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INSTITUT EKOSAINS BORNEO, UPMKB
INSTITUTE OF ECOSYSTEM SCIENCE BORNEO
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Volume 2, Issue 2, 2023

BULLETIN

INSTITUT EKOSAINS BORNEO

(Institute of Ecosystem Science Borneo)

Universiti Putra Malaysia Bintulu Sarawak Campus

~To be a Reference for Ecosystem Quality~

THEME: GREEN ECONOMY



BULLETIN

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Universiti Putra Malaysia Bintulu Sarawak Campus

Editors:

Mugunthan Perumal, Leong Sui Sien, Waseem Razzaq Khan, and Keeren Sundara Rajoo

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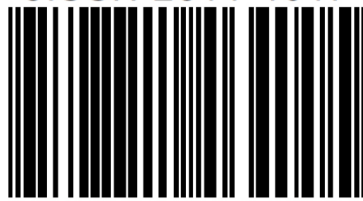
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**Perpustakaan Negara Malaysia
Institut EkoSains Borneo Bulletin
eISSN 2811-4647**

**Mugunthan Perumal, Leong Sui Sien, Waseem Razzaq Khan, and Keeren Sundara Rajoo.
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FOREWORD BY THE CHIEF EDITOR

Welcome to our Institute of Ecosystem Science Borneo bulletin dedicated to the Green Economy — a fusion of economic prosperity and environmental consciousness. In today's rapidly evolving world, the concept of sustainability has transcended mere buzzwords, transforming into a guiding principle steering the course of global development.

As the Chief Editor, I am immensely proud to present this comprehensive edition, delving into the depths of the green economy—an endeavour that intertwines economic prosperity with environmental stewardship. This edition embodies our commitment to shedding light on innovative approaches, groundbreaking research, and the amalgamation of policies shaping this pivotal sphere.

I extend heartfelt thanks to our contributors for enriching this edition. Let this bulletin spark conversations and drive positive change toward a world where environmental preservation and economic progress go hand in hand.

Warm regards,

Assoc. Prof. Dr. Leong Sui Sien
Chief Editor, IEB Bulletin

THE EDITORIAL TEAM



INSTITUT EKOSAINS BORNEO

VISION

We intend to be Borneo referral centre for research and development in ecosystem quality.

MISSION

To be a reference of ecosystem quality.



PAST EVENTS

Keratan Akhbar Utusan Borneo, Dr Syeed SaifulAzry dilantik sebagai Pengarah Institut EkoSains Borneo UPM - 02 April 2023



LANTIK: Mohd Roslan (kanan) menyampaikan surat pelantikan kepada Dr Syeed SaifulAzry sebagai Pengarah Institut Ekosains Borneo (IEB) UPM.

Dr Syeed SaifulAzry dilantik sebagai Pengarah Institut Ekosains Borneo UPM

BINTULU: Dr Syeed SaifulAzry Osman AlEdrus kini dilantik sebagai Pengarah Institut Ekosains Borneo (IEB) Universiti Putra Malaysia (UPM) bagi tempoh setahun berkuat kuasa 1 April 2023 hingga 31 Mac 2024.

Surat pelantikan beliau diserahkan oleh Naib Canselor Universiti Putra Malaysia (UPM) Datuk

Profesor Dr Mohd Roslan Sulaiman.

Menurut UPM, pelantikan itu selaras dengan peruntukan di bawah Seksyen 12 (3) Perlembagaan Universiti Putra Malaysia.

Sebelum ini, Dr Syeed SaifulAzry merupakan Pegawai Penyelidik Institut Perhutanan Tropika dan Produk Hutan UPM.

PAST EVENTS

Keratan Akhbar Utusan Borneo, Institut EkoSains Borneo UPMKB bakal menjadi pemangkin penyelidikan produk hiliran bernilai tambah berasaskan biojisim kelapa sawit - 23 Ogos 2023

Rencana

Khamis, 24 Ogos 2023 **Utusan Borneo** 9

Institut EkoSains Borneo UPMKB bakal menjadi pemangkin penyelidikan produk hiliran bernilai tambah berasaskan biojisim kelapa sawit

Sumbangan UPMKB

PAMERAN dan Persidangan Teknologi Pengilangan Minyak Sawit (POMtec) 2023 anjuran Persatuan Pemilik Ladang Kelapa Sawit Sarawak (SOPPOA) telah diadakan pada 8 hingga 9 Ogos lepas di Hotel Imperial, Miri.

POMtec 2023 bertemakan "Toward Sustainable & Value-Added Business Operation" dianjurkan bagi menentangakan keberkesanan teknologi terkini yang menggalakkan kemampunan seperti proses mesra alam, pengurangan sisa serta kecekapan tenaga dalam operasi pengilangan minyak sawit. Institut EkoSains Borneo (IEB), Universiti Putra Malaysia Kampus Bintulu Sarawak (UPMKB) telah dijemput dan disediakan ruang pameran untuk bersama-sama mempamerkan hasil inovasi penyelidikan dan penerbitan sepanjang program POMtec berlangsung.

Majlis Perasmian POMtec 2023 telah disempurnakan oleh Timbalan Perdana Menteri Malaysia dan Menteri Perlindungan dan Komoditi Datuk Seri Fadillah Yusof. Beliau juga telah melawat ruang pameran IEB, UPMKB bagi melihat produk inovasi penyelidikan dan penerbitan yang telah dihasilkan oleh UPM yang berkaitan dengan kelapa sawit dan biojisimnya.

Semasa lawatan tersebut Fadillah juga diiringi Menteri Industri Makanan, Komoditi dan Pembangunan Wiyah Sarawak (M-FICORD) Dato Sri Dr Stephen Rundi Utom, Pengerusi Persatuan Pemilik Ladang Kelapa Sawit Sarawak (SOPPOA) Eric Kiu Kwong Seng serta dif-dif terhormat yang lain.

Taklimat semasa lawatan tersebut telah disampaikan oleh Pengarah IEB, UPMKB Dr Syeed SaifulAzry Osman Al Edrus. Beliau berminat terhadap hasil penyelidikan dan penerbitan yang ditunjukkan dan turut mencadangkan pihak IEB, UPMKB untuk berbincang lebih lanjut bersama M-FICORD bagi melihat potensi kolaboratif yang boleh diadakan bagi membangunkan produk hiliran berasaskan biojisim



kelapa sawit di Sarawak.

Menerusi program yang dianjurkan, Timbalan Perdana Menteri turut mengesa pihak terlibat untuk terus berkesperimen dengan prosedur dan strategi inovatif untuk menambah nilai kepada rantaian pengeluaran minyak sawit negara.

Turut melawat ruang pameran IEB, UPMKB ialah Timbalan Menteri Tenaga dan Kelestarian Alam, Sarawak Dr Hazlan Abang Hipni.

Pada majlis penutupan, pihak IEB, UPMKB sempat bertukar pandangan bersama dengan Timbalan Menteri Industri Makanan, Komoditi dan Pembangunan Wiyah Sarawak (M-FICORD) MacLaine @ Martin Ben.

Dua orang penyelidik dari UPMKB iaitu Prof Dr Patricia King Jie Hing (Timbalan Pengarah IEB, UPMKB) dan dan Dr

Sivasagar Seenivasagam (Penyarah Kanan, Jabatan Sains dan Teknologi, UPMKB) telah dijemput untuk membentangkan hasil penyelidikan mereka Dalam POMtec 2023.

Turut serta dalam program tersebut ialah Dr Latifah Omar (Ketua Laboratori Biodiversiti Borneo, IEB, UPMKB) bersama Dr Mugunthan Perumal (Pegawai Penyelidik, IEB, UPMKB).

Sempena pameran tersebut, IEB, UPMKB turut mempromosikan program pengajian yang ditawarkan di UPMKB seperti Program Pendedahan Diploma, Diploma, Bachelor, Sarjana dan Doktor Falsafah yang telah dikongsikan kepada para pelajar serta peserta POMtec yang hadir.

Turut hadir memeriahkan program tersebut ialah rakan-rakan dari Institut Pengajian Tinggi Swasta (IPTS) dan pemain industri.

PAST EVENTS

Keratan Akhbar Utusan Borneo, 148 peserta empat negara sertai program e-mobiliti pelajar anjuran UPMKB, UNAS - 20 Oktober 2023

Sarawak Sabah Nasional Dunia Iban Sukan Ekonomi Mahkamah Rencana

Halaman Utama > Sarawak > 148 peserta empat negara sertai program e-mobiliti pelajar anjuran UPMKB, UNAS

148 peserta empat negara sertai program e-mobiliti pelajar anjuran UPMKB, UNAS

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Dr Syeed.

BINTULU: Seramai 148 peserta dari empat negara iaitu Malaysia, Indonesia, Jepun dan India menyertai program 'International Class Exchange: Exploring Sarawak and Indonesia's Nature and Culture 2023' secara dalam talian, baru-baru ini.

Program anjuran Institut Ekosains Borneo (IEB) Universiti Putra Malaysia Kampus Bintulu (UPMKB) dengan kerjasama Universitas Nasional (UNAS) Indonesia itu merupakan program e-mobiliti pelajar telah berlangsung pada 18 dan 19 Oktober lalu.



Dr Tatang.

Jurucakap penganjur berkata, program dua hari itu dilaksanakan secara dalam talian melalui platform Zoom dan diselenggarakan oleh Dr Keeren Sundara Rajoo selaku pengarah program.

Program ini telah dirasmikan oleh Pengarah IEB UPMKB Dr Syeed Saiful Azry Osman Al-Edrus dan Dekan Fakulti Biologi dan Pertanian UNAS Dr Tatang Mitra Setia.

Dr Syeed berkata, kerjasama dalam kalangan universiti-universiti di rantau Asia Tenggara adalah penting dalam menghadapi cabaran global sekali gus berharap program itu akan menjadi platform untuk kerjasama lebih kukuh antara UPMKB dan UNAS.

Sementara itu, Dr Tatang menyatakan mengenai hasrat pihaknya untuk menjadikan program itu sebagai program tahunan kerana manfaatnya jelas terutama untuk pelajar-pelajar UPMKB dan UNAS.

Penceramah-penceramah program ini terdiri daripada penyelidik bersekutu IEB UPMKB Dr Latifah Omar yang menerangkan mengenai tumbuhan asli yang digunakan sebagai perisa dan rempah oleh masyarakat Melanau, manakala Dr Keeren pula membentangkan maklumat mengenai sektor perhutanan di Malaysia.

Dua pensyarah UNAS Profesor Dr Sri Endarti Rahayu dan Profesor Bersekutu Ir Etty Hesthiati berkongsi mengenai kajian etnobiologi di Indonesia dan biodiversiti tumbuhan buah-buahan tempatan di Hutan Kota Jakarta Selatan.



Para peserta yang menyertai program dalam talian.

PAST EVENTS

Keratan Akhbar Utusan Borneo, Dr Syeed SaifulAzry dilantik sebagai Pengarah Institut Ekosains Borneo UPM - 31 Mac 2023



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[Nasional](#)
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[Sukan](#)
[Ekonomi](#)
[Mahkamah](#)
[Rencana](#)

[Halaman Utama](#) » [Sarawak](#) » Dr Syeed SaifulAzry dilantik sebagai Pengarah Institut Ekosains Borneo UPM

Dr Syeed SaifulAzry dilantik sebagai Pengarah Institut Ekosains Borneo UPM

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Menurut UPM, pelantikan itu selaras dengan peruntukan di bawah Seksyen 12 (3) Perlembagaan Universiti Putra Malaysia.

Sebelum ini, Dr Syeed SaifulAzry merupakan Pegawai Penyelidik Institut Perhutanan Tropika dan Produk Hutan UPM.

oleh Abang Ismail Abang Su'ud

Kategori [Sarawak](#)

PAST EVENTS

Keratan Akhbar Utusan Borneo, Kerjasama pelbagai pihak beri impak positif dalam bidang penyelidikan - 10 Jun 2023

Kerjasama pelbagai pihak beri impak positif dalam bidang penyelidikan

BINTULU:Beberapaperkara yang dibincangkan dari aspek potensi kerjasama dilihat mampu memberi impak positif dalam bidang penyelidikan di Malaysia dan Sarawak.

