

TROPICAL FORESTRY 2026

TROPICAL FORESTRY AND SUSTAINABILITY FOR HUMAN SOCIETY

18 - 20 August 2026

Le Méridien, Kota Kinabalu Sabah, Malaysia



TF2026

Tropical Forestry 2026

PROGRAMME BOOK WITH ABSTRACTS

Organised by: Faculty of Tropical Forestry, Universiti Malaysia Sabah (UMS)
Co-Organised by: KTS Plantation Sdn Bhd

Tropical Forestry Conference 2026
Tropical Forestry and Sustainability for Human Society

First Edition, 2026

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FOREWORD FROM **THE MINISTER OF NATURAL RESOURCES AND ENVIRONMENTAL SUSTAINABILITY MALAYSIA**

It is my great pleasure to welcome all distinguished speakers, delegates, researchers, industry representatives, practitioners, students, and guests to Tropical Forestry 2026 (TF2026). This international conference, themed "Tropical Forestry and Sustainability for Human Society," is both timely and significant. Tropical forests are vital to biodiversity conservation, climate regulation, water security, local livelihoods, and sustainable development. As tropical forests face increasing pressures from climate change, land-use change, and environmental degradation, stronger collaboration among government agencies, universities, industry, researchers, and local communities is essential.

TF2026 provides an important platform for sharing knowledge, discussing emerging challenges, and developing practical solutions for sustainable forest management. I commend Universiti Malaysia Sabah, particularly the Faculty of Tropical Forestry, for organising this conference and for its continued contribution to forestry education, research, innovation, and community engagement.

I also extend my appreciation to all partners, speakers, presenters, and committee members who have contributed to the success of this event. I wish all delegates a productive, insightful, and successful conference.

YB Dato' Sri Arthur Joseph Kurup
Minister of Natural Resources and Environmental Sustainability
Malaysia



FOREWORD FROM **THE VICE CHANCELLOR OF UNIVERSITY MALAYSIA SABAH**

It is my pleasure to warmly welcome all esteemed speakers, delegates, and participants to Tropical Forestry 2026 (TF2026), the third edition following the successful events held in 2021 and 2024. This year's event, themed "Tropical Forestry and Sustainability for Human Society," is being held from 18–20 August 2026 in Kota Kinabalu and hosted by Universiti Malaysia Sabah. As the world's tropical forests face increasing pressures from climate change, unsustainable land use, and environmental degradation, TF2026 provides a vital platform for knowledge exchange, meaningful dialogue, and the development of innovative solutions. Its emphasis on science, technology, and community engagement reflects

the importance of strengthening the resilience and sustainability of tropical forest ecosystems. We are proud to bring together leading researchers, academicians, industry experts, policymakers, practitioners, and local community representatives. As Vice-Chancellor, I remain committed to advancing Universiti Malaysia Sabah as a centre of excellence in tropical forestry education, research, innovation, and community engagement. We also aspire to produce graduates who are well prepared to meet the evolving needs of the forestry and environmental sectors.

I am confident that the discussions, knowledge sharing, and collaborations throughout TF2026 will inspire new strategies and meaningful partnerships towards ensuring the sustainability of our tropical forests. I wish all participants a productive, insightful, and successful TF2026.

Professor Datuk Dr. Kasim Hj. Mansor
Vice Chancellor
Universiti Malaysia Sabah



MESSAGE FROM **THE DEAN FACULTY OF TROPICAL FORESTRY**

It is my distinct honour and privilege to welcome all delegates, researchers, and stakeholders to Tropical Forestry 2026 (TF2026). Organised by the Faculty of Tropical Forestry, Universiti Malaysia Sabah, TF2026 serves as an important platform for knowledge exchange, intellectual discourse, and the development of meaningful and lasting collaborations. This year's gathering reflects our shared commitment to addressing the increasingly complex challenges facing tropical forests and the wider natural environment. By bringing together local and international academics, industry representatives, policymakers, practitioners, and conservationists, TF2026 provides an important bridge

between scientific research and practical, on-the-ground approaches to sustainable forest management. Throughout the conference, I encourage all participants to engage actively in the sessions, exchange perspectives, explore emerging ideas, and strengthen the partnerships needed to safeguard our tropical forest ecosystems.

I extend my sincere appreciation to the organising committee, strategic partners, speakers, participants, and everyone who has contributed to the success of TF2026. May this third edition of Tropical Forestry inspire new ideas, meaningful collaborations, and innovative solutions that will contribute to the protection and sustainable management of tropical forests for generations to come.

Professor Dr. Normah Awang Besar @ Raffie
Dean
Faculty of Tropical Forestry
Universiti Malaysia Sabah



MESSAGE FROM THE ORGANISING CHAIRPERSON

On behalf of the organising committee, it is my great pleasure to welcome all delegates, speakers, researchers, practitioners, students, and guests to Tropical Forestry 2026 (TF2026), held from 18th to 20th August 2026 in Kota Kinabalu, Sabah, Malaysia. With the theme "Tropical Forestry and Sustainability for Human Society," TF2026 provides an important platform for intellectual exchange, professional engagement, and interdisciplinary collaboration. This conference brings together participants from academia, industry, government agencies, and related institutions who share a common commitment to advancing knowledge and practice in tropical forestry and sustainability. The conference programme has been carefully designed to address current

and emerging issues in tropical forestry, including forest conservation, biodiversity, ecosystem sustainability, sustainable resource management, forest policy, climate resilience, agroforestry, community development and the broader role of forestry in supporting human well-being. Through keynote addresses, invited talks, oral presentations, and poster sessions. TF2026 aims to stimulate meaningful dialogue and encourage innovative ideas that can contribute to the sustainable future of tropical forest landscapes.

We are deeply honored to host distinguished keynote and invited speakers whose expertise will enrich the conference and inspire all participants. Their contributions, alongside active delegate participation, make this gathering truly impactful. Sincere thanks to the university leadership, organising committee, partners, sponsors, speakers, presenters, volunteers, and participants. Your dedication and support made TF2026 possible. May TF2026 inspire lasting collaboration and action in tropical forestry. We wish all delegates a productive, enriching, and memorable conference in Sabah! Thank you and welcome to Tropical Forestry 2026.

Associate Professor Dr. Kamlisa Uni Kamlun
Organising Chairperson
Tropical Forestry 2026 (TF2026)



KEYNOTE

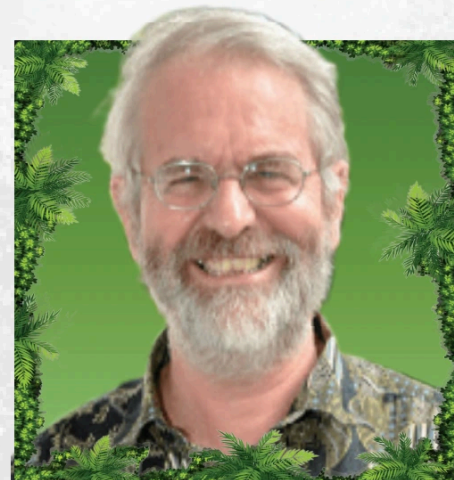
SPEAKERS

KEYNOTE SPEAKERS



YBhg. Tan Sri Datuk (Dr.) Abdul Majid Khan
Chairman, JAWALA Plantation Sdn. Bhd.

