastly focused on the conservation and sustainable utilization of marine resources, the promotion of sustainable fishing practices, and the safeguarding of marine biodiversity. 16

This alignment with the United Nations Sustainable Development Goals underscores the significance of the research carried out at CEMACS and further justifies the importance of this visit for participants seeking to deepen their knowledge in marine and coastal sciences.

In conclusion, the 6th World Conference on Marine Biodiversity was a significant and impactful event for IBEC representatives and all the participants. It showcased the critical importance of marine biodiversity research and its alignment with global sustainability goals. Overall, the conference and the excursion underscored the urgency of addressing marine biodiversity challenges in the Anthropocene era.



Honorary Professor, Prof. Dato' Dr. Zulfigar Yasin from Universiti Sains Malaysia delivers a warm welcome and informative introduction to Centre for Marine and Coastal Studies



Ernadia Elsie presented her research on the feeding ecology of small cetaceans in Sarawak using stomach content analysis



Participants had the chance to explore the marine reference collection which featured a section displaying dry coral reef specimens. Each row of specimens represented the specific aquatic habitat where the coral reefs thrive



Cindy Peter presented her research on estimating marine mammal prey sizes using otolith length of coastal fish in Sarawak



All excursion participants, together with the Director of CEMACS, Prof. Dato' Dr. Aileen Tan Shau Hwai

# Tourism Education and Training Program

---

## Cindy Peter

In Malaysia, to obtain a Permanent Tourist Guide License, one is required to attend courses related to basic tourist guide courses from certified tourism training institution. Additionally, they are also obligated to attend a number of Continuous Tourism Related Education (CTRE) in order to renew their license. The Sarawak Tourist Guides Association (STGA) organizes CTRE training throughout the year for the licensed tourist guides under the Association. The CTRE training for Sarawak tourist guides is approved by the Ministry of Tourism, Arts and Culture (MOTAC) Malaysia.

One of our Research Fellow, Cindy Peter was invited to be a speaker for the CTRE session on 18 August 2023. The objectives of the training were to enhance the knowledge of the tour guides pertaining to dolphins in Sarawak and to increase their guiding knowledge so that they can guide foreign tourists and promote the dolphin-watching tourism of Sarawak. Having studied marine mammals for over ten years, Cindy was selected as a speaker due to her extensive and relevant technical expertise in providing the training and imparting her knowledge.

During the talk, Cindy shared about the biology and taxonomy of marine mammals found in Sarawak especially the Irrawaddy dolphins (*Orcaella brevirostris*), Indo-Pacific Finless porpoises (*Neophocaena phocaenoides*), Indo-Pacific Humpback dolphins (*Sousa chinensis*) and Indo-Pacific bottlenose dolphins (*Tursiops aduncus*). The fifteen guides were also informed of the threats that are facing marine mammals in Sarawak, how they can play a part in ensuring the habitats of these marine mammals are kept clean and the authorities that are responsible if they ever come across stranded or dead marine mammals in Sarawak (Figures

1a and 1b). The guides also shared their experiences and stories while bringing guests for wildlife excursion and dolphin-watching tours. After the question and answer session, photo-identification matching exercises were conducted with the guides using photographs of Irrawaddy dolphins and Humpback dolphins that have been photographed and identified from Cindy's research (Figures 2a and 2b).

Prior to the start of the training session, the guides were requested to complete a pre-training knowledge background quiz where six general knowledge questions were asked. All guides scored moderately, answering three to four questions correctly. Upon the completion of the training session and photograph matching exercises, the same set of six questions were asked in a post-workshop form to investigate if there were any knowledge-retention exhibited by the guides. Six of the guides either answered all correctly or obtained only one wrong answer, an increase of 40% from the pre-training quiz. The tourist guides gave their feedback via an anonymous form at the end of the training session. Some shared that the training session was like a refresher course, where they can relearn what they need to know. The videos and photographs that were showed during the training were a hit as most of the guides mentioned that those were what they liked best about the training, while a few expressed their interest in a possible on-site excursion training sessions.



Figure 1a and 1b: Research Fellow from IBEC, Cindy Peter was invited to be a speaker for the Sarawak Tourist Guides Association (STGA) in August 2023.



Figures 2a and 2b: Photo-identification matching exercises were conducted with the tour guides using photographs of Irrawaddy dolphins and Humpback dolphins.

# The Flora that time forgot

## Wong Sin Yeng

The beginning of botanical exploration in Borneo can be traced back to Georg Müller who from about 1821 undertook exploration and mapping trips during when he made botanical collections for Carl Ludwig Blume who had arrived in Jawa two years earlier and at the time was beginning his botanical career (Blume 1843; Helbig 1941; Hoëvell 1849; Müller 1843a,b,c).