Ia melibatkan Institut Eko-Sains Borneo (IEB) Universiti Putra Malaysia Kampus Bintulu (UPMKB), Lembaga Kenaf dan Tembakau Negara (LKTN), Syarikat Juta Walet Services & Trading serta Syarikat Sinar Samalaju Sdn Bhd semasa pertemuan antara lima pihak terbabit di IEB UPMKB di sini, baru-baru ini.

Dalam pertemuan itu, UPMKB diwakili Pengarah IEB Dr Syeed Saifulazry

Osman Al-Edrus dan LKTN diwakili Timbalan Ketua Pengarah Pembangunannya Mohd Fadzhel Nasir.

Dr Syeed Saifulazry berkata, dengan adanya gabungan dan kolaboratif dari aspek pengetahuan, kepakaran, kemudahan prasarana dan dana penyelidikan mampu meningkatkan keupayaan pengeluaran produk berkaitan bagi memenuhi keperluan pengguna di peringkat nasional dan antarabangsa.

"IEB dan UPMKB mengalukan peluang kerjasama ini selaras dengan misi UPMKB memberi sumbangan bermakna pembentukkan kekayaan

dan pembangunan negara serta kemajuan manusia sejagat menerusi penerokaan dan penyebaran ilmu," katanya.

Kedua-dua pihak turut menerangkan tentang fungsi, peranan, keupayaan dan hala tuju di peringkat agensi masing-masing.

Hadir sama wakil universiti, agensi dan syarikat terbabit Dr Mugunthan Perumal dan Zahora Ismail dari UPMKB, Nik Norhisham Nik Yaacob, Mohd Azizi Awang (LKTN), Patrick Jenau Tindit (Syarikat Juta Walet Services & Trading), Lt Madya (B) Duke Janteng dan Jacky Lanjar (Syarikat Sinar Samalaju Sdn Bhd).



BINCANG: Perbincangan diadakan antara IEB dan LKTN serta dua syarikat berkaitan.

PAST EVENTS

Keratan Akhbar Utusan Sarawak, PPDK Bintulu jual sayur hidroponik,
15 Jun 2023

PPDK Bintulu jual sayur hidroponik

BINTULU: Pertubuhan Pemulihan Dalam Komuniti (PPDK) Bintulu kini memulakan gerai jualan sayur-sayuran hidroponik di hadapan pusat berkeajaan.

Menurut satu kenyataan dari Universiti Putra Malaysia Kampus Bintulu (UPMKB) baru-baru ini, sayur-sayuran hidroponik itu ditanam oleh usahawan muda orang kelainan upaya (OKU) di bawah program 'Team Up with Invisible Minoriti Yet Powerful Organisms' (T-I-N-Y) menerusi Skim Pemindahan Ilmu (KTGS).

"Program tersebut dijalankan di bawah Makmal Biodiversiti Borneo, Institut Sains Ekosistem Borneo (IEB) UPMKB bersama Pusat Transformasi Komuniti Universiti (UCTC) UPM.

"Ia berteraskan visi dan misi merancang program kemasyarakatan melalui pemindahan ilmu dan pembangunan komuniti," kata kenyataan itu.

Penyelidik Bsrsekutu dan Pensyarah Jabatan Sains Haiwan dan Perikanan, Fakulti Sains Pertanian dan Perhutanan, UPMKB, Profesor Madya Dr. Leong Sui Sien yang mengetuai program itu berharap ia dapat menyediakan persekitaran yang menyokong dan memupuk minat OKU untuk menanam sayur hidroponik mereka.

"Program ini boleh meningkatkan ekonomi pusat dan merangsang kemahiran deria atau pergaulan mereka dengan melakukan penanaman hidroponik secara 'hands-on' menggunakan mikrob berkesan dan menjual produk mereka di pusat," ujarnya.

Sementara itu, Pengarah Institut Ekosains Borneo (IEB), Dr. Syeed Saifulazry Osman Al Edrus amat menggalakkan golongan tersebut menyertai program seumpama agar dapat memupuk lebih ramai OKU muda untuk bekerja sendiri dan menjadi usahawan.

PAST EVENTS

Institut EkoSains Borneo Webinar, Talk Series and e-Mobility Programme

LIVE WEBINAR

UPM INSTITUT EKOSAINS BORNEO, UPMKB
UNIVERSITI PUTRA MALAYSIA
INSTITUTE OF ECOSYSTEM SCIENCE BORNEO
انستوتوت ايكوساينس بورنيو

Balau Talk

Siri 1

Anjuran : Laboratori Biodiversiti Borneo

Tajuk 1 : Teknik Penanaman dan Pembajaan Pokok Sagu
Tajuk 2 : Teknik Penyelegaraan Tanaman Sagu

18 April 2023 (Selasa)
9.30am-11.30am

Imbas Kod QR
Meeting number : **2641 183 0414**
Password : **BALAU**

Peserta yang berjaya menghadiri program ini akan menerima :
 • Markah Latihan CPD (Staf UPM)
 • E-Sijil akan diberikan kepada semua peserta

Penceramah 1
Puan Fariza Zaini
Pegawai Penyelidik,
Stesen Penyelidikan CRAJUN Sungai Tatau,
Dalat, Sarawak, Malaysia

Penceramah 2
Encik Peter Stanley Howell
Pegawai Penyelidik Kanan,
Stesen Penyelidikan CRAJUN Sungai Tatau,
Dalat, Sarawak, Malaysia

Moderator
Dr. Mugunthan A/L Perumal
Pegawai Penyelidik,
Laboratori Biodiversiti Borneo,
Institut EkoSains Borneo,
UPM Kampus Bintulu Sarawak (UPMKS)

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LIVE WEBINAR

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Unleashed Turkey Experiences

Speaker
Assoc. Prof. Dr. Leong Sui Sien
Research Associate,
Institute of Ecosystem Science Borneo,
UPM Bintulu Sarawak Campus

Moderator
Dr. Keeren A/L Sundara Rajoo
Research Associate,
Institute of Ecosystem Science Borneo,
UPM Bintulu Sarawak Campus

6th July 2023 (Thursday)
9.30am-10.30am

Scan QR Code
Meeting number : **958 1881 9813**
Password : **upm2023**

CPD Point (Staf UPM) *Upon successful participation
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PAST EVENTS




FREE WEBINAR

Leveraging Next-Gen Sequencing, Bioinformatics and Data Science for Sustainable Advancements in the Oil Palm Industry

Hosted by Institut Ekosains Borneo (IEB), UPMKB
Presented by Dr Hazwan Fikri, Genomics Account Scientist @ Codon Genomics

17 OCT 2023

PLATFORM
Google Meet
(link will be provided one day before the event)

TIME
9:00 am – 10:00 am

About the Webinar

As one of the most economically significant crops globally, the oil palm industry faces numerous challenges in terms of sustainability, yield optimization, and disease resistance. Fortunately, the integration of cutting-edge technologies has opened new possibilities for addressing these issues. NGS technologies allow for rapid and cost-effective sequencing of the oil palm genome, enabling researchers to uncover crucial genetic information related to important traits and disease resistance mechanisms. This genomic data, when combined with bioinformatics tools and algorithms, facilitates comprehensive analysis and interpretation, accelerating the breeding process for desirable traits and disease-resistant varieties. Data science enables the efficient management, integration and analysis of large-scale datasets generated by NGS, facilitating the development of predictive models for breeding and precision agriculture practices. By harnessing the synergy of NGS, bioinformatics, and data science, the oil palm companies in Malaysia aim to achieve sustainable advancements, improving productivity, reducing environmental impact, and ensuring long-term viability.

About the Speaker



Dr Hazwan Fikri is a Genomics Account Scientist in Codon Genomics. He completed his Ph.D. in Systems Biology in 2022. He studied the Ganoderma-oil palm pathosystem, focusing on the effector protein of the pathogen through genome-wide and transcriptome analyses. His current work involves utilizing his expertise in NGS to encourage local researchers to venture beyond the Central Dogma of Molecular Biology by integrating their work with digital technologies and data science with -omics research.

Save Your Seat

Click the link or scan the QR code to register:
<https://portal.darwinapp.co/darwin-sharing-form/ie/ndc>



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LIVE WEBINAR



International Class Exchange: Exploring Sarawak & Indonesia's Nature and Culture

Theme: Plants for Human Welfare

18th October 2023 | Wednesday
8.30am - 1.00pm (Jakarta), 9.30am-2.00pm (Malaysia)

Speaker 1
Dr. Keeren Sundara Rajoo
Institute of Ecosystem Science Borneo, Universiti Putra Malaysia Bintulu Sarawak Campus (UPMKB)
Title 1: Introduction to Malaysian Forests

Speaker 3
Assoc. Prof. Ir. Etty Hesthiati, MSI.
Universitas Nasional (UNAS)
Title 3: Biodiversity of Local Fruit Plants in South Jakarta City Forest

Speaker 2
Prof. Dr. Sri Endarti Rahayu MSI.
Universitas Nasional (UNAS)
Title 2: Studies of Ethnobiological in Indonesia

Speaker 4
Dr. Latifah Binti Omar
Institute of Ecosystem Science Borneo, Universiti Putra Malaysia Bintulu Sarawak Campus (UPMKB)
Title 4: Indigenous Plants Used for Flavour and Spices by The Melanau Community in Sarawak

Moderator
Mr. Mohd Hasyrin Bin Hassan
Institute of Ecosystem Science Borneo, Universiti Putra Malaysia Bintulu Sarawak Campus (UPMKB)



Scan QR Code
Meeting ID: 977 8257 7925
Passcode: BORNEO2023
E-certificate will be provided
CPD Point (Staf UPM)
**Upon successful participation*

Anjuran bersama
Laboratori Biodiversiti Borneo, Institut EkoSains Borneo, Universiti Putra Malaysia Kampus Bintulu Sarawak dengan Fakultas Biologi dan Pertanian, Universitas Nasional (UNAS), Indonesia

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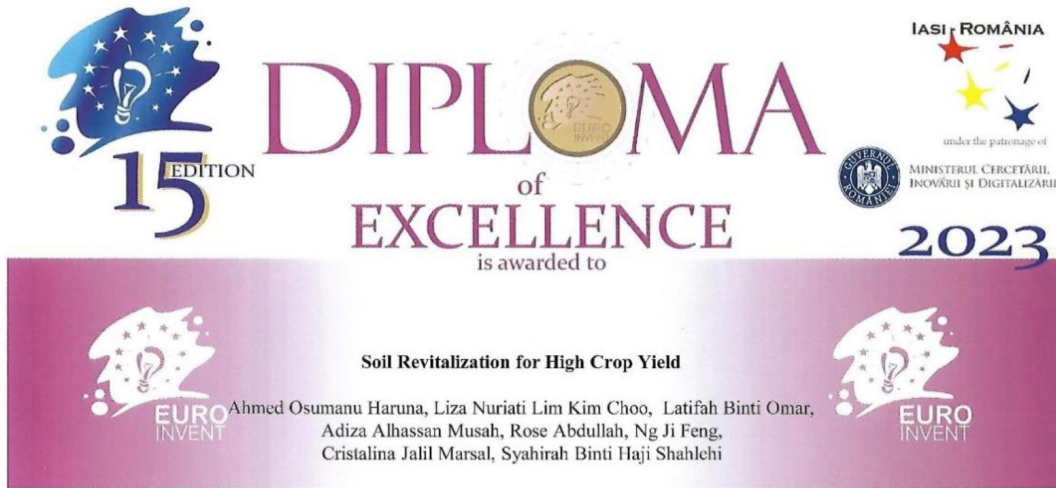
WINNING AWARDS

Institut EkoSains Borneo Awards 2023



WINNING AWARDS

Institute EkoSains Borneo 2023 Awards



15 EDITION

DIPLOMA of EXCELLENCE

is awarded to

2023

Soil Revitalization for High Crop Yield

Ahmed Osumanu Haruna, Liza Nuriati Lim Kim Choo, Latifah Binti Omar, Adiza Alhassan Musah, Rose Abdullah, Ng Ji Feng, Cristalina Jalil Marsal, Syahirah Binti Haji Shahlehi