Prof. Dr. Meine van Noordwijk is a Distinguished Research Fellow at World Agroforestry and has been with the organisation since 1993. For many years, he helped guide the global integration of the centre's scientific agenda and co-led ICRAF's global research programme on environmental services. His scholarship spans a remarkable range of scales, from root-soil interactions to global environmental policy and national-level implementation. In addition to his work at World Agroforestry, he is also Professor of Agroforestry at Wageningen University, the Netherlands. His contributions have been highly influential in linking agroforestry science with sustainability, livelihoods, and policy.



YBrs. Prof. Dr. Meine van Noordwijk
Wageningen University & Research, Netherlands



YBrs. Prof. Dr. Kanehiro Kitayama
Professor Emeritus,
Kyoto University, Japan
Adjunct Professor
Faculty of Tropical Forestry, Universiti Malaysia Sabah

Prof. Dr. Kanehiro Kitayama is Professor Emeritus at Kyoto University and Adjunct Professor at the Faculty of Tropical Forestry, Universiti Malaysia Sabah. He previously served as Professor of Forest Ecology at Kyoto University and holds a PhD in Botanical Sciences from the University of Hawai'i. His academic work has made significant contributions to forest ecology and sustainable forestry, particularly through research on tropical forest systems. His long-standing research career reflects extensive engagement with tropical biodiversity, ecosystem processes and forest sustainability.



INVITED

SPEAKERS



INVITED SPEAKERS



YBhg. Datuk Zulkifli Suara
Chief Conservator of Forests,
Sabah Forestry Department.

Datuk Zulkifli Suara currently serves as the Chief Conservator of Forests at the Sabah Forestry Department. In this capacity, he leads one of Sabah's key institutions in advancing sustainable forest management, conserving natural heritage, and strengthening long-term forestry governance for the state. Under the department's mission and strategic direction, the office of the Chief Conservator plays a central role in balancing conservation priorities with sustainable use, research and institutional development. His presence as an invited speaker brings an important policy and management perspective to the conference's discussions on tropical forestry and sustainability.



YBhg. Dato (Dr.) Henry Lau Lee Kong
Managing Director,
KTS Group of Companies

Dato (Dr.) Henry Lau Lee Kong is the Managing Director of KTS Group of Companies and serves as Executive Chairman of BLD Plantation Bhd. Trained in engineering at the University of Adelaide, Australia, he is a member of the Association of Professional Engineers, Scientists and Managers Australia. He has extensive experience in plantation, timber logging, sawmilling, and property development. In 2025, Universiti Malaysia Sabah conferred upon him an Honorary Doctor of Philosophy in Forestry in recognition of his long-standing commitment to forest conservation, sustainable forestry practices, and academic research in tropical forest ecosystems.



YBrs. Prof. Dr. Ir. Sri Rahayu
Faculty of Forestry,
Universitas Gadjah Mada, Indonesia

Prof. Dr. Ir. Sri Rahayu, M.P. is an academic at the Faculty of Forestry, Universitas Gadjah Mada, Indonesia. Her expertise lies in forest science, with specialization in forest protection and health, silviculture, and tree pathology. She is listed among the teaching staff of the Doctoral Programme in Forestry Science at Universitas Gadjah Mada, where her knowledge field is identified as Tree Pathology. In recent international academic programmes, she has also been presented as Head of the Laboratory of Health and Protection, reflecting her leadership in forest health and plant pathology scholarship within the faculty.

ABOUT THE EVENT**TROPICAL FORESTRY 2026**

The Tropical Forestry 2026 (TF2026) is a scholarly platform that brings together researchers, academicians, policymakers, industry players, practitioners, and students to discuss emerging issues, research findings, and innovations in tropical forestry. The conference aims to strengthen knowledge exchange and collaboration in areas related to forest conservation, sustainable forest management, biodiversity, ecosystem services, forest economics, agroforestry, climate change, community-based forestry, and green development.

This conference provides an important avenue for participants to share research outcomes, present innovative ideas, and explore practical solutions to current challenges facing tropical forests. As tropical forest ecosystems continue to experience increasing pressure from land-use change, climate risks, resource exploitation, and socioeconomic transformation, the conference highlights the need for evidence-based approaches, multidisciplinary research, and inclusive policy responses.

Through keynote addresses, paper presentations, poster sessions, exhibitions, and networking activities, the TF 2026 seeks to promote meaningful academic and professional engagement among local and international participants. The event also supports the development of future collaborations between universities, government agencies, research institutions, industries, non-governmental organisations, and community stakeholders.

By providing a platform for dialogue and knowledge sharing, this conference contributes to the advancement of tropical forestry research and practice, while supporting broader efforts toward environmental sustainability, biodiversity conservation, climate resilience, and sustainable development.



TENTATIVE

PROGRAM

TENTATIVE

PROGRAMME SCHEDULE FOR TROPICAL FORESTRY 2026

Theme: Tropical Forestry and Sustainability for Human Society

LE MÉRIDIEN, KOTA KINABALU, SABAH, MALAYSIA

(This conference applies Malaysian Standard Time – MYT)

Date: 17 -20 August 2026

PRE-CONFERENCE DAY (17 AUGUST 2026 - MONDAY)

1400 – 1700 Pre-registration and Poster Placement

DAY 1 (18 AUGUST 2026 - TUESDAY)

0800	Arrival and Registration of Participants and Invited Guests
0845	Arrival of Senior Officers and Heads of Departments, UMS Arrival of YBhg. Professor Datuk Dr. Kasim Hj. Mansor , Vice Chancellor Universiti Malaysia Sabah Arrival of YB Dato' Sri Arthur Joseph Kurup , Minister of Natural Resources and Environmental and Sustainability of Malaysia
0900 – 1000	OPENING CEREMONY Venue: Grand Ballroom - National and State Anthem - Du'a Recital - Welcoming Speech by YBhg. Professor Datuk Dr. Kasim Hj. Mansor Vice-Chancellor, Universiti Malaysia Sabah - Opening Speech by YB Dato' Sri Arthur Joseph Kurup Minister of Natural Resources and Environmental and Sustainability, Malaysia - Launching Ceremony for TF2026, Officiated by YB Dato' Sri Arthur Joseph Kurup - Book Launching <i>An Introduction to Forest Plantation and Agroforestry</i> <i>Tuhau (Etlingera coccinea): Panduan Penanaman dan Penuaian</i> - MOU Signing - Presentation of Memento - Group Photo
1000 – 1030	Refreshment and Poster Viewing

TENTATIVE**KEYNOTE SPEAKERS SESSION**

Chairperson: Prof. Gs. Dr. Phua Mui How

Venue: Grand Ballroom

1030 – 1100	<i>The Future of Forest Plantation and Sustainability Forestry: From Forests to the Future, Rethinking the Role of Planted Forests in a Changing World</i> Tan Sri Datuk (Dr.) Abdul Majid Khan - Chairman, JAWALA Plantation Sdn. Bhd.	
1100 – 1130	<i>Agroforestry Systems in Sustainable Forest Landscapes: Current Issues</i> Prof. Dr. Meine van Noordwijk - Wageningen University & Research	
1130 – 1200	<i>Ecology of Degraded Tropical Rainforest: Did We Cross the Tipping Point?</i> Prof. Dr. Kanehiro Kitayama - Kyoto University & Universiti Malaysia Sabah	
1200 – 1230	Q & A Session	
1230 – 1300	Presentation of Memento	
1300 – 1400	Lunch Break	
1400 – 1500	CONCURRENT SESSIONS	
	Session 1A Forest Management Chairperson: Assoc. Prof. Dr. Maria Lourdes Lardizabal Venue: Grand Ballroom	Session 2A Forest Diversity Chairperson: Assoc. Prof. Dr. Kartini Saibeh Venue: Gaya Room 1 & 2
1500 -1515	Tea Break	
1515 - 1700	CONCURRENT SESSIONS (CONT.)	
	Session 1A Forest Management Chairperson: Assoc. Prof. Dr. Maria Lourdes Lardizabal Venue: Grand Ballroom	Session 2A Forest Diversity Chairperson: Assoc. Prof. Dr. Kartini Saibeh Venue: Gaya Room 1 & 2
1700	End of Day 1	