Johannes Gottfried 'Hans' Hallier, the botanist attached to Nieuwenhuis' 1893–1894 Borneo expedition, is often credited as being the first to attempt a general flora of Borneo. However, the 34 pages of his *Beiträge zur Flora von Borneo*(1) (Hallier 1916), is preceded by Korthals' botany volume for the *Verhandelingen over de natuurlijke geschiedenis der Nederlandsche overzeesche bezittingen*(2) (Korthals 1839–1842), the three volumes of Beccari's *Malesia* (Beccari 1877–1883, 1884–1886, 1886–1890), and the 156 pages of the four published parts of Hubert Winkler's *Beiträge zur Kenntnis der Flora und Pflanzengeographie von Borneo*(3) (Winkler 1910, 1912, 1913, 1914). Despite this promising start Borneo, today recognized as one of the twelve mega biodiversity centres of the world, has no recent overall survey of vascular plant families and genera. The most recent attempts at a complete enumeration are those of Merrill (1921) and Masamune (1942, 1945). Furthermore, there has been seemingly no active project for complete vascular plant flora for Borneo since Winkler.

It was therefore surprising to encounter in a biographical memoir of the prodigiously productive Elmer Drew Merrill (Robbins 1958), reference to two papers by Merrill dealing with Bornean Myrtaceae and Rubiaceae, published in *Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg*(4) as part of a *Beiträge der Kenntnis der Flora von Borneo*(5) edited by Irmischer.

Further checking found this project mentioned by de Wit (1948: CXLVI), and Morton (1970: 58) but subsequently it appears to have been completely forgotten — most extraordinarily Merrill (1950) makes no mention of it despite having contributed two families (Merrill 1937a,b).

Further checking revealed that the project was initiated in 1927 by Irmischer, at that time a professor at the Universität Hamburg, and it was to there I turned to try to find what survived of the journal and of Irmischer's work. Fortunately the relevant parts of the journal were in the *Fachbereichsbibliothek Biologie* of Universität Hamburg and through the kindness of Cyrille Claudel, Margarete Axnick, and Andrea Krohn (all Universität Hamburg) it was possible to acquire digital copies (Irmischer 1927a,b, 1928, 1931, 1937a) of the published parts, totalling 310 pages. The family accounts in alphabetical order are:

Amaranthaceae (Schwartz 1937a), Annonaceae (Diels 1927), Apocynaceae (Schwartz 1931a), Asclepiadaceae (Schwartz 1931b), Asteraceae (as Compositae) (Schwartz 1937c), Bixaceae (Schwartz 1937b), Combretaceae (Irmischer 1937b), Cyperaceae (Pfeffer 1928), Euphorbiaceae (Pax & Hoffmann (1931); Gentianaceae (Irmischer 1937c), Gesneriaceae (Kränzlin 1927), Gnetaceae (Markgraf (1937), Magnoliaceae (Diels 1937), Melastomataceae (Schwartz 1931c), Meliaceae (Schwartz 1931d), Nepenthes (Danser 1931), Opiliaceae (Schwartz 1937d), Orchidaceae (Smith 1927), Piperaceae (Schwartz 1931e), Poaceae [as Gramineae] (Pilger 1928), Podocarpaceae (Pilger 1937), Polygalaceae (Schwartz 1937e), Sapindaceae (Schwartz 1937f), Selaginellaceae (Alston 1937), Simaroubaceae (Schwartz 1931f), Symplocaceae (Schwartz 1931g), and Urticaceae (Schröte & Winkler 1937). Additionally, there are papers on plankton (Kolkwitz 1931), mosses (Brotherus 1928), and liverworts (Herzog 1931), and a report on Winkler's fieldwork in Borneo (Winkler 1927).

## Edgar Irmscher

Edgar Irmscher (1887–1968) is today renowned for his work on *Begonia*, a genus on which he began publishing in 1913 and continued working on almost until his death. He also studied *Saxifraga* particularly between 1912 and 1919 when he was working in Berlin as an assistant to Adolf Engler, and had an active interest in the then developing science of phytogeography much inspired by the work of Alfred Wegener the German geologist, climatologist, and polar explorer, who today is best remembered as the originator of continental drift hypothesis. It is odd that Irmscher abandoned the flora of Borneo after the war, especially since his *Begonia* work continued apace (109 taxa described leading up to 1939 and 185 described between 1945 and 1964). Perhaps odder still is that Merrill seemed to distance himself from the Beiträge der Kenntnis der Flora von Borneo. Given the political situation in Germany in the 1920s and 1930s, coupled with Irmscher's prominent position in one of the major universities, and his abrupt dismissal and then 'demotion' to work at the Hohenheim Agricultural College (now Universität Hohenheim) in 1943. I began to wonder if there was a back-story. There was:

Irmscher, at least on paper, was a committed Nazi. He joined the Nationalsozialistische Deutsche Arbeiterpartei (NSDAP), better known as the Nazi party, in 1933 – the year that Hitler was appointed chancellor of a coalition government in Germany, and the same year that the Reichstag implemented the Enabling Act which gave Hitler 4 years of dictatorial power, during which time all other political parties and the unions were banned. In November of 1933 Irmscher signed the Bekenntnis der Professoren an den Universitäten und Hochschulen zu Adolf Hitler und dem Nationalsozialistischen Staat(6), and from 1936 to 1938 was leader of the Nationalsozialistische Deutsche Dozentenbund(7), a party organization of the NSDAP that emerged from the Nationalsozialistischer Lehrerbund(8) and was set up in July 1935 on order from Rudolf Hess.