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EURO INVENT

President of International Jury
Prof.Dr.Eng. Mohd Mustafa Al Bakri ABDULLAH

President of Scientific Committee
Prof.Dr. Ion SANDU

EUROINVENT

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May 13, 2023




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EURO INVENT

President of International Jury
Prof.Dr.Eng. Mohd Mustafa Al Bakri ABDULLAH

President of Scientific Committee
Prof.Dr. Ion SANDU

May 13, 2023



WINNING AWARDS

Institut EkoSains Borneo Awards 2023



Congratulations

SILVER PRIZE WINNERS OF
INNOVATION COMPETITION 2023

POSTGRADUATE CATEGORY

**Deborah Renting Anak Jimmy, Rafeah Wah, Latifah Omar,
Nathaniel Maikol**
*Organic-based fertilizers produced from sago hampas and decanter
cake and their uses in maize cultivation*

**Nurfaezzah Amat Jafar, Nurashikin Suhaili,
Dayang Salwani Awang Adeni**
Bioethanol from Banana Waste

**Nur Afqah Kamaludin, Claudeareena Garding Anak Malien,
Farah 'Izzah Nabilah Jokdin, Dayang Norafizan Awang Chee**
*Synthesis and Adsorption Study of Amino Functionalized Zeolitic
Imidazole Framework (ZIF-8/NH₂) for Methyl Blue Removal*

Community-Driven University For a Sustainable World



SPECIAL AWARD

For

Prof. Dr. Ahmed Osumanu Haruna, Dr. Liza Nuriati Lim Kim Choo,
Dr. Latifah Binti Omar, Dr. Adiza Alhassan Musah, Assoc. Prof. Dr. Rose Abdullah,
Ng Ji Feng, Dr. Cristalina Jalil Marsal, Dr. Syahirah Binti Haji Shahlehi

to

Soil Revitalization for High Crop Yield

On the occasion of
15th European Exhibition of Creativity and Innovation
"EUROINVENT 2023" Iasi, Romania,
11-13 May 2023

Iasi, Romania
May 2023

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WIIPA SPECIAL AWARD

Presented to

Prof. Dr. Ahmed Osumanu Haruna, Dr. Liza Nuriati Lim Kim Choo,
Dr. Latifah Binti Omar, Dr. Adiza Alhassan Musah,
Assoc. Prof. Dr. Rose Abdullah, Ng Ji Feng, Dr. Cristalina Jalil Marsal,
Dr. Syahirah Binti Haji Shahlehi

in recognition of the outstanding invention

Soil Revitalization for High Crop Yield

exhibited at

The 15th European Exhibition of Creativity and Innovation
« EUROINVENT 2023 »
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Regeneration of Soil
Health Increased Crop Yeild

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Embracing the Green Economy in Sarawak: A Holistic Approach for a Sustainable Future

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Sustainable development is a widely discussed concept worldwide, but its essence may be hard to grasp due to complex definitions. Simply put, sustainable development means living in a way today that ensures a better tomorrow. It rests on three core pillars: environmental, social, and economic factors, resembling a delicate juggling act. To sustain this balance, one must simultaneously prioritize environmental responsibility, social equity, and economic growth. Neglecting any of these aspects disrupts the delicate equilibrium. For instance, rapid economic growth becomes unsustainable if it disregards human rights and exploits finite natural resources. Similarly, hasty deforestation for immediate gains jeopardizes animal habitats, leaving local communities vulnerable to enduring risks like floods. Balancing these elements is challenging, but the concept of the Green Economy has emerged as a guiding light, offering a practical “manual” for navigating the complexities of sustainability.

United Nations Environment Programme (UNEP) defined green economy^{1,*} as “one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities (UNEP, 2023). It marks a significant shift towards sustainability, striving to harmonize economic growth with environmental responsibility and social inclusiveness. The green economy stands on three key pillars: environmental responsibility, social equity, and economic prosperity (Figure 1). Environmental responsibility involves sustainable resource use and practices, emphasizing conservation. Social equity ensures fair opportunities, fair salary, and community well-being. Economic prosperity focuses on growth that aligns with sustainability, encouraging innovation and green technologies. These pillars work together to create a holistic approach where ecological, social, and economic considerations are harmonized for a balanced and resilient future. The Green Growth Index is a comprehensive measure that assesses a country’s progress in achieving environmentally sustainable and economically inclusive development. It goes beyond traditional economic indicators by considering factors such as environmental sustainability, social inclusivity, and resource efficiency (Figure 2). The performance in scores of countries on the Green Growth Index in 2019 is depicted in Figure 3.

The green economy is not a one-size-fits-all concept; rather, it is a dynamic and evolving framework that integrates environmental considerations into economic decision-making. Greening the economy depends on policy and institutional settings, industrial focus, level of development, social structures, resource availability, and specific environmental challenges. Let’s delve into City A and City B, each with unique industrial focus. City A, deeply rooted in agriculture, prioritizes sustainable farming, emphasizing organic methods and renewable energy.



FIGURE 1: THE PILLARS OF GREEN ECONOMY.



FIGURE 2: CONCEPTUAL FRAMEWORK FOR THE GREEN GROWTH INDEX (GLOBAL GREEN GROWTH INSTITUTE, 2020).

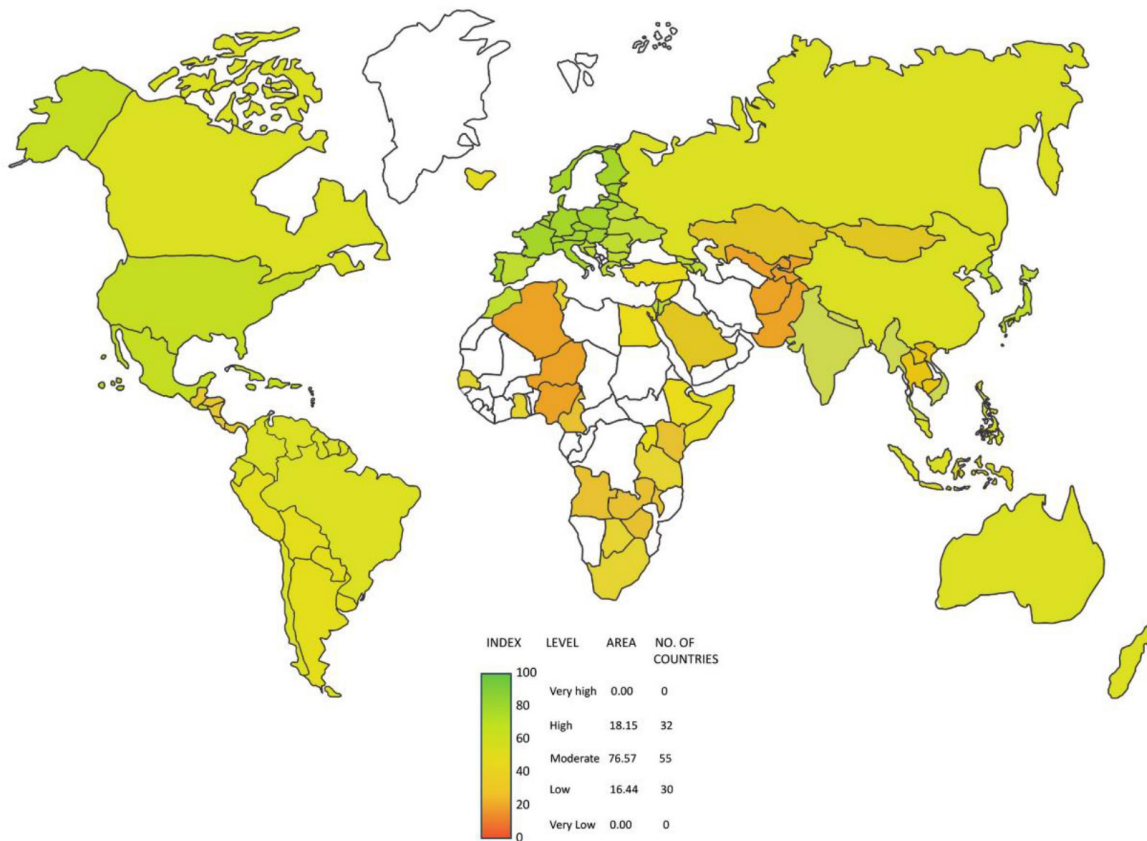


FIGURE 3: PERFORMANCE IN SCORES OF COUNTRIES ON THE GREEN GROWTH INDEX IN 2019 (GLOBAL GREEN GROWTH INSTITUTE, 2020).

The energy, forestry, and agricultural sectors play pivotal roles in achieving a green economy. The energy sector, through the adoption of renewable energy such as solar, wind, and hydro power, reduces reliance on finite fossil fuels, mitigating environmental impact and promoting sustainable energy practices. In forestry, responsible management practices, afforestation efforts, and conservation contribute to biodiversity preservation, carbon sequestration, and the sustainable use of forest resources. The agricultural sector, focusing on sustainable practices like organic farming and agroforestry, ensures responsible resource management, soil health, and ecosystem preservation. Together, these sectors exemplify the commitment to building a green economy, where the responsible utilization of resources aligns with environmental conservation, social inclusivity, and long-term economic growth. Sarawak has demonstrated proactive sustainability efforts towards a green economy. The Samalaju Industrial Park, spearheaded by the Regional Corridor Development Authority (RECODA) and Bintulu Development Authority (BDA) as part of the Sarawak Corridor for Renewable Energy (SCORE), encompasses an extensive 8,000-hectare area dedicated to energy-intensive industries (Figure 4). These industries adhere to sustainable practices, deriving their power from renewable hydro energy sourced from the 2,400MW Bakun and 944MW Murum dams (Figure 5) (Wong, 2023). In the forestry sector, Sarawak's commitment to the Sustainable Forest Management (SFM) standard is acknowledged by the National Audit Department (Jee, 2023). Despite historical dependence on timber for income, the Forest Department Sarawak (FDS) actively advocates for reforestation, forest conservation, social forestry, and emphasizes the nexus between forests and the carbon market (Figure 6).



FIGURE 4: AN ALUMINIUM SMELTER OWNED BY PRESS METAL IN SAMALAJU INDUSTRIAL PARK (WONG, 2023).



FIGURE 5: 2400 MW BAKUN DAM, SARAWAK (HYDROPOWERS AND DAMS, 2018).

Circular economy and low-carbon cities concepts cannot be overlooked in the journey towards a green economy. The circular economy model, focused on waste reduction, recycling, and sustainable product design, fosters a closed-loop system that minimizes environmental impact. By promoting the efficient use of resources and reducing waste, it aligns with the green economy's commitment to responsible resource utilization and environmental conservation. Simultaneously, the concept of low-carbon cities contributes significantly to the green economy agenda.



FIGURE 6: RAINFOREST SURROUNDING BATANG AI, SARAWAK (SARAWAK TOURISM, 2020).

Through urban planning that prioritizes energy-efficient buildings, green spaces, and sustainable transportation infrastructure, low-carbon cities aim to minimize carbon emissions. This approach not only addresses environmental concerns but also enhances the overall quality of life for residents, reflecting the social equity pillar of the green economy. BDA is at the forefront of green economy efforts with the drafting of the Strategic Plan 2024-2030, which aims to establish a low-carbon industry hub in Sarawak. This strategic initiative signifies a comprehensive dedication to sustainability, aligning economic activities with environmental responsibility and social inclusivity.

In summary, the path to a green economy is both intricate and crucial, striking a careful balance between caring for the environment, ensuring fairness in society, and fostering economic success. The commitment to sustainable development is encapsulated in the dynamic framework of the green economy, guiding us through various industrial focuses, proactive sustainability efforts, and strategic initiatives like the Samalaju Industrial Park and the Strategic Plan 2024-2030. The principles of environmental responsibility, social fairness, and economic success serve as the foundation of this transformative approach, ensuring a harmonious and resilient future. In this collective effort, where diverse sectors and innovative strategies come together, the vision of a sustainable and balanced world for generations to come becomes not just a possibility but a compelling reality.