TENTATIVE**DAY 2 (19 AUGUST 2026 - WEDNESDAY)**

0730 – 0830	Registration				
INVITED SPEAKERS SESSION					
Chairperson: Assoc. Prof. Dr. Berhaman Ahmad					
Venue: Grand Ballroom					
0830 – 0900	Forests at the Frontier: Powering a Green Economy Through Sustainable Forest Stewardship for a Climate-Resilient Future				
Datuk Zulkifli Suara - Chief Conservator of Forests					
0900 – 0930	Industry Leadership in Sustainable Forest Production				
Dato (Dr.) Henry Lau Lee Kong - KTS Group					
0930 – 1000	Emerging Forest Diseases Outbreak in the Tropics: Management, Ecosystem Restoration and Conservation				
Prof. Dr. Ir. Sri Rahayu - Universitas Gadjah Mada					
1000 – 1030	Q & A Session				
1030 – 1045	Presentation of Memento				
1045 – 1100	Coffee and Tea Break				
1100 – 1300	CONCURRENT SESSIONS				
Session 1B Nature Tourism & Recreation Chairperson: Assoc. Prof. Dr. Andy Russel Mojjol Venue: Laban Rata & Sayat-Sayat Room		Session 2B Social Forestry Chairperson: Assoc. Prof. Dr. Kamlisa Uni Kamlun Venue: Timpohon Room		Session 3B Interdisciplinary Approaches I Chairperson: Assoc. Prof. Dr. Mohamadu Boyie Jalloh Venue: Gaya Room 1 & 2	
1300 – 1400	Lunch Break				
1400 – 1600	CONCURRENT SESSIONS				
Session 4B Biodiversity & Conservation Chairperson: Assoc. Prof. Dr. Jephthe Sompud Venue: Laban Rata & Sayat-Sayat Room		Session 5B Forestry & Technology Chairperson: Assoc. Prof. Ts. Dr. Ismawati Palle Venue: Timpohon Room		Session 6B Interdisciplinary Approaches II Chairperson: Assoc. Prof. Ts. Dr. Liew Kang Chiang Venue: Gaya Room 1 & 2	
1600 - 1630	Tea Break				
1630 - 1700	CLOSING CEREMONY				
Venue: Laban Rata & Sayat-Sayat Room					
1700	End of Day 2				

DAY 3 (20 AUGUST 2026 – THURSDAY) FIELD EXCURSION

0800 – 1600	Field Excursion
1600 – 1630	Closing Session
1630	End of TF2026



FLOOR

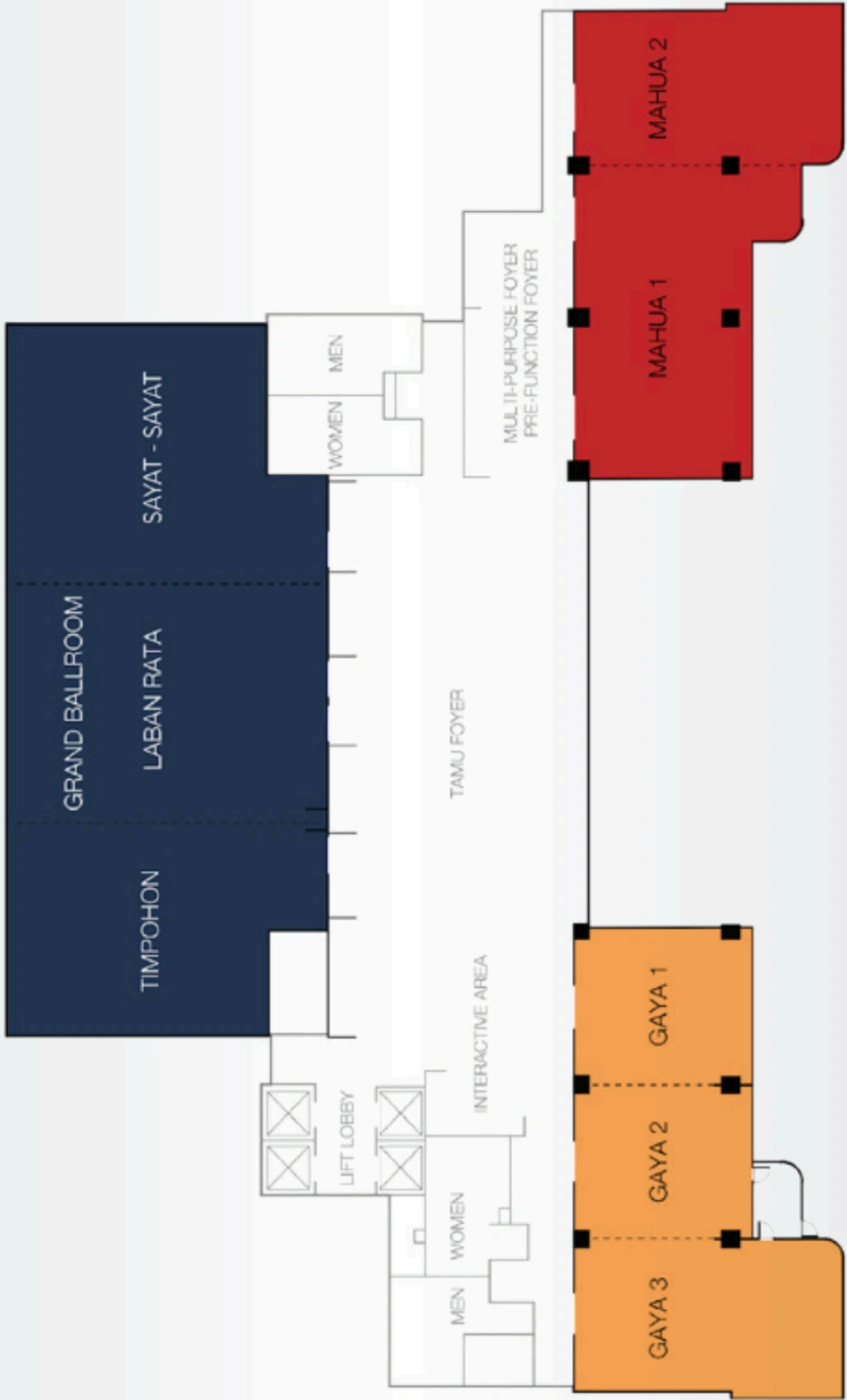
PLAN LAYOUT



FLOOR PLAN



Function Room Floor Plan (Level 3)