Most disturbingly between November 1936 and November 1938 Irmscher was leader of the Hamburg Gaudozentenbund(9) the academic body tasked with checking the 'ideological reliability' of degree candidates. Irmscher's days in the sun were cut short in late 1942 or early 1943 when he was forced to resign his university position following a dispute over his inept running of the Gaudozentenbund with Karl Kaufmann, the Gauleiter(10) of Hamburg (Giles 1978; Grüttner 2004: 81–82), whom late in the war collaborated with Joseph Goebbels, Adolf Hitler's Minister of Propaganda and Gauleiter of Berlin, to declare Hamburg an 'open city' in order to free up German troops to reinforce the defence of Berlin. In 1943 Irmscher was offered a position at the Hohenheim Agricultural College, near Stuttgart, where he taught until his retirement in 1959.

Concerning his Beiträge der Kenntnis der Flora von Borneo nothing further seems to have been produced after 1937 (there is nothing in Heft 8 or 9), and after Heft. 10 (1939) the journal ceased publication until 1957, by which time Irmscher was about 70. Although he continued to publish (mostly in *Begonia*) until 1964, even there not without quirks, such as never visiting Kew, although active in Singapore herbaria, it seems that his interest in general Bornean botany ceased in the late 30s and was never rekindled while seemingly his known past was enough to dissuade others, notably Merrill, to acknowledge their part in the project.

## References

- Alston AHG. 1937. Selaginellaceae. In: E. Irmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(4): 305–308.
- Beccari O. 1877–1883. Malesia, volume 1. Genova, Tip. del R. Istituto sordo-muti.
- Beccari O. 1884–1886. Malesia, volume 2. Genova, Tip. del R. Istituto sordo-muti.

- Beccari O. 1886–1890. *Malesia*, volume 3. Genova, Tip. del R. Istituto sordo-muti.
- Blume CL. 1843. Toelichting aangaande de nasproingen op Borneo van G. Müller. *De Indische Bijl* 1: 103–176.
- Brotherus VF. 1928. Musci. In: E. Irsmscher, (Ed.). *Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg* 7(2): 115–140.
- Danser BH. 1931. Nepenthaceae. In: E. Irsmscher, (Ed.). *Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg* 7(3): 217–221.
- de Wit HCE. 1948. Short history of the phytography of Malaysian vascular plants. *Flora Malesiana ser. 1, 4*, LXXI–CLXI.
- Diels L. 1927. Anonaceae (sic). In: E. Irsmscher, (Ed.). *Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg* 7(1): 76–79.
- Diels L. 1937. Magnoliaceae. In: E. Irsmscher, (Ed.). *Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg* 7(4): 310.
- Giles GJ. 1978. University Government in Nazi Germany: Hamburg. *Minerva* 16(2): 196–221.
- Grüttner, M. 2004. *Biographisches Lexikon zur nationalsozialistischen Wissenschaftspolitik (= Studien zur Wissenschafts- und Universitätsgeschichte. Band 6)*. Synchron, Heidelberg.
- Hallier H. 1916. *Beiträge zur Flora von Borneo. Beihefte zum botanischen Centralblatt* 34, 2e Abt.: 19–53.
- Helbig K. 1941. Georg Müller, ein Deutscher pionier im Malaiischen archipel. *Geographische Zeitschrift*, 47. Jahrg., 2. H.: 88–94.
- Herzog T. 1931. Hepaticae. In: E. Irsmscher, (Ed.). *Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg* 7(3): 182–216.
- Hoëvell WR van. 1849. De dood van George Muller. *Tijdschrift voor Nederlandsch-Indië* 1(1): 139–148.
- Irsmscher E. (Ed.) 1927a. *Beiträge der Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg* 7(1): 1–113.
- Irsmscher E. 1927b. Vorbemerkungen. In: E. Irsmscher, (Ed.). *Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg* 7(1): 1–2.
- Irsmscher E. (Ed.) 1928. *Beiträge der Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg* 7(2): 115–178.
- Irsmscher E. (Ed.) 1931. *Beiträge der Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg* 7(3): 179–262.
- Irsmscher E. (Ed.) 1937a. *Beiträge der Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg* 7(4): 263–310.
- Irsmscher E. 1937b. Combretaceae. In: E. Irsmscher, (Ed.). *Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg* 7(4): 308.

- Irmscher E. 1937c. Gentianaceae. In: E. Irmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(4): 308.
- Kolkwitz R. 1931. Eine Planktonprobe aus dem Kapuas-Strom. In: E. Irmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(3): 179–181.
- Korthals PW. 1839-1842. Verhandelingen over de natuurlijke geschiedenis der Nederlandsche overzeesche bezittingen. Botanie: 1–259, t. 1–70.
- Kränzlin F. 1927. Gesneriaceae. In: E. Irmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(1): 80–113.
- Markgraf F. 1937. Gnetaceae. In: E. Irmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(4): 309.
- Masamune G. 1942. Boruneo no kenka shokubutsu. Enumeratio phanerogamarum Borneorum. Taihoku Imperial University, Taihoku, Formosa, 739 pp.
- Masamune G. 1945. Boruneo no shokubutsu hoi. Enumeratio pteridophytarum Borneorum. Taihoku Imperial University, Taihoku, Formosa ii + 124 pp.
- Merrill ED. 1921. A Bibliographic Enumeration of Bornean Plants. Journal of the Straits Branch of the Royal Asiatic Society, Special Number, 637 pp.
- Merrill ED. 1937a. Myrtaceae. In: E. Irmscher (Ed.), Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(4): 269.
- Merrill ED. 1937b. Rubiaceae. In: E. Irmscher (Ed.), Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(4): 270–301.
- Merrill ED. 1950. A brief survey of the present status of Bornean botany. Webbia 7: 309–324.
- Morton CV. 1970. The Fern Collections in Some European Herbaria, VI. American Fern Journal 60(2): 49–61.
- Müller E. 1843a. Levensberigt van G. Müller. De Indische Bij 1: 177–196.
- Müller E. 1843b. Proeve eenerr Geschiedenis van ein gedeelte der West-kust van het eiland Borneo. De Indische Bij 1: 197–319.
- Müller E. 1843c. Matan en andere Etablissement op de Westkust van het eiland Borneo. De Indische Bij 1: 321–375.
- Pax F, Hoffmann K. 1931. Euphorbiaceae. In: E. Irmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(3): 222–230.
- Pfeiffer H. 1928. Cyperaceae. In: E. Irmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(2): 166–176.
- Pilger R. 1928. Gramineae. In: E. Irmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(2): 177–178.