References

Global Green Growth Institute. (2020). Green Growth Index 2020: Measuring performance in achieving SDG targets. Seoul.

Hydropowers and Dams. (2018). SMEC to study extension of Bakun hydropower plant in Sarawak. <https://www.hydropower-dams.com/news/smec-to-study-extension-of-bakun-hydropower-plant-in-sarawak/>. Accessed on 15 Nov 2023.

Jee, N. (2023). Thumbs-up to Sarawak's sustainable forest management. <https://www.newsarawaktribune.com.my/thumbs-up-to-sarawaks-sustainable-forestmanagement>. Accessed on 15 Nov 2023.

Sarawak Tourism. (2020). Sarawak may be Malaysia's most musical state — here's why. <https://www.nationalgeographic.co.uk/travel/2020/03/all-you-need-know-about-sarawaks-rain-forest-world-music-festival>. Accessed on 15 Nov 2023.

United Nations Environment Program (UNEP). (2023). Green economy. <https://www.unep.org/pt-br/node/23750#:~:text=The UN Environment Programme has,in carbon%2C resource efficient and>. Accessed on 15 Nov 2023.

Wong, J. (2023). Samalaju Industrial Park continues to attract FDI. <https://www.thestar.com.my/business/business-news/2023/10/30/samalaju-industrial-park-continues-to-attract-fdi>. Accessed on 15 Nov 2023.

Organic Fertilizers for Green Economy

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Food crops and commodity crops production in sustainable approaches need to be enhanced to provide healthy food and commodity crops without compromising environment quality, economic profitability, as well as social and economic equity. In addition, it is important to improve soil fertility because nutrients in the soil are not readily available and most of the nutrients in the soil are release from the application of either organic fertilizers or chemical fertilizers. However, the imbalanced use of chemical fertilizers is currently an important issue that needs to be addressed. Moreover, chemical fertilizers are one of the expensive inputs in food crops production. Organic farming is considered as the best-known alternative for achieving circular and economically feasible practice when the farmers can get a premium price for their product. Regulations on sustainability practices in agriculture have been enforced by many countries to monitor pollution, protect the environment, and control climate change. Using organic fertilizers produced from waste could be one way to contribute to a green economy. Many studies have been carried out on producing organic fertilizers from agricultural wastes to manage those wastes and to also produce organic fertilizers to replenish soil fertility for food crops production.

Some of the local entrepreneurs who produce organic fertilizers from crop residues are Mr. Razipin Gutuk, the owner of Hasil Pertanian Organik, Ranau, Sabah and Mr. Leong Boon Huat, the Director of X Community Project, Bintulu, Sarawak. Both of these organic fertilizer operators use insect larvae to produce organic fertilizers due to the shorter production duration compared with the production of composts. In the production of organic fertilizers commercially on a medium scale, Mr. Razipin used waste materials such as banana stems and spent mushroom as carbon source, whereas chicken manure is included as a source of nitrogen. The combination of rhinoceros beetles' larvae and earthworms are



FIGURE 1: COMMERCIAL ORGANIC FERTILIZER PRODUCTION ON A MEDIUM SCALE USING AGRICULTURAL WASTES.

used as degrading agents to decompose banana stems which contain high fiber and lignin. The effective microorganisms (EM) are also added into the feedstock mixture (banana stem + spent mushroom + chicken manure + rhinoceros beetles' larvae + earthworms) to speed up the decomposition process (Figure 1).

Owing to the addition of degrading agents such as insect larvae, earthworms, and EM, the duration of organic fertilizer production only takes 32 to 35 days compared to compost processing which typically take up from 50 to 100 days, especially if it involves the use of materials containing high fiber and lignin such as banana trunk (Figure 2). For the commercial production of organic fertilizers, the time-consuming production period of organic fertilizers is disadvantageous and impractical. Therefore, the use of degrading agent is important to speed up the rate of decomposition of the main feedstock used in the production of organic fertilizers (Figure 2).



FIGURE 2: ORGANIC FERTILIZERS PRODUCED WITHIN A MONTH USING DEGRADING AGENTS.

Mr. Razipin named the organic fertilizer he produced as *tosonong* fertilizer which means the best fertilizer as an effective marketing strategy and his *tosonong* fertilizer is sold at a price of RM3.00 per kilogram. The production cost of producing *tosonong* fertilizer is not expensive because most of the materials used are from waste such as banana stems, refused spent mushroom (after being used for 6 cycles), beetles grubs, and earthworms. The only materials that he obtains from the shop is molasses which is used for EM production.

Mr. Leong produced organic fertilizer (frass) from black soldier fly larvae digested on decanter cake as feeding substrates for frass production (Figure 3). Using degrader agent such as insect larvae is a good approach to produce organic fertilizer because the larvae could digest and transform the waste by excreting them in the form of frass. Frass is the excretion of insect larvae after they digested the feeding substrate. In addition, decanter cake is one of the wastes that is difficult to manage due to high moisture and grease content. Black soldier fly larvae able to digest almost all of the organic wastes, thus they become a very important decomposing agent to transform most of the degradable waste's materials. Mr. Leong operates the frass production in a moderate scale and also used wastes as feeding substrate to produce frass, larvae, and pupae. Frass produced from rearing black soldier fly larvae is sold at a price of RM3.00 per kilogram and is in great demand because the frass fertilizer is suitable to be used as an organic fertilizer. Apart from frass, larvae and pupae are sold based on their weight, such as RM5.00 per 100 gram for animal and fish feed.



FIGURE 3: USE OF BLACK SOLDIER FLY LARVAE TO DIGEST ON DECANTER CAKE FOR FRASS PRODUCTION.

The use of organic fertilizers for growing food crops and commodity crops is important to ensure the production of high-quality products in line with the good quality of the environment and the production of high commercially valuable products. It is important to practice organic farming for a green economy because agricultural land is the most basic and vast natural resource that contains diversity from which the world's population derives food and shelter. The agricultural sector contributes to the source of income and ensures food security through the production of commodity crops and food crops, but it must be done without compromising the environment.

Microbial Alchemy: Pioneering Plastic Biodegradation for a Green Tomorrow

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Introduction

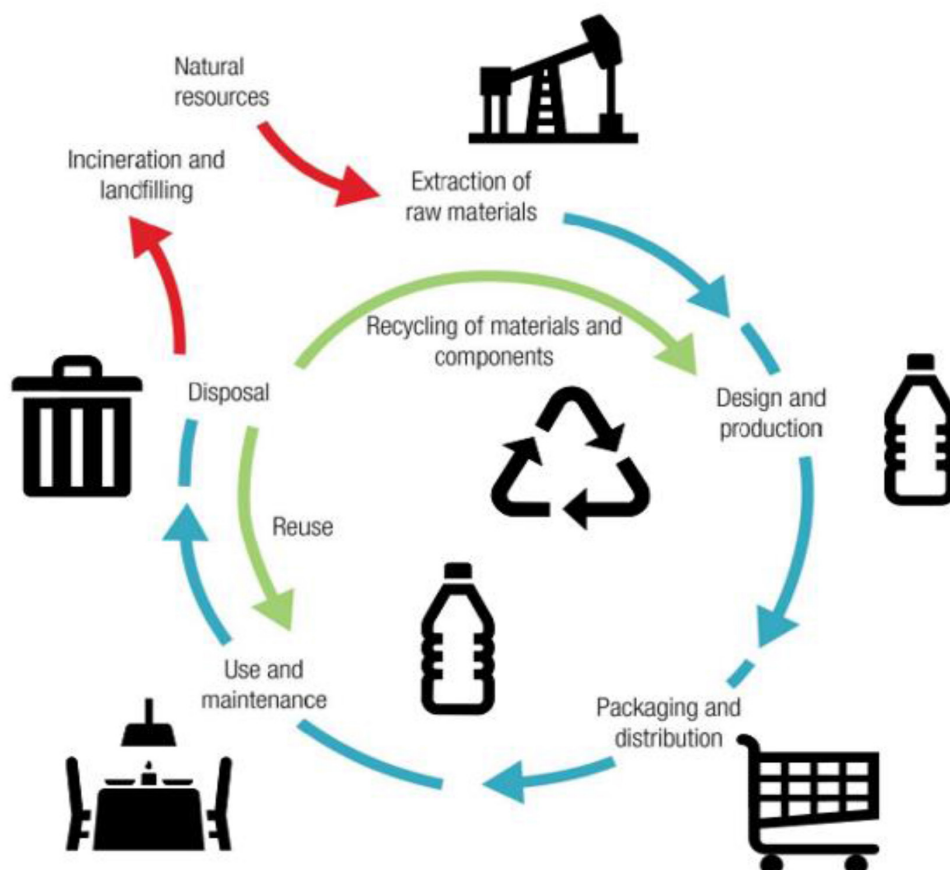


FIGURE 1: INFOGRAPHIC DIAGRAM SHOWING THE LIFE CYCLE OF PLASTIC POLLUTION CRISIS.

In recent years, the surge in plastic pollution has become an alarming global concern. Malaysia, ranking among the top 10 countries for discarding plastic waste into the ocean, is grappling with a significant environmental challenge. A report by New Straits Times (September 23, 2023) highlighted Malaysia's position as the fifth-largest contributor to ocean plastic, discarding approximately 2.29 kilograms of plastic per person annually. In response, the Malaysian government is emphasizing the importance of recycling as a crucial step in combatting this escalating issue, urging citizens to adopt a recycling culture and minimize plastic consumption.

Plastic, present everywhere in modern life, poses an enduring environmental threat due to its resistance to degradation. Conventional disposal methods have proven insufficient, prompting a global call for innovative and eco-friendly strategies. Microorganisms, with their intrinsic capacity to break down complex organic compounds, emerge as key players in the pursuit of a greener, more sustainable future.

Amidst these challenges, our research team has delved into the world of microorganisms, seeking sustainable solutions to the plastic waste predicament. Microbes, the unsung heroes of the microscopic realm, possess the unique ability to revolutionize our approach to plastic waste management. This exploration marks a significant convergence of microbiology and green economy principles, presenting a promising avenue for mitigating the environmental impact of plastic pollution. This investigation delves into the intricate interactions between microorganisms and plastic, unveiling the remarkable processes through which these microbial agents initiate the biodegradation process from enzymatic degradation of polymer chains to the integration of microbial communities into waste management systems, the potential applications of microbial solutions to reduce plastic pollution are vast. Embarking on research through the microscopic landscapes where bacteria, fungi, and other microbial marvels thrive, we unravel the promise of a circular economy. Here, plastic waste transforms from a burden into a resource, showcasing the potential of microorganisms to lead us toward a more sustainable and ecologically conscious global community. The synergy between microorganisms and green economy principles offers a beacon of hope, fostering an era where the environmental footprint of plastics can be significantly diminished. The schematic process of plastic biodegradation in aerobic environments is illustrated in Figure 2. There are some pictures for the plastic biodegradation research on going in the laboratory funded by VOT:99692700.

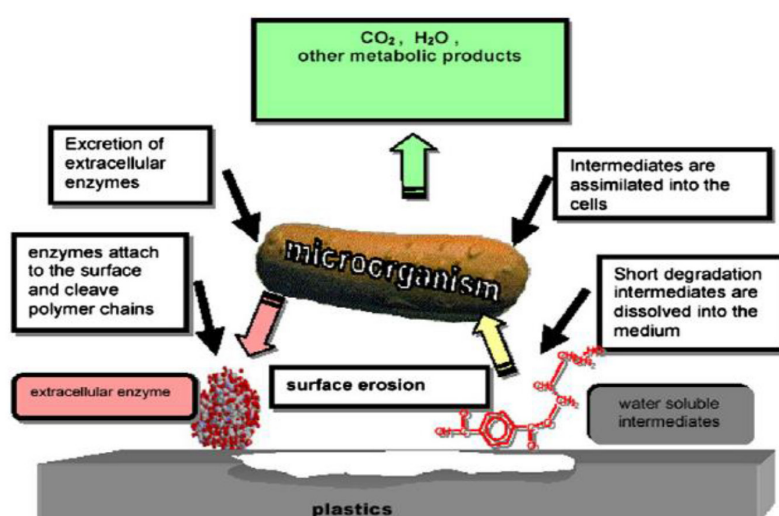


FIGURE 2: THE SCHEMATIC PROCESS OF PLASTIC BIODEGRADATION IN AEROBIC ENVIRONMENTS. (SHAH ET AL., 2008)



FIGURE 3: PROGRESS PICTURES FOR ON-GOING STUDENTS' RESEARCH IN THE LABORATORY. (A) PLASTIC DEGRADING THERMOPHILES ISOLATES ON PVC MODIFIED AGAR; (B) PLASTIC DEGRADING THERMOPHILES GROWTH AS COMPARED WITH CONTROL (NO GROWTH); (C) CLEAR ZONE ASSAY FLOODED WITH 0.1% COOMASSIE BLUE SOLUTION.