ORAL

PRESENTATION

ORAL PRESENTATION



DAY 1 (18 AUGUST 2026 - TUESDAY)		
Time	Session 1A Forest Management Chairperson: Assoc. Prof. Dr. Maria Lourdes Lardizabal Venue: Grand Ballroom	Session 2A Forest Diversity Chairperson: Assoc. Prof. Dr. Kartini Saibeh Venue: Gaya Room 1 & 2
1400 - 1415	TF2026#15 Phosphorus Storage and Turnover in Bornean Forest Biomass <i>Yuki Tsujii and Kanehiro Kitayama</i>	TF2026#52 How Deep Is Deep Enough? Solum Depth Shapes Agroforestry Effects on Soil Function in Tropical Karst Landscapes <i>Danny Dwi Saputra, Rika Ratna Sari, Syifa Azzahra, Nanda Ardiansyah, Muhammad Shulton Cahaya Ramadhan, Rizki Maulana Ishaq, Syahrul Kurniawan, Meine van Noordwijk</i>
1415 - 1430	TF2026#16 Impact of Fire on the Soil Properties at Different Land Classification Within the Boundary of Southeast Pahang Peat Swamp Forest, Malaysia <i>Dayang Nur Sakinah Musa, Kamlisa Uni Kamlun, Hardawati Yahya, Ahmad Faiz Tharima</i>	TF2026#53 Deciphering the Relative Importance of Root Quality and Microclimate in Fine-Root Decomposition in Coffee Agroforestry <i>Rika Ratna Sari, Leony Siska Aldini, Rahma Carissadelia Ramadhan, Reiki Barkah Dwi Ahmad Yani, Danny Dwi Saputra, Meine van Noordwijk</i>
1430 - 1445	TF2026#20 Experimental Characterizations of Smoldering Fire Spread in Tropical Peat under Controlled Laboratory Conditions <i>Wan Mohd Nurulhisam Wan Nawang, Azfarizal Mukhtar, Dayang Nur Sakinah Musa</i>	TF2026#54 Canopy Gradients in Coffee Agroforestry: Vegetation Structure Modifies Microclimate and Physiological Responses <i>Danny Dwi Saputra, Nandha Ardiansyah, Arya Cahyo Pratama, and Rika Ratna Sari</i>
1445 - 1500	TF2026#87 Comparative Study of Water Status and Leaf Traits Among Trees, Wildings, and Ground Cover Plants at Different Topographical Niche and Forest Layer <i>Rhema D. Maripa, Kayle Jane Jauni, Nadhirah Binti Razali, Nurul Izzah Binti Apong @Bakri, and Anand Nainar</i>	TF2026#72 Diversity of Bats in Small Caves at Lower Kinabatangan Wildlife Reserves, Sabah, Malaysian Borneo <i>Go Xian Yun and Azniza Mahyudin, Mohammad Zahirul Hoque and Vijay Kumar Subbiah</i>
1500 - 1515	Tea break	

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1515 - 1530	TF2026#22 Study Of The Natural Distribution Of Dipterocarpaceae Species In Degraded Forests Around Central Kalimantan <i>Siti Maimunah, Inang, Puji AA, Amir Noviyanto, Siman Suwaji, Galang Indrajaya</i>	TF2026#56 Diversity and Biogeography of Land Snail in Limestone Hills in Peninsular Malaysia <i>Hilda SW Tee, Thor-Seng Liew</i>
1530 – 1545	TF2026#33 Propagation of Various Species of Tropical Bamboo Through Tissue Culture Techniques in an Effort to Achieve the Sustainable Development Goals <i>Novella SW; Yohanna FS; Rusdi Z; Marc AM Peeters; Jan M Oprins; Siti Maimunah</i>	TF2026#64 Preliminary Checklist of Ground-dwelling Birds in a 50 Years of Naturally Regenerating Forest in Sapong, Tenom <i>Anis Imsyazreen Ahmad Kamal and Abdul Hamid Ahmad</i>
1545 - 1600	TF2026#73 A Retrospective Thematic Analysis of Reforestation Paradigms in Oil Palm Landscapes <i>Hardawati Yahya, Muhammad Sahrani Ridwan and Elia Godoong</i>	TF2026#23 Conservation of the endemic pig <i>Babyrusa babyrussa</i> on Buru Island, Indonesia <i>Tri Sayektiningsih, Agus S. Jati, Bayu W. Broto, Muhammad I. Lubis, Didin Alfaizin, Sahid A. Hudjimartsu, Tri H. Kuswoyo, and Chang Yong Choi</i>
1600 – 1615	TF2026#37 Do Bamboo Stands Restore Soil Functions? A Comparison of Soil Physicochemical Properties Between <i>Gigantochloa Atter</i> (Hassk.) Kurz and Secondary Forest in Tropical Sarawak <i>Nur Athirah Auni Abdul Taib and Mugunthan Perumal</i>	TF2026#67 Assessment Of Street Tree Diversity And Species Composition In Kepong, Kuala Lumpur <i>Ahmad Nazarudin, M.R. and Abdul Hayat, M.S.</i>
1615 - 1630	TF2026#50 Mitigating Peat Fire Risks: Evaluating Water Resource Limitations and Road Accessibility Performance in Sabah's Peat Swamp Forests, Malaysia <i>Rebecca Mishallyne, Kamlisa Uni Kamlun, Hardawati Yahya, Ahmad Faiz Tharima, Dayang Nur Sakinah Musa</i>	TF2026#69 Camera Trap study of Mammalian Species Richness and Conservation Status at Crocker Range Biosphere Reserve, Sabah: Insights from Two Transitional Landscapes <i>Hanna Wissie Dakiel, and Andy Russel Mojol</i>
1630	End of day 1	

ORAL PRESENTATION



DAY 2 (19 AUGUST 2026 - WEDNESDAY)			
Time	Session 1B Nature Tourism & Recreation Chairperson: Assoc. Prof. Dr. Andy Russel Mojiol Venue: Laban Rata & Sayat Sayat Room	Session 2B Social Forestry Chairperson: Assoc. Prof. Dr. Kamlisa Uni Kamlun Venue: Timpohon Room	Session 3B Interdisciplinary Approaches Chairperson: Assoc. Prof. Dr. Mohamadu Boyie Jalloh Venue: Gaya Room 1 & 2
1100-1115	TF2026#10 An Assessment of Tour Operators' Intention to Develop Community-Based Tourism (CBT) in Kota Belud, Sabah: Integrating Social Exchange Theory and Community Involvement Approach <i>Mohd Aidil Bin Jainin, Boyd Sun Fatt and Spencer Hedley Mogindol</i>	TF2026#12 The Political Ecology of Social Forestry Formation in West Sumatra, Indonesia: A Comparative Narrative of Community Mobilization, Environmental Shock and Institutional Support <i>Yonariza, Mutiara Vonny Indah, and Mahdi</i>	TF2026#90 Oil palm-based agroforestry and soil health in Indonesia: food and habitat as essentials for earthworms and microbial biomass <i>Kurniatun Hairiah</i>
1115-1130	TF2026#11 Integrating Economic Valuation and Community Livelihoods for the Sustainable Management of the Southeast Pahang Peat Swamp Forest, Malaysia <i>Mukrimah Abdullah, Hyrul Izwan MH, Ariff Fahmi AB, Norliyana A, Azian M, Marryanna L, Mohd Azahari F, Mohamad Danial MS, Muhamad Afizzul M, Mohammad Shahfiz A & Kaviarasu M</i>	TF2026#18 Land Cover Change Dynamics across Social Forestry Schemes: Evidence from Multi-Period Spatial in West Sumatra, Indonesia <i>Mahdi, Yonariza, Vonny Indah Mutiara, Muhammad Iqbal Edrizal, Isna Yarni</i>	TF2026#83 A Review of The Current Status of Forest Certification for Plantation Forests in Asia: Challenges and Way Forward <i>Siti Radiah Mohamad, Walter Lintangah</i>