- Pilger R. 1937. Podocarpaceae. In: E. Irsmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(4): 309.
- Robbins WJ. 1958. Elmer Drew Merrill, 1876–1956. A Biographical Memoir. National Academy of Sciences, Biographical Memoirs 32: 274–333.
- Schröte H, Winkler H. 1937. Urticaceae, I. Teil. In: E. Irsmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(4): 263–268.
- Schwartz O. 1931a. Apocynaceae. In: E. Irsmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(3): 258.
- Schwartz O. 1931b. Asclepiadaceae. In: E. Irsmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(3): 259–262.
- Schwartz O. 1931c. Melastomataceae. In: E. Irsmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(3): 237–257.
- Schwartz O. 1931d. Meliaceae. In: E. Irsmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(3): 235–236.
- Schwartz O. 1931e. Piperaceae. In: E. Irsmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(3): 231–234.
- Schwartz O. 1931f. Simarubaceae (sic). In: E. Irsmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(3): 234.
- Schwartz O. 1931g. Symplocaceae. In: E. Irsmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(3): 257.
- Schwartz O. 1937a. Amaranthaceae. In: E. Irsmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(4): 301.
- Schwartz O. 1937b. Bixaceae. In: E. Irsmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(4): 304.
- Schwartz O. 1937c. Compositae. In: E. Irsmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(4): 304.
- Schwartz O. 1937d. Opiliaceae. In: E. Irsmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(4): 301.
- Schwartz O. 1937e. Polygalaceae. In: E. Irsmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(4): 302.
- Schwartz O. 1937f. Sapindaceae. In: E. Irsmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(4): 303.
- Smith JJ. 1927. Orchidaceae. In: E. Irsmscher, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(1): 9–75.
- Winkler H. 1910. Beiträge zur Kenntnis der Flora und Pflanzengeographie von Borneo. I. Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie 44: 497–571.
- Winkler H. 1912. Beiträge zur Kenntnis der Flora und Pflanzengeographie von Borneo. II. Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie 48: 87–118.

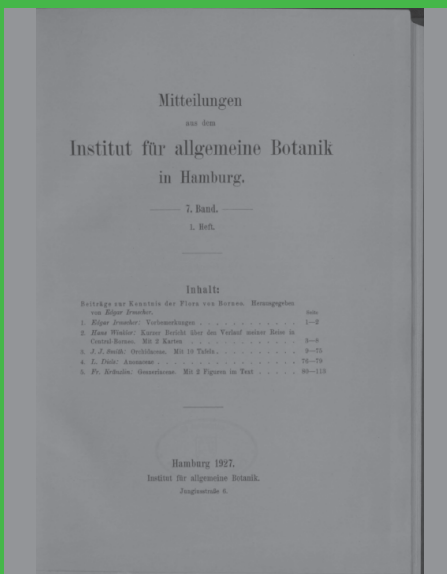
Winkler H. 1913. Beiträge zur Kenntnis der Flora und Pflanzengeographie von Borneo. III. Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie 49: 349–380.

Winkler H. 1914. Beiträge zur Kenntnis der Flora und Pflanzengeographie von Borneo. IV. Botanische Jahrbücher für Systematik, Pflanzengeschichte und Pflanzengeographie 50, Suppl.-Bd: 188–208.

Winkler H. 1927. Kurzer Bericht über den Verlauf meiner Reise in Central-Borneo. In: E. Irmischer, (Ed.). Beiträge zur Kenntnis der Flora von Borneo. Mitteilungen aus dem Institut für allgemeine Botanik in Hamburg 7(1): 3–8.

Footnotes

1. Contributions to the Flora of Borneo.
2. Treatises on the natural history of the Dutch overseas possessions.
3. Contributions to the knowledge of the flora and plant geography of Borneo.
4. Communications from the Institute for General Botany in Hamburg.
5. Contributions to the knowledge of the Flora of Borneo.
6. Vow of Allegiance of the Professors of the German Universities and High-Schools to Adolf Hitler and the National Socialist State.
7. National Socialist German Lecturers Association.
8. National Socialist Teachers' Association.
9. Hamburg Association of Lecturers.
10. A Gauleiter (District leader) was a regional leader of the NSDAP who served as the head of a Gau (district). Gauleiter was the third-highest rank in the Nazi political leadership, subordinate only to Reichsleiter, and to the Führer himself.