Microbiology plays a crucial role in various aspects of the green economy, contributing to sustainable practices in waste management, agriculture, energy production, and environmental restoration. Harnessing the power of microorganisms can lead to innovative solutions that align with the principles of a more sustainable and environmentally friendly economy.

References

New Straight Times. (September 23, 2023). Malaysia in world's top 10 for throwing plastic waste and rubbish in the ocean. <https://www.nst.com.my/news/nation/2023/09/959759/malaysia-worlds-top-10-throwing-plastic-waste-and-rubbish-ocean-nsttv>. Accessed 12 November 2023.

Shah, A. A., Hasan, F., Hameed, A., & Ahmed, S. (2008). Biological degradation of plastics: A comprehensive review. *Biotechnology Advances*, 26(3), 246-265. <https://doi.org/10.1016/j.biotechadv.2007.12.005>

Nurturing Sarawak's Indigenous Durians through a Green Economy

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Sarawak's Indigenous Durians

Borneo is recognized as the land of diversity and a rich heritage of flora, as it is the widest island in the world. Sarawak, a part of the Borneo region, is endowed with abundant biodiversity, encompassing approximately 3,000 plant species. This tropical rainforest is abundant in diverse beneficial indigenous plants; some of them are endemic species to the state of Sarawak. Durians, often referred to as the "King of Fruits," have a special place in Sarawak's indigenous cultures. Sarawak is serving as the home to 16 unique indigenous *Durio* species, namely *D. acutifolius*, *D. affinis*, *D. carinatus*, *D. crassipes*, *D. dulcis*, *D. excelsus*, *D. grandiflorus*, *D. graveolens*, *D. griffithi*, *D. kutejensis*, *D. lanceolatus*, *D. lissocarpus*, *D. testudinarum*, *D. oblongus*, *D. oxleyanus* and *D. zibethinus*. Among these, the edible durians of *D. graveolens* (isu), *D. kutejensis* (nyekak), *D. oxleyanus* (durian daun), and *D. zibethinus* (durian kampung) are domesticated and widely sold at Tamu markets at a good fetching price. The other wild edible species, such as *D. dulcis* (tutong), *D. graveolens* (isi merah), and *D. testudinarum* (durian kura-kura), are still found in the wild forest, but occasionally they can be found semi-domesticated. The wild edible *Durio* species are equally valuable to *D. zibethinus*, widely grown on the same large scale. Indigenous communities have been the custodians of traditional knowledge and practices of indigenous fruits, possessing invaluable insights into sustainable cultivation methods harmoniously aligned with the environment. Indigenous durians could provide a steady source of nutrition and hold deep cultural and economic significance for local communities. However, in the face of environmental challenges and changing market dynamics, a transition to a green economy offers a promising path for nurturing Sarawak's indigenous durians can provide the means for sustainable cultivation. This article explores the potential of such a transition and its impact on the preservation of both the environment and traditional heritage.

The Green Economy and Sarawak's Indigenous Durians

A green economy is defined by its emphasis on economic growth and development while also considering the social and environmental dimensions. When applied to the cultivation of Sarawak's indigenous durians, the green economy concept can serve as a blueprint for a harmonious coexistence of economic development and environmental conservation. By incorporating modern sustainable farming methods such as agroforestry, indigenous durian growers can not only reduce their ecological footprint but also maintain the ecological integrity of the land. Besides, durian orchards can be transformed into eco-tourism destinations, which not only offer a source of income for indigenous communities but also promote ecological education. Sustainable tourism can create economic benefits while educating visitors

on the importance of preserving the local ecosystem. In term of biodiversity conservation, indigenous durian farms often feature a rich assortment of various fruit trees. This biodiversity not only enhances the resilience of the ecosystem but also provides additional revenue sources for the communities. More importantly accessing to markets is crucial for indigenous durian growers to benefit from the green economy. Initiatives that support direct-to-consumer sales can ensure the economic benefits of durian cultivation.

Challenges and Solutions

While the prospects of a green economy for Sarawak's indigenous durians are promising, there are several challenges that must be addressed. For instance, the recognition of indigenous land rights and respect for their cultural heritage is of utmost importance. Policies should be in place to ensure that indigenous communities have control over their resources. Besides, indigenous communities may require support to access sustainable farming technologies and practices. Collaborations with environmental organizations and government agencies can provide the necessary assistance. Capacity-building programs also can help indigenous growers to develop the skills and knowledge needed for sustainable durian cultivation and business management. Moreover, sustainable practices should be enforced to prevent the overuse of natural resources and the degradation of the environment.

The Way Forward

With the global environmental issues and growing consciousness of sustainable practices, a green economy presents a chance for Sarawak's indigenous durian producers to preserve their cultural legacy while advancing environmental sustainability and economic expansion. By maintaining traditional knowledge and embracing sustainable practices, indigenous communities can play a pivotal role in both environmental conservation and economic development. The protection of indigenous land rights, provision of access to resources, and the fostering of sustainable practices are crucial steps in realizing a greener, more equitable future for all. A transition to a green economy for Sarawak's indigenous durians holds the promise of nurturing cultural traditions, conserving natural ecosystems, and safeguarding these invaluable resources for future generations.



References

Sujang, G. B., Ramaiya, S. D., Saupi, N., & Lee, S. Y. (2023). Profiling of volatile organic compounds (VOCs) of wild edible durians from Sarawak, Borneo associated with its aroma properties. *Horticulturae*, 9(2), 257. <https://doi.org/10.3390/horticulturae9020257>

Tissue Culture via Synthetic Seed Technology in Borneo Sour Eggplant (*Solanum lasiocarpum* Dunal.)

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Borneo Sour Eggplant, scientifically known as *Solanum lasiocarpum* Dunal, is a native plant and a naturally occurring edible crop that can be found in the state of Sarawak, Malaysia. Its unique characteristics have gained the admiration of both, tourists who have visited Sarawak and local residents who have settled in the region. The sour eggplant is subject to various botanical classifications, including *S. lasiocarpum* and *S. ferox*. These plants are part of the Solanaceae plant family, closely related to tomatoes and peppers, and are predominantly distributed throughout Southeast Asia.

Bacterial wilt (*Ralstonia solanacearum*), a destructive plant disease causes significant damage and affecting 10% to 90% of harmful plant diseases. It appears after transplanting and can affect fruit production and harvest. This disease usually starts in the upper leaves, leading to complete plant failure within just a few days. Soil serves as the primary source of infection although it's important to note that the pathogen can also be transported by seeds and seedlings. While the pathogen can induce wilt in various host plants, its aggressiveness may vary. Plant propagation primarily through seeds faces limitations due to seed dormancy. Despite, vegetative propagation through grafting is feasible, requiring meticulous rootstock and scion development for successful production. Vegetative propagation through tissue culture is a promising solution for ensuring uniform planting materials and addressing challenges in the production of *Solanum lasiocarpum* Dunal.

Synthetic seed technology offers a promising method for propagating transgenic, non-seeding, polyploid, and challenging plants. Encapsulation and micropropagation of seeds reduce commercialization costs and distribution, making it a popular choice for tissue-cultured plants with commercial and economic importance. Synthetic seeds are living structures obtained from propagules, allowing them to grow into plants under various conditions. They offer low-cost, high-volume propagation, easy handling, extended storage potential, and preservation of clonal properties. They promote superior plant production, preserve rare species, and enhance biodiversity. The alginate coating protects explants during storage.

To our knowledge, limited publications exist on in vitro preservation of *Solanum* species. We have tested two different nodal segment length which were 2 mm and 5 mm (Figure 1). Our tests showed 5 mm nodal segments had more shoots, buds, and leaves. The most significant growth development was observed when using 3% sodium alginate and 1% CaCl₂ resulting in the highest number of buds, leaves, and shoots. Media with ½ Murashige and Skoog (MS) composition showed high significant growth development compared to all other treatments mm (Figure 1).

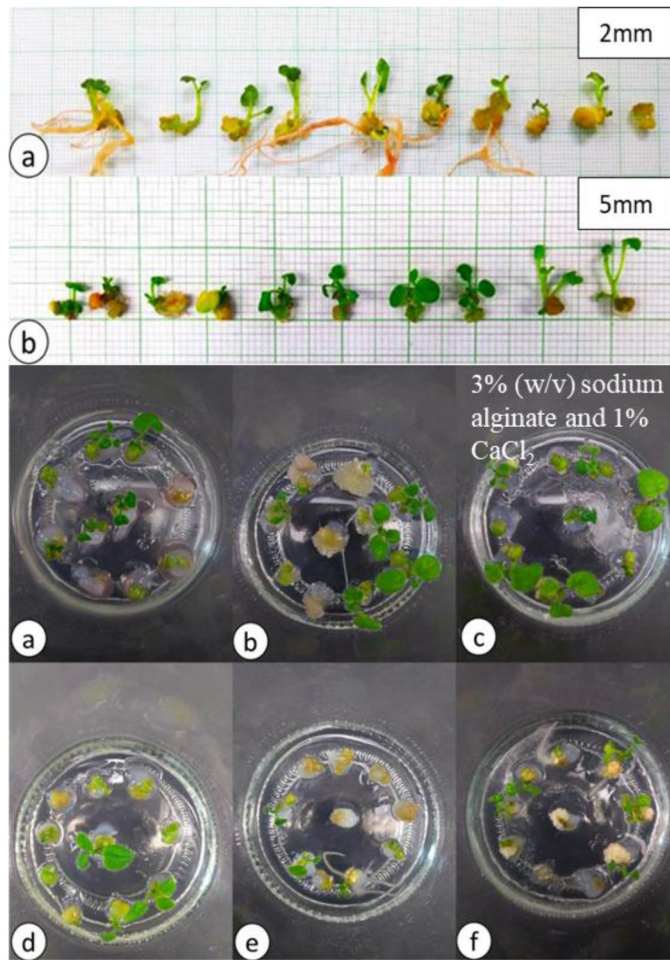


FIGURE 1: OBSERVATION ON DIFFERENT TYPES OF EXPLANT SIZE AND DIFFERENT SODIUM ALGINATE AND CALCIUM CHLORIDE AFTER 4-WEEKS.



FIGURE 2: SHOOT AND ROOT FORMATION OF IN VITRO BORNEO SOUR EGGPLANT ON COMBINED CONCENTRATION OF 8 KIN MG/L + 2 IBA MG/L.

The development of encapsulated nodes into plantlets was significantly influenced by the type of growing media used, the medium's media strength, and the presence or absence of plant growth regulators (PGRs) in the media. This can be attributed to the fact that the balanced concentration of plant growth regulators in the MS media may have provided an optimal environment for the growth development of *Solanum lasiocarpum* Dunal. Our observation showed evident that the combination of 8mg/L and KIN+2.0mg/L IBA exhibited highest shoot formation percentage, while the control treatment displayed significantly highest root formation percentage (Figure 2). Borneo Sour Eggplant known as *Solanum lasiocarpum* Dunal, a native wild vegetable in Sarawak, is traditionally grown by local ethnic communities. However, soil-borne pathogens can hinder its growth. To address this, sterilization and an *in vitro* propagation method can be used for tissue culture to enhance the commercialization potential of this native vegetable.