ORAL PRESENTATION



1130 - 1145	TF2026#14 Recreation-Induced Vegetation and Soil Disturbance in a Tropical Forest: Immediate Impact and One-Year Recovery in SFERA-UMS, Malaysia <i>Walter Azwal Malandi</i>	TF2026#19 Planning Documents and Organizational Task Allocation in First-Generation Social Forestry Groups in West Sumatra, Indonesia: A Cross-Scheme Descriptive Analysis <i>Vonny Indah Mutiara, Yonariza, Mahdi, Muhammad Iqbal Edrizal, and Isna Yarni</i>	TF2026#84 Foraging Ecology of the Sunda Pangolin at Termite Nests in SFERA@UMS <i>Carmen Adros, Normah Awang Besar, Maria Lourdes Lardizabal, Jephthe Sompud</i>
1145 – 1200	TF2026#17 Landscape Character of Scenic Trails in Lipis District <i>Rohana Mohd Firdaus, Wan Yusryzal Wan Ibrahim and Nurzuliza Jamirsah</i>	TF2026#21 Study on the Management of Permanent Nursery by BPDAS SOP in Providing Free Seedlings to the Community <i>Gistillo J, Ade Jernie H; Yolanda DC, Timotheus AKW, Setiaji HS; MD Falah; Siti Maimunah</i>	TF2026#92 Rehabilitation of Degraded Peat Swamp Forest: Growth Performance And Survival of Peat Swamp Tree Species <i>Hyrul Izwan Mohd Husin, Farah Shahanim Mohamed Mohidin and Nurcahaya Khairany Mohamad Azmi</i>
1200 – 1215	TF2026#25 Community Participation and Benefit-Sharing in Ecotourism Development <i>Huda Farhana MM, Muhammad Azizul M, Nur Fazreen Z, Norhafiza S, Norliyana A, & Faizal Adli Z</i>	TF2026#24 Facilitation Patterns in First-Generation Social Forestry Groups in West Sumatra, Indonesia: A Comparative Analysis by Scheme <i>Yenny Oktavia, Yonariza, Vonny Indah Mutiara, Mahdi, Rahmat Iqbal Edrizal, and Isna Yarni</i>	TF2026#91 Prevalence of Parasites among Fishes at Darau River, Kota Kinabalu, Sabah, Malaysia <i>Hairul Hafiz Mahsol, Elsha Cashitra Percy Ijoy, Marcellus Nicholson, Andy Mohamad Hidayat, Dwayneduncan Jmirin, Yuwinah Natasha, Malborn Solynsem, Moh Pak Yan, Muhammad Ali Syed Hussein, Sudin Yusop, Azniza Mahyudin & Homathevi Rahman</i>

ORAL PRESENTATION



1215 - 1230	TF2026#26 Strengthening Community Forestry through Community-Based Ecotourism: Pantai Malindo Coastal Mangrove Forest, Penang <i>Norliyana Adnan, Mohd Parid Mamat, Huda Farhana Mohd Muslim</i>	TF2026#29 Sustainability Potentials of First-Generation Social Forestry Groups in West Sumatra, Indonesia A Comparative Cross-Scheme Qualitative Synthesis <i>Rudi Febriamansyah, Yonariza, Vonny Indah Mutiara, Mahdi, Muhammad Iqbal Edrizal and Isna Yarni</i>	TF2026#96 Spatial Variation in Wildlife Distribution across Substations of Tawau Hills Park, Sabah, Malaysia <i>Andy Martin Ginal Martin, Suzana Nasib, Aeril Amputong, Frederick Francis Gansau, Ajirullah Jatullah, Marcell Odin, Nurien Haziqah Zamri, and Annabel Timothy Pianzin*</i>
1230 - 1245	TF2026#27 Synergizing Traditional and Conservation: Community-driven Enhancement of Ecosystem Services in The Crocker Range Biosphere Reserve, Sabah, Malaysia <i>Hardawati Yahya, Andy Russel Mojiol, Ene Betrece Jhnlee, Dessy Ijes, Jesselyn Kijin, Kamliisa Uni Kamlun, Sirorytha Sining, Siti Kashnirah Kuntal, Siti Nur Faizah Syed Nor, Rachal Jim, Ricky Alisky Martin, Nasiri Sabiah, and Walter Lintangah</i>	TF2026#48 Linking Landscape Change and Community Well-being in Limestone Karst Areas: A Case Study of Kinta Valley, Perak <i>Shaelza Shaca Shalmon, Liew Thor Seng, Zulqarnain Mohamad, and Marcela Pimid</i>	TF2026#85 Current Progress on the Taxonomy and Conservation Assessment of Bornean <i>Ardisia</i> subgenus <i>Pyrgus</i> (Primulaceae) <i>Avelinah Julius and Timothy M.A. Utteridge</i>
1245 -1300	TF2026#32 Integrating Cultural Ecotourism and Ecological Restoration: Community Narratives from High Conservation Value (HCV) plantations in Sabah, Malaysia <i>Muhammad Syahrani Ridwan, Robert Francis Peters, Elia Godoong, Hardawati Yahya</i>	TF2026#70 Visual Landscape Preference: A Case Study In Teluk Likas Public Park (TLPP), Kota Kinabalu, Sabah <i>Hamimah Talib, and Sendy Lee Che Sing</i>	TF2026#60 Preliminary Assessment of Anuran Diversity at Universiti Malaysia Sabah <i>Muhammad Fadzil Amram, Nooraisyah Mohammad Wali, Jelna Audrey Jalit, Arniza Abdul Batin, and Rozie Rozeana Liu</i>
1300 - 1400	Lunch break		

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Time	Session 4B Biodiversity & Conservation Chairperson: Assoc. Prof. Dr. Jephthe Sompud Venue: Laban Rata & Sayat Sayat Room	Session 5B Forestry & Technology Chairperson: Assoc. Prof. Dr. Ismawati Palle Venue: Timpohon Room	Session 6B Interdisciplinary Approaches Chairperson: Assoc. Prof. Dr. Liew Kang Chiang Venue: Gaya Room 1 & 2
1400 - 1415	TF2026#13 Effect of Organic Litter Mulch on Seedling Survival and Growth <i>Gerald Lee Zheng Yang and Maria Lourdes T Lardizabal</i>	TF2026#49 Community Participation as a Primary Predictor of Effective Forest Conservation: Case Study of Community Forest Management in Sabah, Malaysia <i>Hardawati Yahya and Fiffy Hanisdah Saikim</i>	TF2026#71 Feasibility Study of Integrating Low-Carbon Emission Cocoa with Oil Palm <i>Albert Ling Sheng Chang, Ahmad Kamil Hj. Mohd. Jaffar, Norasekin Tamchek, Girish Ramachandran, Ee Wei Yuan</i>
1415 - 1430	TF2026#30 A Preliminary Diagnostic Survey of Herbivory Symptoms in Four Newly Planted Native Tree Saplings in a Forest Restoration Project at Deramakot, Forest Reserve, Sabah <i>Estherpeni Stephen and Maria Lourdes T. Lardizabal</i>	TF2026#55 Linking social drivers, water quality, and economic value in fragmented spring forest <i>Michelle Talisia Sugianto, Auralia Novriani Putri, Felix Bintara Putra Sinaga, Sugeng Prijono, Rika Ratna Sari, Danny Dwi Saputra</i>	TF2026#59 Early Growth Performance of Dipterocarps Under Varying Planting Strategies in Sapong Forest Estate, Tenom <i>Nurul Nabilah Binti Abdul Karim, Elia Godoong, & Mandy Maid</i>
1430 - 1445	TF2026#86 Diversity and Taxonomy of Schismatoglottideae (Araceae) of Sabah, Malaysia <i>Kartini Saibeh</i>	TF2026#57 Linking Microclimate to Vanilla Productivity in Agroforestry Systems under Contrasting Rainfall Regimes <i>Danny Dwi Saputra, Arif Firmansyah, Hasanathul Jannah, Rika Ratna Sari</i>	TF2026#36 Plot-level time-series assessment of enrichment planting in Sow-A-Seed project, Sabah <i>Keiko Ioki, Wilson Yun Chiong Wong, Shazrul Azwan Jhari, David Alloysius, E Petter Axelsson, Ulrik Ilstedt</i>