# Publications

Cindy, P. and Minton, G., Norliza, Zulkifli, Poh 1. Anna, L. Haigh and Marc, Gibernau and Olivier, Maurin and Paul, Bailey and Mónica M., Carlsen and Alistair, Hay and Kevin, Leempoel and Catherine, McGinnie and Simon, Mayo and Sarah, Morris and Oscar Alejandro, Pérez-Escobar and Wong, Sin Yeng and Alejandro, Zuluaga and Alexandre R., Zuntini and William J., Baker and Félix, Forest (2023) Target sequence data shed new light on the infrafamilial classification of Araceae. *American Journal of Botany*, 2023 (e1611). pp. 1-27.

2. Brodie, Jedediah F. and Mohd Azlan, Jayasilan and Cheng, Chen and Wearn, Oliver R. and Deith, Mairin C. M. and Ball, James G. C. and Slade, Eleanor M. and Burslem, David F. R. P. and Shu, Woan Teoh and Williams, Peter J. (2023) Landscape-scale benefits of protected areas for tropical biodiversity. *Nature*, 620. pp. 807-812.

3. Chunrong, Mi and Liang, Ma and Mengyuan, Yang and Xinhai, Li and Shai, Meiri and Uri, Roll and Aleksandra, Oskyrko and Daniel, Pincheira-Donoso and Lilly P., Harvey and Daniel, Jablonski and Barbod, Safaei-Mahroo and Hanyeh, Ghaffari and Jiri, Smid and Scott, Jarvie and Ronnie, Mwangi Kimani and Razaqat, Masroor and Indraneil, Das (2023) Global protected areas as refuges for amphibians and reptiles under climate change. *Nature Communications*, 14 (e1389). pp. 1-11.

4. Cindy, Peter and Gianna, Minton and Anna Norliza, Zulkifli Poh and Goh, Ann Jie and Andrew Alek, Tuen and Samuel, Kiyui. and Marie-Françoise, Van Bressems and Oswald Braken, Tisen (2023) Records of Postmortem Attentive Behavior on an Irrawaddy Dolphin (*Orcaella brevirostris*) Calf and Implications for Conservation in Kuching Bay, Sarawak, East Malaysia. *Aquatic Mammals*, 49 (1).

5. Das, Indraneil (2023) Soapbox. *The Stamp Magazine* 89(5):29. (I. Das & G.V.A. Gee.). *Stamp Magazine*, 89 (5). p. 29.

6. Das, Indraneil and Tan, Shu Han (2023) *Fordonia leucobalia* (Crab-eating snake). *Geographical Distribution*. *Herpetological Review*, 54 (1). pp. 74-75.

7. Engkamat, Lading and Indraneil,

Das (2023) Saltwater crocodile. In: Bako : Biodiversity between land and the sea. Life from Headwaters to the Coast . UNIMAS Publisher and Natural History Publications (Borneo) Sdn Bhd, Kota Samarahan and Kota Kinabalu, pp. 106-110.

8. Haas, Alexander and Das, Indraneil (2023) Making small animals big - The Tadpoles of Borneo Project. *World Congress of Herpetology Newsletter*, 4 (1). pp. 14-21.

9. Hayden R., Davis and Izneil, Nashriq and Kyra S., Woytek and Shanelle A., Wikramanayake and Aaron M., Bauer and Benjamin R., Karin and Ian G., Brennan and Djoko T., Iskandar and Indraneil, Das (2023) Genomic analysis of Bornean geckos (Gekkonidae : *Cyrtodactylus*) reveals need for updated taxonomy. *Zoologica Scripta*, 52 (1). pp. 1-15.

10. Indraneil, Das and Pui Yong, Min and Sabariman, Hassan and Taha, Wahab (2023) Reptiles. In: Bako : Biodiversity between land and the sea. Life from Headwaters to the Coast . UNIMAS Publisher and Natural History Publications (Borneo) Sdn Bhd, Kota Samarahan and Kota Kinabalu, pp. 69-76.

11. Indraneil, Das and Ramlah, Zainudin and Pui Yong, Min and Elvy Quatrin, Deka and Taha, Wahab (2023) AMPHIBIANS. In: BAKO : Biodiversity Between Land and the Sea. Life from Headwaters to the Coast . UNIMAS Publisher and Natural History Publications (Borneo) Sdn. Bhd., pp. 65-68.

12. Jayasilan, Mohd. Azlan and Mohamad Kadim, Suaidi and Indraneil, Das (2023) BAKO Biodiversity Between Land and the Sea. *Universiti Malaysia Sarawak, (UNIMAS)*.

13. Jongkar, Grinang (2023) CRABS AND SHRIMPS. In: BAKO : Biodiversity Between Land and the Sea. Life from Headwaters to the Coast . UNIMAS Publisher and Natural History Publications (Borneo) Sdn. Bhd., pp. 57-59.