References

- Albert Ting, K. S., & Ding, P. (2021). A review on wild indigenous eggplant, Terung Asam Sarawak *Solanum lasiocarpum* Dunal. *Sains Malaysiana*, 50(3), 595-603.
- Abbas, M. K., Mahood, H. E., & Alhasan, A. S. (2022). Production of synthetic seeds in vegetable crops: A review. In *IOP Conference Series: Earth and Environmental Science*, 1060(1), 012099.
- Gantait, S., Bustam, S., & Sinniah, U. R. (2012). Alginate-encapsulation, short-term storage and plant regeneration from protocorm-like bodies of Aranda Wan Chark Kuan 'Blue'× *Vanda coerulea* Griff. ex. Lindl. (*Orchidaceae*). *Plant Growth Regulation*, 68, 303-311.
- Ranil, R. H. G., Niran, H. M. L., Plazas, M., Fonseka, R. M., Fonseka, H. H., Vilanova, S., Andújar, I., Gramazio, P., Fita, A., & Prohens, J. (2015). Improving seed germination of the eggplant rootstock *Solanum torvum* by testing multiple factors using an orthogonal array design. *Scientia Horticulture*, 193, 174-181.
- Shallal, H. H., Stănică, F., Peticilă, A. G., Butcaru, A. C., & Nicolae, C. I. (2020). The use of artificial seed technology in the production of horticultural plants. *Scientific Papers. Series B. Horticulture*, 64(1).
- Soon, A. T. K., & Ding, P. (2021). A review on wild indigenous eggplant, terung asam Sarawak (*Solanum lasiocarpum* Dunal.). *Sains Malaysiana*, 50(3), 595-603.

FOREST THERAPY: A PATH TO WELLNESS AND A GREEN ECONOMY IN MALAYSIA

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Introduction

Malaysia, with its abundant rainforests and diverse wildlife, offers a beautiful natural environment. More than half of its land is covered in lush forests, making it a great place for forest therapy. This growing wellness practice, called *Shinrin-yoku* in Japanese, encourages people to enjoy the peace of the forest, leading to many health benefits and supporting environmental sustainability.



FIGURE 1: EXPOSURE TO NATURAL ENVIRONMENTS HAS BEEN SHOWN TO PROVIDE A WIDE RANGE OF BENEFITS FOR BOTH MENTAL AND PHYSICAL HEALTH (PICTURE CREDIT: DAYALAN SUNDARA RAJOO).

What is Forest Therapy?

Forest therapy originated in Japan in the 1980s, where it was developed as a complementary and alternative medicine practice. The term “*Shinrin-yoku*” literally translates to “forest bathing” and encompasses a range of activities that encourage people to connect with nature through their senses. These activities may include mindful walking, breathing exercises, and simply sitting or lying in the forest.

Health Benefits of Forest Therapy

Research has shown that forest therapy has a wide range of health benefits, including:

- **Reduced stress levels:** Exposure to forest environments has been shown to lower cortisol levels, the body’s primary stress hormone.
- **Improved mood:** Being in nature can boost levels of serotonin and dopamine, neurotransmitters that are associated with feelings of happiness and well-being.
- **Enhanced cognitive function:** Forest therapy has been shown to improve memory, attention, and concentration.
- **Strengthened immune system:** Spending time in the forest can increase the production of natural killer cells, which play a role in fighting infections.
- **Reduced risk of chronic diseases:** Forest therapy has been linked to a lower risk of developing chronic diseases such as heart disease, stroke, and diabetes.

The Role of Forest Therapy in the Green Economy

Forest therapy has the potential to play a significant role in the development of a green economy in Malaysia. By promoting ecotourism and creating jobs in the wellness sector, forest therapy can contribute to rural economic development and poverty reduction. Additionally, forest therapy can help to raise awareness of the importance of forest conservation and promote sustainable forest management practices.

Ecotourism Potential

Malaysia’s rich biodiversity and extensive forest cover make it an ideal destination for ecotourism. Forest therapy can be integrated into ecotourism packages, offering visitors a unique and immersive experience that promotes connection with nature and well-being. This can attract tourists who are seeking eco-friendly and wellness-focused travel experiences, contributing to the growth of the ecotourism sector in Malaysia.

Job Creation in the Wellness Sector

The growing interest in forest therapy is creating demand for trained professionals to guide and facilitate forest therapy sessions. This presents an opportunity to create new jobs in the wellness sector, particularly in rural areas where forest therapy is being promoted. Additionally, forest therapy can also stimulate demand for local products and services, such as accommodation, transportation and food and beverages, further contributing to local economic development.

Promoting Forest Conservation

Forest therapy can play a crucial role in raising awareness about the importance of forest conservation. By experiencing the benefits of forests firsthand, people are more likely to appreciate their value and support efforts to protect them. This can lead to increase support for conservation initiatives and sustainable forest management practices.

Sustainable Forest Management

Forest therapy can be a valuable tool for promoting sustainable forest management practices. By encouraging responsible use of forests for recreational purposes, forest therapy can help to reduce the impact of tourism on forest ecosystems. Additionally, forest therapy can promote a sense of stewardship among local communities, encouraging them to protect and conserve their forest resources.

Conclusion

Forest therapy offers a promising approach to promote sustainable development and contributing to a green economy in Malaysia. By harnessing the therapeutic power of forests, Malaysia can develop a thriving ecotourism industry, create jobs in the wellness sector and foster a culture of forest conservation. As the world transitions towards a greener and more sustainable future, forest therapy has the potential to play a significant role in shaping Malaysia's path towards a greener economy.

References

- Rajoo, K. S., Karam, D. S., & Abdullah, M. Z. (2020). The physiological and psychosocial effects of forest therapy: A systematic review. *Urban Forestry & Urban Greening*, *54*, 126744. <https://doi.org/10.1016/j.ufug.2020.126744>
- Shang, Y., Bi, C., Wei, X., Jiang, D., Taghizadeh-Hesary, F., & Rasoulinezhad, E. (2023). Eco-tourism, climate change, and environmental policies: Empirical evidence from developing economies. *Humanities and Social Sciences Communications*, *10*, 275. <https://doi.org/10.1057/s41599-023-01777-w>
- Zhang, H., Liang, Q., Li, Y., & Gao, P. (2023). Promoting eco-tourism for the green economic recovery in ASEAN. *Economic Change and Restructuring*, *56*, 2021-2036. <https://doi.org/10.1007/s10644-023-09492-x>

Yes, We Need Blue Carbon Market (BCM)

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Carbon emissions are now a major global problem due to the acceleration of global warming. The ocean is the greatest active carbon pool in the world, able to store up to 30% of the carbon dioxide (CO₂) released annually by human activity. This carbon storage period can extend up to thousands of years. “Blue carbon” refers to the CO₂ that is taken up and held by marine life and ocean activity. Tidal marshes, mangroves and seagrasses ecosystems come under the umbrella of blue carbon. To combat climate change, numerous nations have developed and put into effect regulations aimed at safeguarding blue carbon resources.

A widely accepted objective for the international response to the climate change challenge is “carbon neutrality.” Numerous activities have been made in support of this common objective by governments, multinational corporations, non-profit organizations, and other organizations. All nations committed to keeping the rise in Earth’s temperature to less than 2 degrees Celsius, starting with the 1997 “Kyoto Protocol” and ending with the 2016 “Paris Agreement.” The “European Green New Deal,” announced by the European Union in December 2019, aimed to achieve “Net zero emissions” of greenhouse gases by the year 2050. In addition to the United States, other nations that have committed to “net zero emissions” include Japan, South Korea, Malaysia, and others. It is evident that the main international organizations and countries have committed to achieving “carbon neutrality” and have come to certain understandings and conclusions. The concept of “carbon neutrality” encompasses not just government involvement but also the involvement of manufacturers, carbon sink providers, individual consumers, and the public. The objective of “carbon neutrality” can be effectively realized in practice by combining these factors using market trading mechanisms.

Green carbon (the carbon sink on land) and blue carbon (the carbon sink in the ocean) are the two main mechanisms involved in the generation of carbon sinks. Governments, academics, and allied organizations have acknowledged green carbon, which has grown quickly. Regional carbon sink trading markets like voluntary carbon markets (VCM) have been developed by certain nations. Owing to its belated discovery, blue carbon has not received the attention it deserves, and its carbon sink mechanism and measuring techniques are incomplete. The blue carbon sink trading market has thus not yet reached its full potential. Blue carbon ecosystems, however, offer an advantage over other ecosystems. It has capacity to store or sequester 5 times more carbon than another ecosystem. It completes over 55% of the Earth’s carbon sink and stores 93% of the planet’s CO₂ emissions. It ought to be included as soon as possible in the carbon sink trading market system since it is the biggest carbon pool in the world. In support, the “Global Blue Carbon Market” plan was suggested in the 2011 “Blueprint for Sustainable Development of Ocean

and Coastal Areas” published by the five main United Nations agencies. Including blue carbon activities in voluntary carbon markets and other carbon financial mechanisms aimed at mitigating climate change is one of the five policy goals set forth in the 2012 “Blue Carbon Policy Outline.” The development of the blue carbon market (BCM) has drawn increased attention since then.

By valuing the blue carbon and integrating it to the carbon market, blue carbon market can be established. It is necessary to consider issues like unclear accounting practices, unclear ownership of blue carbon and insufficient financial resources for oversight and leadership. So here is question what BCM will give the benefit:

- The establishment of Blue Carbon Market (BCM) will help countries to achieve their net zero targets.
- BCM will provide more clarity in the accounting methods for blue carbon.
- BCM will raise awareness in the community about the high quality of blue carbon credits compared to other carbon credits.
- BCM will give confidence to investors in this nature-based solution (NBS) carbon business for mitigating climate change.
- A stable price for blue carbon credits.



FIGURE 1: MATANG MANGROVE FOREST RESERVE (MMFR), PERAK.

Mangroves are the primary focus of blue carbon research in Malaysia. The country has an estimated total mangrove area of 629,038 hectares as of 2017, with Sabah (60%), Sarawak (22%), and Peninsular Malaysia (18%) having the largest areas. The average mangrove carbon stock in Malaysia, including above and below-ground biomass, is estimated to be approximately 181 MgC/ha. Between 1990 and 2017, Malaysia experienced a 3.3% reduction in mangrove area, which contributed to roughly 14 million Mg of CO₂ emissions. By looking at the Malaysia's Blue Ecosystems Carbon Sequestration Potential (BECSP), this ecosystem has the ability to be a leading contributor to the carbon business. Recently, Prime Minister Datuk Anwar Ibrahim invested RM 10 million in the VCM to boost this business, while Bursa Malaysia has published a VCM handbook to guide investors in this carbon business. Sarawak state amended its Forest Ordinance in 2022 and added important sections to support carbon trading, making it one of the leading states in carbon business and activities. It is now time for Sarawak again to take steps to raise the BCM concept at the federal level, given that it has one of the largest mangrove areas in Malaysia. As an academician and carbon awareness campaigner, I believe that BCM will be a worthwhile and profitable step for Malaysia to take to reap economic benefits.

References

- Cao, Y., Kang, Z., Bai, J., Cui, Y., Chang, I. S., & Wu, J. (2022). How to build an efficient blue carbon trading market in China?-A study based on evolutionary game theory. *Journal of Cleaner Production*, 367, 132867
- Xu, X., Wang, G., Fang, R., & Xu, S. (2023). Blue carbon governance for carbon neutrality in China: Policy evaluation and perspectives. *Heliyon*, 9(10).

Potentials of Bamboo and Its Ecological Benefits in a Sustainable Green Economy

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Bamboo is also known as “green gold”, “poor man’s timber”, “wonder plant”, contributes substantially to ecological sustainability because of its uniqueness in providing environmental, economic, and social benefits to mankind (Scheba et al., 2017; Manandhar et al., 2019). It offers ecological benefits such as soil conservation and carbon sequestration. Due to its rapid growth rate and organic content, bamboo can be used as a potential tool for mitigating climate change, which also helps to reduce soil erosion and enhance soil quality. Bamboo is widely acknowledged as a green substitute for conventional building materials because of its wood-like attributes, environmentally friendly growing, and sustainable harvesting. Although bamboo is not regarded as wood, it is a fast-growing species of woody grass that can be utilised as an excellent raw material distribution, reducing the demand for wood and wood products as well as the high rate of forest degradation. Bamboo has been dubbed one of the fastest-growing plants on Earth with a short gestation time (3 to 5 years) before reaching maturity and harvest (Atanda, 2015). It may be harvested and replanted in seven years due to its rapid growth, unlike certain indigenous tree species’ 10 to 50 years (Mohamed, 2003; Basumatary et al., 2015). Hence, this makes it appropriate for afforestation purpose.