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1445 - 1500	TF2026#42 Impacts of Land Degradation on Soil Microbial Activity Mediated by Soil Moisture in a Bornean Tropical Forest <i>Taiki Mori, Kei Funakawa, Ryota Aoyagi, Nobuo Imai, Sandy Tsen Tze Lui, Reuben Nilus, and Kanehiro Kitayama</i>	TF2026#51 Understanding Decomposition Dynamics in Marginal Coffee-Agroforestry: Interplay Between Litter Quality and Microclimate Indicators <i>Rika Ratna Sari, Catur Luhur Atmaja, Shifa A. H. Syahputri, Dyah Ajeng Ramadhani, Muhammad Al'akhari Ubaidullah, Danny Dwi Saputra</i>	TF2026#58 Assessing Hydrological and Erosional Impacts of Forest Restoration in The Sapong Estate, Sabah <i>Emylia Hadi, Anand Nainar and Elia Godoong</i>
1500 – 1515	Tea break		
1515 - 1530	TF2026#44 Developing Conservation Strategies for <i>Dipterocarpus gracilis</i> in Java through Genetic and Silvicultural Integration <i>Nesty Pratiwi Romadini, Sapto Indrioko, Widiyatno, Eny Faridah</i>	TF2026#61 Carbon Recovery in Restored Riparian Forests: Implications for Aboveground Biomass and Climate Mitigation <i>Nur Nazatul Hashima Binti Jaafar and Elia Godoong</i>	TF2026#93 Tropical seedling performance under drought: a functional trait approach for species selection in restoration <i>Musyarofah Zuhria, b, Nuri Nurlaila Setiawanc, Susana Paulina Dewid, Endah Sulistyawatid*</i>
1530 – 1545	TF2026#46 Soil Physical and Chemical Properties in Different Forest Structures at Sapong Estate, Tenom, Sabah <i>Muhamad Danial Ali, Mohd Hamirul Hakimi Talip, Ag. Mohd Sa'd Afiq Jusman, Normah Awang Besar and Elia Godoong</i>	TF2026#62 Forest Fragmentation and Restoration in Tropical Asia: Impacts on Carbon and Biodiversity <i>Anastasia Anak Jimmy, Elia Godoong</i>	TF2026#09 Spatial analysis of land cover change and ecosystem service dynamics in the Crocker Range Biosphere Reserve (CRBR), Sabah <i>Kamlisa Uni Kamlun, Hardawati Yahya, Walter Lintangah, Andy Russell Mojiol, Ricky Alisky Martin, Ene Betrece Johnlee, Dessy Ijes, Jesselyn Kijin, Nasiri Sabiah & Charmila Flora Miuse</i>
1545 - 1600	TF2026#65 A Checklist of Rhopalocera (Butterflies) at Sapong Estate, Tenom Sabah <i>Ricky Shearer Richard and Maria Lourdes Lardizabal</i>	TF2026#63 Ecological Responses of Native Dipterocarps to Environmental Variation in Tropical Riparian Landscapes <i>Awing Ahip, Elia Godoong</i>	
1600 - 1630	Break		
1630-1700	Closing Ceremony		
1700	End of day 2		



POSTER

PRESENTATION

POSTER PRESENTATION



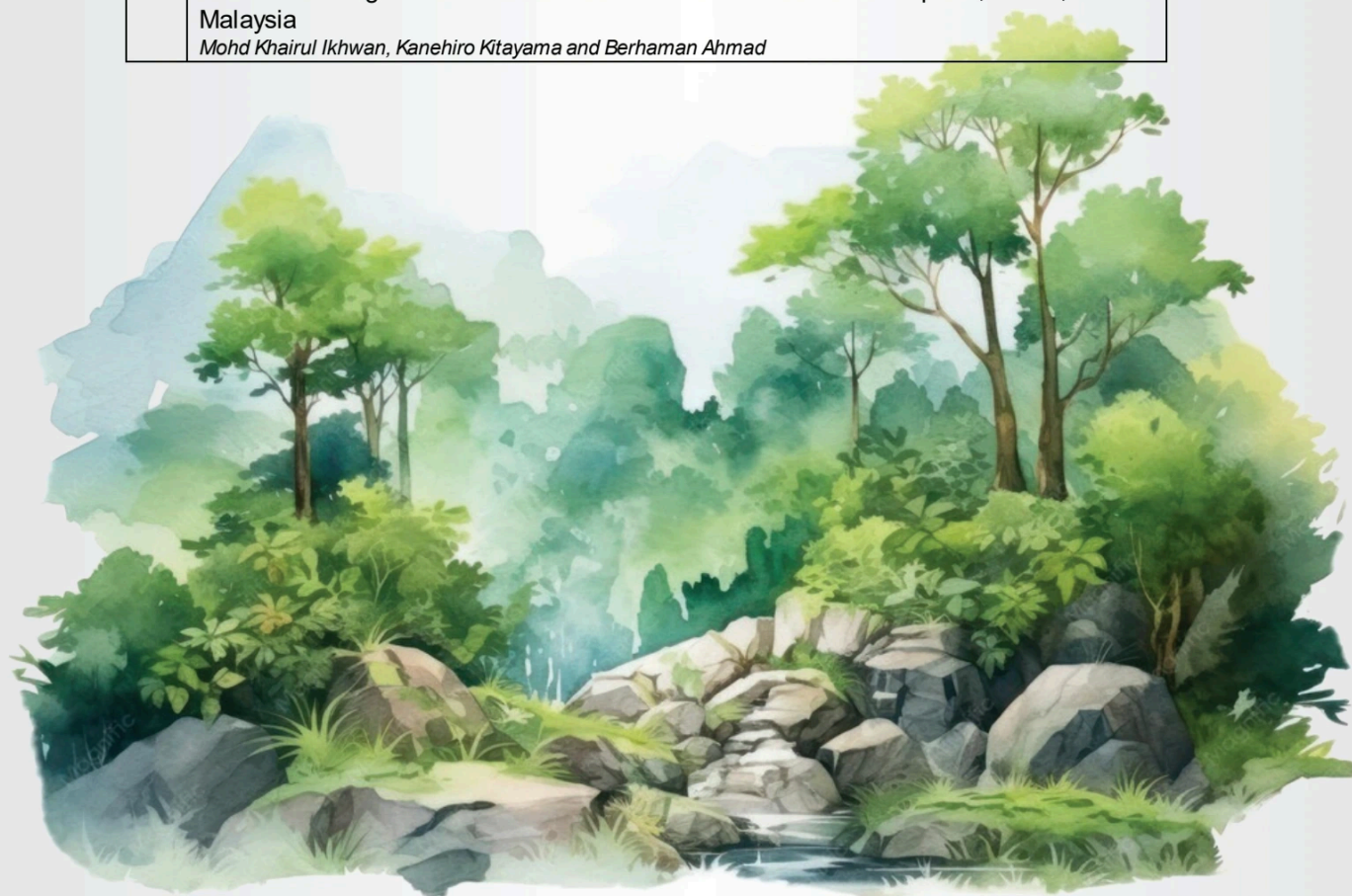
DAY 1-2 (18-19 AUGUST 2026)