14. Khairunnisa, Mohammad Hamdi and Samuel, Lihan and Stanley, Sait and Scholastica, Ramih and Nur Azzah, Osman and Nur Nazifah, Mohamad and Tay, Meng Guan and Fazia, Mohamad Sinang and Hashimatul Fatma, Hashim (2023) Water Quality Analysis and The Occurrence of Antibiotic-Resistant Bacteria (ARB) From Satow Waterfall in Bau, Malaysian Borneo. *Malaysian Applied Biology*, 52 (2). pp. 1-11.
15. Kurz, David J. and Connor, Thomas and Brodie, Jedediah F. and Baking, Esther L. and Szeto, Sabrina H. and Hearn, Andrew J. and Gardner, Penny C. and Wearn, Oliver R. and Deith, Mairin C.M. and Deere, Nicolas J. and Ahmad, Ampeng and Bernard, Henry and Goon, Jocelyn and Granados, Iys and Helmy, Olga E. and Lim, Hong Ye and Luskin, Matthew Scott and Macdonald, David W. and Ross, Joanna and Simpson, Boyd K. and Struebig, Matthew J. and Mohd Azlan, Jayasilan and Potts, Matthew D. and Goossens, Benoît and Brashares, Justin S. (2023) Socio-ecological factors shape the distribution of a cultural keystone species in Malaysian Borneo. *npj Biodiversity*, 2 (4). pp. 1-9.
16. Lau, Alice C.C. and Wessam Mohamed, Ahmed Mohamed and Nakao, Ryo and Onuma, Manabu and Qiu, Yongjin and Nakajima, Nobuyoshi and Shimozuru, Michito and Mohd Azlan, Jayasilan and Mohamed Abdallah, Mohamed Moustafa and Tsubota, Toshio (2023) The dynamics of the microbiome in Ixodidae are shaped by tick ontogeny and pathogens in Sarawak, Malaysian Borneo. *Microbial Genomics*, 9 (2). pp. 1-20.
17. Lucy C.M., Omeyer and Emily M., Duncan and Neil Angelo S., Abreo and Jo Marie V., Acebes and Lea A., AngSinco-Jimenez and Sabiqah T., Anuar and Lemnuel V., Aragones and Gonzalo, Araujo and Luis R., Carrasco and Marcus A.H., Chua and Muhammad R., Cordova and Lantun P., Dewanti and Emilyn Q., Espiritu and Cindy, Peter (2023) Interactions between marine megafauna and plastic pollution in Southeast Asia. *Science of the Total Environment*, 874 (162502). pp. 1-15.
18. Marius, Joscha Maiwald and Mohd Azlan, Jayasilan (2023) Recent record of Bulwer's pheasant in a production forest in central Sarawak. *Malayan Nature Journal*, 75 (2). pp. 307-309.
19. Mohd Azlan, Jayasilan and Aida Shafreena, Ahmad Puad (2023) Preface. In: Bukit Durang Hidden Jewel of Ulu Suai, Sarawak: Biodiversity at a Glance. UNIMAS Publisher and Wilmar Plantations Sdn Bhd, pp. 5-6.
20. Mohd Azlan, Jayasilan and Chin, Sing Yun and Wong, James Tai Hock and Lok, Lisa Choy Hong (2023) Introduction. In: Bukit Durang Hidden Jewel of Ulu Suai, Sarawak: Biodiversity at a Glance. UNIMAS Publisher and Wilmar Plantations Sdn Bhd, pp. 9-14.
21. Mohd Azlan, Jayasilan and Lok, Lisa Choy Hong and Sally, Soo Kaicheen (2023) Medium to Large Terrestrial Mammals. In: Bukit Durang Hidden Jewel of Ulu Suai, Sarawak: Biodiversity at a Glance. UNIMAS Publisher and Wilmar Plantations Sdn Bhd, pp. 95-104.
22. Mohd Azlan, Jayasilan and Mohamad Kadim, Suaidi and Indraneil, Das (2023) BAKO : Biodiversity Between Land and the Sea. Life from Headwaters to the Coast . UNIMAS Publisher and Natural History Publications (Borneo) Sdn. Bhd.
23. Mohd Azlan, Jayasilan and Mohamad Kadim, Suaidi and Indraneil, Das (2023) INTRODUCTION. In: BAKO : Biodiversity Between Land and the Sea. Life from Headwaters to the Coast . UNIMAS Publisher and Natural History Publications (Borneo) Sdn. Bhd., pp. 1-2.
24. Mohd Azlan, Jayasilan and Aida Shafreena, Ahmad Puad, eds. (2023) Bukit Durang Hidden Jewel of Ulu Suai, Sarawak: Biodiversity at a Glance. UNIMAS Publisher and Wilmar Plantations Sdn Bhd.
25. Mohd Azlan, Jayasilan and Mohamad Kadim, Suaidi and Indraneil, Das (2023) PREFACE. In: BAKO : Biodiversity Between Land and the Sea. Life from Headwaters to the Coast . UNIMAS Publisher and Natural History Publications (Borneo) Sdn. Bhd., ix-x.