In order to drive the growth of the Sarawak bamboo industry in 2016, the Sarawak Government has directed the Sarawak Timber Industry Development Corporation (STIDC) in collaboration with research institutes to spearhead the development of the Sarawak bamboo industry. Part of the initiatives was the establishment of bamboo nursery and bamboo trial plots (Figure 1), and the development of Bambusetum under the Sabal Bamboo Pilot Project that adopted a bamboo plantation model, which is technically and commercially viable. The bamboo pilot project aimed to improve management practices, guarantee a sustainable supply of high-quality bamboo and explore the greater business potential of the bamboo industry for Sarawak in the future.

Bamboo has been identified and introduced as a potential non-timber forest product (NTFP) to serve as an alternative source of raw timber materials since 2016. It was based on the potential of bamboo as a raw material for the construction, manufacturing, and food industries as well as for environmental conservation. By 2030, Sarawak aims to develop bamboo-based industries to produce food, charcoal, pharmaceutical, pulp and paper, cosmetics, textiles, handicrafts, and engineered bamboo products which is in line with Sarawak Post COVID-19 Development Strategy 2030 (PCDS 2030). Accelerating data utilisation to generate incomes and driving economic and social benefits were among the two strategic thrusts to accelerate Sarawak’s economic growth.

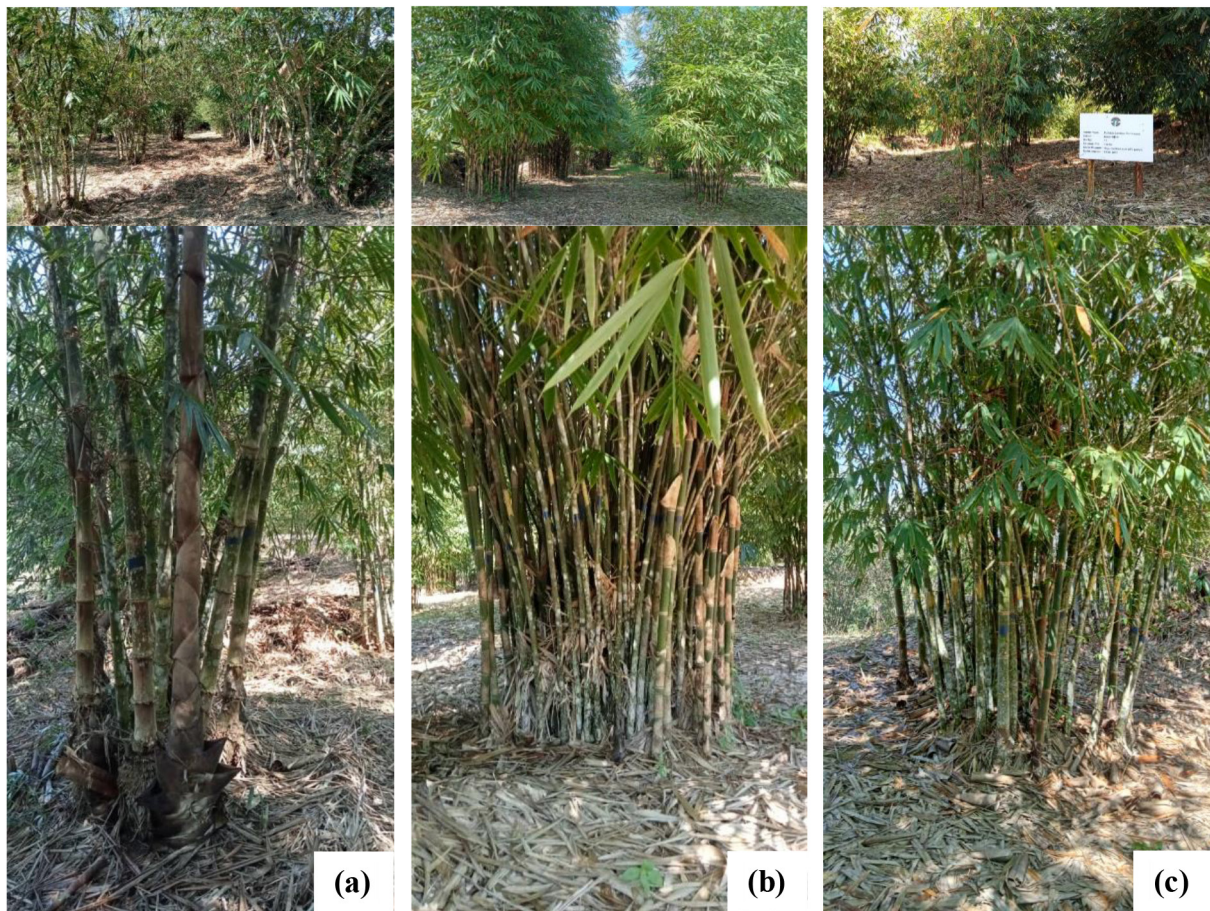


FIGURE 1: PLANTED BAMBOO SPECIES UNDER THE SABAL BAMBOO PILOT PROJECT BY SARAWAK TIMBER INDUSTRY DEVELOPMENT CORPORATION (STIDC). (A) *DENDROCALAMUS ASPER* (BULUH BETONG); (B) *GIGANTOCHLOA HASSKARLIANA* (BULUH BETI); (C) *GIGANTOCHLOA LEVIS* (BULUH BETING).

Carbon Sink and Sequestration Potential of Bamboo

Bamboo is a valuable resource known to sequester carbon faster than almost any other tree species, and carbon sequestration is the process of storing carbon for a long time in biomass or soil (Gu et al., 2019). A product's greenness is determined by how quickly and sustainably it can be renewed, which is peculiar to bamboo. Under-utilised natural resources such as bamboo can help significantly to combat global land degradation, desertification, and aid in the mitigation and adaptation of climate change (Holt, 2019; INBAR, 2014). Bamboo has a great deal of potential for sequestration and as a carbon sink. It can absorb and store a significant amount of CO₂ from the atmosphere, which helps mitigate climate change's effects. This is mostly because bamboo has a propensity to grow at an extremely fast rate, meaning that harvested biomass is quickly replaced by new culms. Compared to species of hardwood, it generates 30% more oxygen. It retains carbon and prevents it from returning to the environment for a very long time when used as a building material. Numerous studies have reported on the rate of carbon sequestration from diverse species of bamboos, highlighting their role in carbon storage. According to Nath et al. (2015), woody bamboos in carbon farming is estimated to sequester 6 to 13 Mg C ha⁻¹ annually and store 30 to 121 Mg C ha⁻¹.

Conclusion

Bamboo provides sustainable solutions to address serious issues of climate change and environmental degradation, which are posing unprecedented challenges to the world. By harnessing bamboo's potential and implementing well-designed policies and practices, we can build a more resilient and greener future where bamboo is pivotal in balancing human demands with nature's well-being. Bamboo's preservation and prudent utilisation demonstrate humanity's ability to live in harmony with the natural world and preserve the globe for future generations.

References

- Atanda, J. (2015). Environmental impacts of bamboo as a substitute constructional material in Nigeria. *Case Studies in Construction Materials*, 3, 33-39. <https://doi.org/10.1016/j.cscm.2015.06.002>
- Basumatary, A., Middha, S. K., Usha, T., Brahma, B. K., & Goyal, A. K. (2015). Bamboo, as potential sources of food security, economic prosperity and ecological security in North-East India: An overview. *Research in Plant Biology*, 5(2), 17-23.
- Gu, L., Wu, W., Ji, W., Zhou, M., Xu, L., & Zhu, W. (2019). Evaluating the performance of bamboo forests managed for carbon sequestration and other co-benefits in Suichang and Anji, China. *Forest Policy and Economics*, 106, 101947. <https://doi.org/10.1016/j.forpol.2019.101947>
- Holt, E. (2019). Bamboo, A Sustainability Powerhouse. <http://www.ipsnews.net/2018/06/bamboo-sustainability-powerhouse>. Accessed 30 November 2023.
- International Bamboo and Rattan Organization (INBAR). (2014). Bamboo: A strategic resource for countries to reduce the effects of climate change (Policy Synthesis Report). Beijing: International Network for Bamboo and Rattan.
- Manandhar, R., Kim, J., & Kim, J. (2019). Environmental, social and economic sustainability of bamboo and bamboo-based construction materials in buildings. *Journal of Asian Architecture and Building Engineering*, 18(2), 49-59. <https://doi.org/10.1080/13467581.2019.1595629>
- Mohamed, A. H. J. (2003). Macro-proliferation of *Gigantochloa liglata* seedlings for mass production of planting stock in its field performance. *Journal of Bamboo and Rattan*, 2(1), 13-21.
- Nath, A. J., Lal, R., & Das, A. K. (2015). Managing woody bamboos for carbon farming and carbon trading. *Global Ecology and Conservation*, 3, 654-663. <http://dx.doi.org/10.1016/j.gecco.2015.03.002>
- Scheba, A., Blanchard, R., & Mayeki, S. (2017). Bamboo for green development? The opportunities and challenges of commercialising bamboo in South Africa. Institute for Development Studies, Brighton.

The Interconnectedness of Our Choices: Climate Crisis and Food

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Recent years have been a rollercoaster with wild swings—2020's locust swarms, wildfires, floods, and the ongoing struggles with COVID-19 in 2021. We've also seen extreme weather ramp up worldwide. For instance, Greenland's ice sheet is melting fast, bumping up sea levels by 1.4 mm annually. What used to be rare—fires, floods, hurricanes, and scorching heatwaves—is now becoming the norm. Experts connect this worsening weather to our climate crisis.

But have you ever thought about how our daily meals might connect to all this chaos? Think about your food choices—fast-food deliveries, homemade meals with garden-fresh ingredients, or fine dining experiences. The journey of our food matters. How it's grown, transported, and how far it travels before it reaches our plates all play a part in determining its impact on the environment and our planet's future.

Let's chat about carbon. It's not the villain; in fact, it's the building block of life. Picture this: 500 million years ago, life on land started to bloom, and carbon cycled smoothly, helping life evolve. Then came us. We discovered fossil fuels and unlocked tons of carbon dioxide, heating up our planet and upsetting the climate balance. This excess carbon is messing with the oceans, causing acidification, and endangering marine life.

To avoid an uncertain future with less biodiversity and harsher climate problems, we need to cut back on greenhouse gas emissions pronto. Understanding where these emissions come from is key to finding solutions. Choosing food with a lower carbon footprint and backing regenerative farming practices can help big time.

Supporting local produce or plant-based meals and getting behind farming methods that care for soil health and biodiversity can slash our environmental impact. By encouraging farmers to use smart techniques like crop rotation, we can reduce the use of harmful chemicals and cut emissions from farming. Our food choices and support for sustainable farming can truly shape a more resilient and green future for our planet.