1.	TF2026#28 Automated Urban Forest Inventory: Integrating Vision-Language Models (VLM) and QGIS Atlas Based on High-Resolution Remote Sensing and Ground Truth GPS <i>Olivia Elfatma, Siti Maimunah and Sri Gunawan</i>
2.	TF2026#31 Balancing Forest Resource Use and Conservation: Community Adaptation in The Vicinity of Croker Range Biosphere Reserve, Sabah <i>Siti Nur Aisyah Binti Mohamed Surin and Walter Lintangah</i>
3.	TF2026#34 Contrasting forest recovery trajectories between FSC-certified and conventionally logged forests in Sabah: insights from 20 years of monitoring <i>Nobuo Imai, Jan T. Pereira, Sandy Tsen Tze Lui, Reuben Nilus, and Kanehiro Kitayama</i>
4.	TF2026#40 Monitoring resilience of tropical forest biodiversity using tree functional group ratio and remote sensing <i>Ryota Aoyagi, Ryuichi Takeshige, Komatsu Kotaro, Shogoro Fujiki, Kazuki Miyamoto, Nobuo Imai, Shin-ichiro Aiba, Taiki Mori, Sandy Tsen Tze Lui, Nilus Reuben, Jewell Dawat, and Kanehiro Kitayama</i>
5.	TF2026#43 Repeated intense selective logging induces loss of resilience in a Bornean timber production forest <i>Ryuichi Takeshige, Ryota Aoyagi, Nobuo Imai, Sandy Tsen Tze Lui, Reuben Nilus, and Kanehiro Kitayama</i>
6.	TF2026#68 Soil microbial community shifts and their effects on soil enzyme activities along a logged-over tropical forest degradation gradient <i>Linzi Jang, Masayuki Ushio, Nobuo Imai, John Sugau & Kanehiro Kitayama</i>
7.	TF2026#74 Review of Mangrove Species Composition, Diversity, and Biomass in Malaysia and Bornean Mangrove Forests <i>Nurul Aqilah Awet, and Muhammad Azmil Abdul Razak</i>
8.	TF2026#77 Restoration of degraded forest - physiological aspects of selected species planted using innovative techniques <i>Farah Shahanim, Nurcahaya Khairany and Hyrul Izwan</i>
9.	TF2026#78 Cultivating Pro-Environmental Behaviour: An Analysis of Public Synergy in Malaysia's 100 Million Tree-Planting Initiative <i>Abdul Hayat, M.S., Ahmad Nazarudin, M.R., Mukrimah, A., Ariff Fahmi, A.B., Dasrul Iskandar, D. and Mohd Zaki, A.</i>
10.	TF2026#79 The Effectiveness of Recreational Park Facility Provision in Kota Kinabalu Based on the Kota Kinabalu Landscape Master Plan 2002: An Assessment of User Satisfaction and Importance of Playground Equipment <i>Alfian Bin Mansyur, Hamimah Talib</i>
11.	TF2026#80 Effects of coconut leaf sheath mulch and watering frequency on Okra (<i>Abelmoschus esculentus</i>) fruit production and soil water content <i>Ummul Khairah Kamal, Siti Suliza Salamat², Azwan Awang, Normah Awang Besar, Affendy Hassan, Thamer A. Thabet, Mandy Maid, Jephthe Sompud, Nur Fadzlunnisa Wakimin, Go Wen Ze, Ahmad kamil Mohd Jaaffar, Maznah Muning, Julius Kodoh, Berhaman Ahmad, Ag. Ahmad Mohd. Yunus, Elisa Azura Azman, Osumanu Haruna Ahmed, Toong Foo Weng, Huck Ywih Ch'ng, Mohamadu Boyie Jalloh*</i>

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12.	TF2026#81 Bioactive Potential of Dendrobium anosmum: A Sustainable Tropical Forest Bioresource from Borneo <i>Abdul Hanif bin Hatim, Harniza Izzati Razali, Nur Hanisah Binti Azmi, Siti Fatimah Md.-Isa</i>
13.	TF2026#82 SMASTING: Smart Glasses Harvesting for Oil Palm Ripeness Detection in SEAT Urban Forest <i>M. Nur Aldy Ndraha, Ledyu Upara Sivina, Marlianti, Vido Wijaya, Olivia Elfatma</i>
14.	TF2026#38 Evaluating the Role of Community Governance in Forest Management within the Crocker Range Biosphere Reserve in Kampung Ulu Senagang, Keningau <i>Odella Emo Fedelis, Walter Lintangah</i>
15.	TF2026#41 Development of a UAV-based model for dipterocarp crown identification in lowland tropical forests <i>Kotaro Komatsu, Ryuichi Takeshige, Masanori Onishi, Yusuke Onoda, Sandy Tsen Tze Lui, Nilus Reuben, Jel Dawat and Ryota Aoyagi</i>
16.	TF2026#94 Seed germination variability and its association with functional traits in submontane tropical forest species of Indonesia: recommendations for direct seeding <i>Musyarofah Zuhria, Nuri Nurlaila Setiawan, Susana Paulina Dewi, Endah Sulistyawati</i>
17.	TF2026#95 Wildlife Tracking in the Wildlife Corridor in a Forest Plantation in Sepulut, Sabah, Malaysia <i>Mohd Khairul Ikhwan, Kanehiro Kitayama and Berhaman Ahmad</i>





ORAL PRESENTER'S

ABSTRACTS

ORAL PRESENTER'S ABSTRACTS

THEME 1A: FOREST MANAGEMENT

1. TF2026#15

Phosphorus Storage and Turnover in Bornean Forest Biomass

Yuki Tsujii ^{1*} and Kanehiro Kitayama ²

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Abstract

Phosphorus (P) is an essential macronutrient for plant growth, yet its availability is extremely low in certain types of tropical soils, including the highly weathered red soils that are widespread across Borneo. Although P limitation could cause forest decline on such soils, Bornean forests maintain high productivity and accumulate huge biomass carbon, likely through highly efficient use and tight cycling of P within the ecosystems. Knowledge of the P cycle in ecosystems therefore provides opportunities to understand the ecology of Bornean forests and implement sustainable forest management. Here, we present our work that quantified the turnover time of P in forest biomass across seven Bornean rain forests. Using long-term monitoring data from Mount Kinabalu, we estimated P turnover time in aboveground forest biomass and compared it with the turnover time of aboveground forest biomass, i.e. a proxy for carbon turnover. P turnover time in aboveground forest biomass ranged from 3 to 10 years, which was much faster than turnover time for biomass (20–50 years). These results suggest that P cycles much more rapidly than carbon within the ecosystems, and this may be a key mechanism that enables Bornean forests to sustain high productivity on P-impooverished soils. In the talk, we will further present data on P pools in each tree organ (i.e. leaves, wood, flower/fruit, etc.) and briefly discuss how rapid P cycling is maintained in forest ecosystems.