26. Mohd Azlan, Jayasilan and Sally, Soo Kaicheen and Lok, Lisa Choy Hong and Khan, Faisal A.A. (2023) Small Mammals. In: Bukit Durang Hidden Jewel of Ulu Suai, Sarawak: Biodiversity at a Glance. UNIMAS Publisher and Wilmar Plantations Sdn Bhd, pp. 85-94.
27. Mohd Azlan, Jayasilan and Sally, Soo Kaicheen and Lok, Lisa Choy Hong and Voon, Audrey Mei Fang (2023) Birds. In: Bukit Durang Hidden Jewel of Ulu Suai, Sarawak: Biodiversity at a Glance. UNIMAS Publisher and Wilmar Plantations Sdn Bhd, pp. 69-62.
28. Mohd Azlan, Jayasilan and Sally Soo, Kaicheen (2023) BEARDED PIG. In: BAKO : Biodiversity Between Land and the Sea. Life from Headwaters to the Coast . UNIMAS Publisher and Natural History Publications (Borneo) Sdn. Bhd., pp. 123-124.
29. Mohd Azlan, Jayasilan and Sally Soo, Kaicheen (2023) LARGE MAMMALS. In: BAKO : Biodiversity Between Land and the Sea. Life from Headwaters to the Coast . UNIMAS Publisher and Natural History Publications (Borneo) Sdn. Bhd., pp. 99-105.
30. Mohd Azlan, Jayasilan and Wong, James and Chin, Sing Yun (2023) Way Forward. In: Bukit Durang Hidden Jewel of Ulu Suai, Sarawak: Biodiversity at a Glance. UNIMAS Publisher and Wilmar Plantations Sdn Bhd, pp. 111-114.
31. Mohd Azlan, Jayasilan and conway, S. and Travers, T.J.P. and Lawes, Michael J. (2023) The Filtering Effect of Oil Palm Plantations on Potential Insect Pollinator Assemblages from Remnant Forest Patches. *Land*, 12 (6). pp. 1-20.
32. Ord, Terry J. and Diesmos, Arvin and Norhayati, Ahmad and Das, Indraneil (2023) Evolutionary loss of complexity in animal signals: cause and consequence. *Evolution*, 77 (3). pp. 660-669.
33. Patrick, David and Jean, Lescure and Jay M., Savage and Indraneil, Das and Olivier, S. G. Pauwels and Gernot, Vogel and Thomas, Ziegler (2023) *Coluber korros* Lesson, 1831 and *Coluber korros* Schlegel, 1837 (Reptilia: Squamata: Colubridae) : there is a korros too many in the family. *Zootaxa*, 5231 (3). pp. 331-339.
34. Raja Nur Atiqah, Raja Azizi and Madinah, Adrus and Mohd Azlan, Jayasilan (2023) The Diversity, Distribution, and Habitat Preference of Rodents in Five Contrasting Habitats in the Tropical Rainforest of Malaysian Borneo. *Tropical Natural History*, 23 (1). pp. 19-29.
35. Samantha, Ambie and Cindy, Peter and Gianna, Minton and Jenny, Ngeian and Anna Norliza, Zulkifli Poh and Aazani, Mujahid and Andrew Alek, Tuen (2023) Utilizing interview-based data to measure interactions of artisanal fishing communities and cetacean populations in Kuching Bay, Sarawak, East Malaysia. *Ocean and Coastal Management*, 239. p. 162502.
36. Seng, Chiew Toh and Samuel, Lihan and Scholastica, Ramih Bunya and Leong, Sui Sien (2023) In vitro antimicrobial efficacy of *Cassia alata* (Linn.) leaves, stem, and root extracts against cellulitis causative agent *Staphylococcus aureus*. *BMC Complementary Medicine and Therapies*, 23 (85). pp. 1-17.
37. Siti Nor Baizurah, Abd Malik and Indraneil, Das (2023) Plastral deossification in the Endangered Spiny Hill Turtle, *Heosemys spinosa* (Testudines: Geoemydidae) on Borneo. *Journal of Threatened Taxa*, 15 (6). pp. 23307-23314.
38. Stanley, Sait and Samuel, Lihan and Flonia, Benet and Scholastica Ramih, Bunya and Khairunnisa, Mohammad Hamdi (2023) Isolation and molecular characterization of bacterial species from Sikog waterfall, Padawan, Sarawak. *Malaysian Journal of Microbiology*, 19 (3). pp. 308-321.
39. Steffie, Philip and Tonga, Noweg and Andrew Alek, Tuen and Jongkar, Grinang (2023) Fish Communities of Tropical Headwater Streams Under Multiple Landuse Influence. *Borneo Journal of Resource Science and Technology*, 13 (1). pp. 62-71.
40. Veronica, Martin and Indraneil, Das (2023) BORNEAN KEELED PIT-VIPER. In: BAKO : Biodiversity Between Land and the Sea. Life from Headwaters to the Coast . UNIMAS Publisher and Natural History Publications (Borneo) Sdn. Bhd., pp. 111-113.