LIST OF JOURNAL PUBLICATIONS

Ali, J., Bayram, A., Mukarram, M., Zhou, F., Karim, M. F., Hafez, M. M. A., Mahamood, M., Yusuf, A. A., King, P. J. H., Adil, M. F., Ma, Z., & Shamsi, I. H. (2023). Peach–potato aphid *Myzus persicae*: Current management strategies, challenges, and proposed solutions. *Sustainability*, *15*(14), 11150. <https://doi.org/10.3390/su151411150>

Ali, J., Wei, D., Mahamood, M., Zhou, F., King, P. J. H., Zhou, W., & Shamsi, I. H. (2023). Exogenous application of methyl salicylate induces defence in brassica against peach potato aphid *Myzus persicae*. *Plants*, *12*(9), 1770. <https://doi.org/10.3390/plants12091770>

Gintoron, C. S., Mohammed, M. A., Sazali, S. N., Deka, E. Q., Ong, K. H., Shamsi, I. H., & King, P. J. H. (2023). Factors affecting pollination and pollinators in oil palm plantations: A review with an emphasis on the *Elaeidobius kamerunicus* weevil (Coleoptera: Curculionidae). *Insects*, *14*(5), 454. <https://doi.org/10.3390/insects14050454>

Goh, E. P., Ramaiya, S. D., Sujang, G. B., Saupi, N., & Ding, P. (2023). Effects of seed maturity and storage on storability and germinability of terap (*Artocarpus odoratissimus* Blanco). *Asian Journal of Plant Sciences*, *22*(1), 37-47. <https://scialert.net/abstract/?doi=ajps.2023.37.47>

Hamidi, N. H., Ahmed, O. H., Omar, L., Ch'ng, H. Y., Johan, P. D., Paramisparam, P., Musah, A. A., & Jalloh, M. B. (2023). Co-application of inorganic fertilizers with charcoal and sago bark ash to improve soil nitrogen availability, uptake, use efficiency, and dry matter production of sorghum cultivated on acid soils. *Sustainability*, *15*(1), 827. <https://doi.org/10.3390/su15010827>

Hamidi, N. H., Ahmed, O. H., Omar, L., Ch'ng, H. Y., Johan, P. D., Paramisparam, P., Musah, A. A., & Jalloh, M. B. (2023). Charcoal and sago bark ash regulates ammonium adsorption and desorption in an acid soil. *Sustainability*, *15*(2), 1368. <https://doi.org/10.3390/su15021368>

Hakimi, N.M.F., Mohamad, S.F., Al Edrus, S.S.O., Antov, P., Fatriasari, W., Abdan, K., & Lee, S.H. (2023). Radiation induced admicellar polymerization of methacrylate acid for pH responsive cellulose nanofibrils. *Cellulose*, 1-14. <https://doi.org/10.1007/s10570-023-05610-0>

Haq, E. U., Hassan, F. U., Zhou, F., Gong, X., Manaf, A., Shabbir, G., Karim, M. F., King, P. J. H., Adil, M. F., & Shamsi, I. H. (2023). Nitrogen fertilization improves the agro-morphological and yield attributes of *Sinapis alba* L. *Agronomy*, *13*(6), 1621. <https://doi.org/10.3390/agronomy13061621>

Hoe, P.K., King, J.H., Ong, K.H., Bong, C.F., & Mahadi, N.M. (2023). Elucidating the lignocellulose digestion mechanism *Coptotermes curvignathus* based on carbohydrate-active enzymes profile using the meta-transcriptomic approach. *Malaysian Applied Biology*, *52*(5), 177-186. <https://doi.org/10.55230/mabjournal.v52i5.icfic13>

Ismail, H. A., Richard, I., Ramaiya, S. D., Zakaria, M. H., & Lee, S. Y. (2023). Browning in relation to enzymatic activities and phytochemical content in Terap peel (*Artocarpus odoratissimus* Blanco) during postharvest ripening. *Horticulturae*, *9*(1), 57. <https://doi.org/10.3390/horticulturae9010057>

- Ismail, H. A., Ramaiya, S.D., & Zakaria, M.H. (2023). Compositional characteristics and nutritional quality of indigenous fruit *Artocarpus odoratissimus* Blanco. *Malaysian Applied Biology*, 52(5), 187-203. <https://doi.org/10.55230/mabjournal.v52i5.icfic15>
- Justin, M., James Antony, J.J., Embu, E.A., & Subramaniam, S. (2023). Optimization of different auxin and cytokinin combination in nutrient medium for establishment of optimal *in vitro* multiple plantlet in *Ficus carica* L. cv Siyah Orak. *Malaysian Applied Biology*, 52(5), 35-40. <https://doi.org/10.55230/mabjournal.v52i5.cp19>
- Kavitha, R., Latifah, O., Ahmed, O. H., Charles, P. W., & Susilawati, K. (2023). Potential of rejected sago starch as a coating material for urea encapsulation. *Polymers*, 15(8), 1863. <https://doi.org/10.3390/polym15081863>
- Krishnan, K., Ahmed, O. H., Omar, L., Ali, M., Chowdhury, A. J. K., & Musah, A. A. (2023). Fate of nitrogen in a tropical peat soil treated with clinoptilolite zeolite. *Desalination And Water Treatment*, 281, 217-224. <https://doi.org/10.5004/dwt.2023.28735>
- Leong, S. S., Hamli, H., Abdul Rahim, E. F., & Mustafa, S. (2023). Prevalence and diversity of antibiotic resistance heterotrophic bacteria found along the Bintulu rivers, Sarawak. *Borneo Journal of Resource Science and Technology*. (Accepted)
- Leong, S. S., Korel, F., Lingoh, A. D., Sarbini, S. R., Toh, S. C., Abit, L. Y., & Wong, S. C. (2023). Current probiotics application for aquaculture feed: A review. *Borneo Science*, 44(2). <https://doi.org/10.51200/bsj.v44i2.4703>
- Leong, S. S., Korel, F., & King, J. H. (2023). *Bacillus cereus*: A review of “fried rice syndrome” causative agents. *Microbial Pathogenesis*, 185, 106418. <https://doi.org/10.1016/j.micpath.2023.106418>
- Majid, S., Zhang, X., Khaskheli, M. B., Hong, F., King, P. J. H., & Shamsi, I. H. (2023). Eco-efficiency, environmental and sustainable innovation in recycling energy and their effect on business performance: evidence from European SMEs. *Sustainability*, 15(12), 9465. <https://doi.org/10.3390/su15129465>
- Mohamad, S.A., Hung, K.J., Ahmad, S.N., Mohammed, M. A., Sulaiman, M.R., & Mohd Masri, M.M. (2023). The insect pest management strategies and their influence on the emergence rate of *Elaeidobius kamerunicus* Faust (Coleoptera: Curculionidae) from the post-anthesising male inflorescence of oil palm, *Elaeis guineensis*. *Malaysian Applied Biology*, 52(5), 147-154. <https://doi.org/10.55230/mabjournal.v52i5.icfic06>
- Mohd Sazali, M.I.N.H., Zakry, F.A.A., & Kundat, F.R. (2023). Plants wilt disease of red leaf lettuce (*Lactuca sativa* L.) after colonized by *Trichoderma longibrachiatum*. *Malaysian Applied Biology*, 52(5), 163-176. <https://doi.org/10.55230/mabjournal.v52i5.icfic12>
- Nillian, E., Buyong, N. L., Lesen, D., Basiron, M. M., Ahad, N., Wan Jesfrydi, W. N. Q., Jamaludin, M. H., Fadilah, M. F. A. Tilai, A., & Tunung, R. (2023). A survey study on the assessment of food handler's compliance to personal hygiene practices regulation in selected Malaysia food outlets. *Food Research*, 7(1), 64-75. https://www.myfoodresearch.com/uploads/8/4/8/5/84855864/_7__fr-2021-620_elexson.Pdf

- Omar, L., Hassan, M. H., Ahmed, O. H., Mohd Roslim, M. H., & Perumal, M. (2023). Black soldier fly larvae frass production for managing water hyacinth encroachment. *International Journal of Agriculture, Forestry and Plantation (IJAFP)*, 13, (Sept), 75-79. https://ijafp.org/wp-content/uploads/2023/11/IJAFP-Vol.13_069.pdf
- Paramisparam, P., Ahmed, O.H., Ch'ng, H.Y., Omar, L., Johan, P.D., Hamidi, N.H., & Musah, A.A. (2023). *Malaysian Journal of Soil Science*, 27, 56-69. https://www.msss.com.my/mjss/Full%20Text/vol27/V27_05.pdf
- Perumal, M., Mohd Hassan, N.H., Abdullah, N., Omar, L., Zainudin, J., & Wasli, M.E. (2023). Survivorship and field growth characteristics of four selected bamboo species for the development of bamboo industry in Sarawak, Malaysian Borneo. *Malaysian Applied Biology*, 52(5), 155-162. <https://doi.org/10.55230/mabjournal.v52i5.icfic08>
- Rosli, A., Daud, A., Md Saad, J., & Robin, T. (2023). Participation of women in side-income: A case study of Iban women as a bread-earner in the family in Sarawak. *International Journal of Academic Research in Business and Social Sciences*, 13(3). <https://doi.org/10.6007/ijarbss/v13-i3/16410>
- Sujang, G. B., Ramaiya, S. D., Saupi, N., & Lee, S. Y. (2023). Profiling of volatile organic compounds (VOCs) of wild edible durians from Sarawak, Borneo associated with its aroma properties. *Horticulturae*, 9(2), 257. <https://doi.org/10.3390/horticulturae9020257>
- Sundara Rajoo, K., Ismail, A., Abdu, A., Singh Karam, D., Rosli, Z., Zulperi, D., Abdullah, R., & Teik Zheng, A. L. (2023). Soil cadmium contamination and ecological implications in a tropical urban ecosystem: a case study of Air Hitam Sanitary Landfill in Puchong, Malaysia. *Malaysian Journal of Soil Science*, 27, 97-110. https://www.msss.com.my/mjss/Full%20Text/vol27/V27_08.pdf
- Sundara Rajoo, K., Ismail, A., Singh Karam, D., Abdu, A., Izani, N., James Gerusu, G., Ibrahim, Z., Abdullah, M. A., & Ibrahim, M. K. (2023). Determining the phytoremediation potential of naturally growing tropical plant species at a sanitary landfill. *Malaysian Journal of Soil Science*, 27, 138-146. https://www.msss.com.my/mjss/Full%20Text/vol27/V27_11.pdf
- Sundara Rajoo, K., Lepun, P., Alan, R., Singh Karam, D., Abdu, A., Rosli, Z., Izani, N., & James Gerusu, G. (2023). Ethnobotanical study of medicinal plants used by the Kenyah community of Borneo. *Journal of Ethnopharmacology*, 301, 115780. <https://doi.org/10.1016/j.jep.2022.115780>
- Taasim, S. I., Rosli, A., Md Saad, J., Daud, A., & Robin, T. (2023). Iban women development and empowerment: Role of Iban women as breadwinner in the family. *Malaysian Journal of Consumer and Family Economics*, 30(1), 502–533. <https://doi.org/10.60016/majcafe.v30.20>
- Toh, S. C., Lihan, S., Bunya, S. R., & Leong, S. S. (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(1). <https://doi.org/10.1186/s12906-023-03914-z>
- Toh, S. C., Lihan, S., Leong, S. S., Lahuri, A. H., Woon, W. C., and Ng, W. W. (2023). Enzymatic screening and genotypic characterization of thermophilic bacteria from the hot springs of Sarawak, Malaysia. *Makara Journal of Science*, 27(4), 4. <https://doi.org/10.7454/mss.v27i4.1449>

Umar, A. H. M., & Zakry, F. A. A. (2023). Plant growth-enhancing traits of rhizobacteria isolated from brinjal, okra, and leaf mustard. *Plant Root*, 17, 1-15. <https://doi.org/10.31117/plantroot.17.1>

Umar, A. H. M., Zakry, F. A. A., Rahman, M. F. A., Sazali, M. I. N. H. M., Kundat, F. R., Malahubban, M., Yusoff, M. M., & Sajili, M. H. (2023). Mechanisms used by plant growth-promoting rhizobacteria to boost plant growth - A Review. *Journal of Phytology*, 101–109. <https://doi.org/10.25081/jp.2023.v15.7213>

Yi Lih Teo, E., Marzuki, O. F., & Chong, K. F. (2023). Graphene functionalized carbon felt/graphite felt fabrication as electrodes for vanadium redox flow batteries (VRBs): A review. *Pertanika Journal of Science and Technology*, 31(4). <https://doi.org/10.47836/pjst.31.4.05>

Yusli, N.A., Saupi, N., & Dadi, S.N. (2023). Documentation of plant-based food wrapper utilised by communities in Bintulu, Sarawak. *Malaysian Applied Biology*, 52(5), 41-54. <https://doi.org/10.55230/mabjournal.v52i5.cp17>



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