41. Veronica, Martin and Indraneil, Das (2023) Bornean Keeled Pit-viper. In: Bako : Biodiversity between land and the sea. Life from Headwaters to the Coast . UNIMAS Publisher and Natural History Publications (Borneo) Sdn Bhd, Kota Samarahan and Kota Kinabalu, pp. 111-113.
42. Wong, Sin Yeng (2023) TWO ENDEMIC HERBS. In: BAKO : Biodiversity Between Land and the Sea. Life from Headwaters to the Coast . UNIMAS Publisher and Natural History Publications (Borneo) Sdn. Bhd., pp. 25-28.
43. Wong, Sin Yeng and Peter C., Boyce (2023) Homalomeneae (Araceae) of Borneo XXVIII– Homalomena bengohensis [Chamaecladon Clade] a new species endemic to the Bengoh Range, Sarawak. *Webbia : Journal of Plant Taxonomy and Geography*, 78 (1). pp. 15-19.
44. Wong, Sin Yeng and Peter C., Boyce (2023) Homalomeneae (Araceae) of Borneo XXX — Homalomena atlas [Hanneae Complex] a new species from the Rejang Basin, Sarawak. *Webbia. Journal of Plant Taxonomy and Geography*, 78 (1). pp. 33-37.
45. Wong, Sin Yeng and Peter C., Boyce (2023) Studies on Homalomeneae (Araceae) of Borneo XXIX — Homalomena latisinus, a new species for the Borneensis Complex from Brunei. *Webbia. Journal of Plant Taxonomy and Geography*, 78 (1). pp. 29-32.
46. Moritz, Müller and Andrew J., Spiers and Angelica, Tan and Aazani, Mujahid (2023) Investigating quorum-quenching marine bacilli as potential biocontrol agents for protection of shrimps against Early Mortality Syndrome (EMS). *Scientific Reports*, 13 (4095). pp. 1-10.
47. Lau, Winnie Lik Sing, Sing Tung Teng, Hong Chang Lim, Kieng Soon Hii, Sandric Chee Yew Leong, Chui Pin Leaw, and Po Teen Lim (2023) Molecular Detection of the Harmful Raphidophyte *Chattonella subsalsa* Biecheler by Whole-Cell Fluorescence in-situ Hybridisation Assay. *Tropical Life Sciences Research*, 34 (1). pp. 99.
48. Brodie, Jedediah F., and Philip D. Mannion (2023) The hierarchy of factors predicting the latitudinal diversity gradient. *Trends in Ecology & Evolution*.
49. Brodie, Jedediah F., and James EM Watson (2023) Human responses to climate change will likely determine the fate of biodiversity. *Proceedings of the National Academy of Sciences*, 120 (8), pp. e2205512120.
50. Brodie, Jedediah F., L. Francisco Henao-Diaz, Bayu Pratama, Conner Copeland, Travis Wheeler, and Olga E. Helmy (2023) Fruit size in Indo-Malayan island plants is more strongly influenced by filtering than by in situ evolution. *The American Naturalist*, 201 (4), pp. 574-585.
51. Williams, Peter Jeffrey, and Jedediah F. Brodie (2023) Predicting how defaunation-induced changes in seed predation and dispersal will affect tropical tree populations. *Conservation biology*, 37 (2), pp. e14014.
52. Menge, Enock O., and Michael J. Lawes (2023) Influence of Landscape Characteristics on Wind Dispersal Efficiency of *Calotropis procera*. *Land*, 12 (3), pp. 549.
53. Kyokuhaira, Anna Muchwampaka, Colin A. Chapman, Patrick A. Omeja, David Mwesigye Tumusiime, Banana Yabezi Abwoli, and Michael J. Lawes (2023) Mitigating crop raiding by forest elephants and baboons at Kibale National Park. *African Journal of Ecology*, 61 (1), pp. 129-140.
54. Adie, Hylton, Geoff Nichols, and Michael J. Lawes (2023) Coastal Forest in Eastern Southern Africa has Savanna Bush-clump Origins. *Ecosystem*, 2023, pp. 1-14.
55. Adie, Hylton, and Michael J. Lawes (2023) Solutions to fire and shade: resprouting, growing tall and the origin of Eurasian temperate broadleaved forest. *Biological Reviews*, 98 (2), pp. 643-661.
56. Barahukwa, Anke, Colin A. Chapman, Mary Namaganda, Gerald Eilu, Patrick A. Omeja, and Michael J. Lawes (2023) The effects of the invasive species, *Lantana camara*, on regeneration of an African rainforest. *African Journal of Ecology*.

57. Preece, Noel D., Penny van Oosterzee, and Michael J. Lawes (2023) Reforestation success can be enhanced by improving tree planting methods. *Journal of environmental management*, 336, pp. 117645.
58. Ajibola, Olaide Olawunmi, Raymond Thomas, and Babatunde Femi Bakare (2023) Selected fermented indigenous vegetables and fruits from Malaysia as potential sources of natural probiotics for improving gut health. *Food Science and Human Wellness*, 12(5), pp. 1493-1509.
59. Nelson, Heira Vanessa, Jualang Azlan Gansau, Ahmad Asnawi Mus, Nurul Najwa Mohammad, Nor Amirah Shamsudin, Jumatiah Amin, and Nor Azizun Rusdi (2023) Developing *Paraphalaenopsis labukensis* (Shim, A. Lamb & CL Chan), an Orchid Endemic to Sabah, Borneo, Asymbiotic Seed Germination and In Vitro Seedling Development. *Horticulturae* 9 (6). pp. 681.
60. Wee, Sze Yee and Ahmad Zaharin, Aris (2023) Revisiting the "forever chemicals", PFOA and PFOS exposure in drinking water. *npj Clean Water*, 6 (57). pp. 1-16.