Keywords: adaptation, ecosystem function, lowland forest, mountain, nutrient deficiency

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2. TF2026#16

Impact of Fire on the Soil Properties at Different Land Classification Within the Boundary of Southeast Pahang Peat Swamp Forest, Malaysia.

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Abstract

Forest boundary areas play an important role in regulating fire behaviour and influencing susceptibility to fire spread. In the Southeast Pahang Peat Swamp Forest, Pahang, these peripheral zones are frequently exposed to repeated burning and land-use disturbance, yet data on peat soil properties in degraded areas near the forest reserve remain limited. This knowledge gap constrains understanding of how boundary degradation contributes to fire recurrence. This study aims to quantify the effects of fire on peat soil physical properties across five land classifications along the SEPPSF boundary. Soil samples were collected and analysed for moisture content, porosity, and bulk density using standard gravimetric and volumetric methods. Results indicate that the degraded area due to fire were low in porosity (0.15–0.89%), high compaction compared to pristine peat (0.76–1.13 g/cm³, bulk density), and moisture contents ranging from 67.87 to 744.89%. Fern Land exhibited the most severe peat properties alteration, suggesting extensive peat oxidation and compaction, while Grassland and Barren Land showed moderate but still significant changes. These patterns indicate that fire severity strongly influences peat characteristics near forest boundaries. Overall, the findings underscore the need for targeted boundary-zone management to prevent fire spread and enhance peatland ecosystem conservation.

Keywords: Peat Swamp Forest, Fire Impact, Peat Properties

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3. TF2026#20

Experimental Characterizations of Smoldering Fire Spread in Tropical Peat under Controlled Laboratory Conditions

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Abstract

Smoldering peat fires pose persistent combustion challenges due to low temperature oxidation, subsurface heat retention, and resistance to suppression. This study experimentally examines smoldering fire spread behaviors in tropical peat soils collected from three contrasting land use types in Peninsular Malaysia: agricultural peat in Johor, oil palm plantation peat in Terengganu, and protected peat swamp forest in Selangor. 27 peat samples were subjected to controlled laboratory combustion tests under fully dried conditions to isolate intrinsic fuel effects. Fire spread was quantified using mass loss rate and distance-based propagation rate, while temperature evolution was monitored to characterize ignition, growth, steady state, and decay phases. All samples followed a consistent five phase smoldering progression. However, significant regional differences were observed. Johor exhibited the highest mean mass loss spread rate of 1.569 g min⁻¹ and shorter ignition progression times, indicating greater combustibility. Selangor showed lower spread rates at 1.491 g min⁻¹ and longer ignition duration, while Terengganu demonstrated intermediate behaviors. Comparative analysis confirmed that peat origin exerted stronger control over combustion intensity than sampling depth or drainage distance under standardized dry conditions. The results indicate that intrinsic fuel properties influenced by land use history play a critical role in governing oxygen diffusion and sustained oxidation. This study provides quantitative evidence of regional differentiation in tropical peat smoldering behaviors.

Keywords: Peatland Fires, Fire Spread Dynamics, Laboratory Experiment, Land-Use Type, Fire Curve

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4. TF2026#87

Comparative Study of Water Status and Leaf Traits Among Trees, Wild Seedlings, and Ground Cover Plants at Different Elevation

Rhema D. Maripa*, Kayle Jane Jauni, Nadhirah Binti Razali, Nurul Izzah Binti Apong @ Bakri, and Anand Nainar¹

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Abstract

Water potential is an important physiological parameter used to evaluate plant water status and adaptation to environmental conditions. This study compared the leaf water potential, relative water content (RWC), and leaf morphological characteristics of trees, wild seedlings, and ground cover plants growing at different elevations in the Sustainable Forest Education and Research Area (SFERA), Universiti Malaysia Sabah (UMS). Sampling was conducted in valley and ridge plots over several months using predawn (4:30 - 6:30 a.m.) and midday (11:30 a.m. - 1:30 p.m.) measurements with a pressure chamber. Across all plant groups, predawn water potential values ranged from -0.05 ± 0.12 MPa to -1.20 ± 0.05 MPa, while midday values ranged from -0.10 ± 0.50 MPa to -2.35 ± 0.20 MPa, indicating greater water stress during midday due to increased transpiration and environmental exposure. Relative water content remained consistently high, ranging from $92.48 \pm 1.06\%$ to $99.99 \pm 1.56\%$, suggesting strong water retention capacity and adaptability among species under varying environmental conditions. Leaf area ranged from 3.829 ± 60.35 cm² to 248.331 ± 60.35 cm², where larger leaf areas were commonly observed in valley species, while ridge species generally possessed smaller leaves. Leaf thickness ranged from 0.05 ± 0.05 mm to 0.28 ± 0.05 mm, with thicker leaves observed in certain species such as *Trema* sp. and *Garcinia macrocarpa*, indicating adaptive responses to water stress. Environmental factors such as elevation, rainfall, and species variation significantly influenced plant water relations and leaf morphology across different plant forms. Overall, the findings demonstrate that tropical forest plants exhibit important physiological and morphological adaptations that enable survival under varying environmental conditions and elevation gradients.

Keywords: Water potential, relative water content, leaf morphology, elevation, tropical forest

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5. TF2026#22

Study of the Natural Distribution of Dipterocarpaceae Species in Degraded Forests Around Central Kalimantan

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Abstract

The extinction of Dipterocarpaceae species that grow naturally in Central Kalimantan is caused by massive forest damage for other uses and land conversion, both legally and illegally, for various economic activities by the community, companies, and the government, including illegal mining, land conversion for agriculture or mining, and illegal logging. Evacuation activities were carried out in several forest areas in 11 sites at 4 regency, there are Harowu Village Forest, Rangan Hiran Village Forest, PT Taiyoung Engreen (Forestry Company) and the Temporary Food Estate Project Site in Gunung Mas Regency; Communal forests in Jakatan Pari Village, PT Asmin Bara Bronang (2 sites) Conservation Area, PT Suprabari Mapanindo Mineral Conservation Area and PT Dasa Intiga (forestry companies) in Kapuas Regency, Tangkahan Communal Forest in Pulang Pisau Regency and Mungku Baru Village, Palangka Raya City. The collection data in 2024 – 2026 in the field yielded 295 trees species the arranger of its natural habitat, most of which are categorized as rare species, and 131 of them were Dipterocarpaceae consisting of 11 genera, namely Anisoptera; Cotylelobium; Dipterocarpus; Dryobalanops; Hopea; Vatica; Upuna; Rubroshorea, Richetia, Antoshorea, Parashorea and Shorea, with the highest number found in the field. The evacuated activities for endangered Dipterocarpaceae species in Central Kalimantan are still carried out on a voluntary basis, with the aim of saving the existing Dipterocarpaceae species within forest areas and, if possible, preserving the natural habitat of Dipterocarpaceae by enriching it. This activity is a pioneering effort to save Dipterocarpaceae species from evacuation for maintenance in nurseries and will be planted in conservation areas in collaboration with multiple parties concerned with the efforts to save these species. Planting activities are carried out by identifying areas dominated by Dipterocarpaceae in disturbed/damaged forest areas, beginning with collecting wild seedlings found in the field (without depleting field stocks and ensuring the species is preserved in the forest) together with third parties such as mining companies, plantations, or other landowners; planting them in nursery and maintaining them until a third party is ready to adopt them (companies and conservation organizations) and offering the planting of Dipterocarpaceae species to conservation area developers for their managed areas that meet the growth requirements of these species. The activities are still carried out voluntarily to save these species from extinction and need to establish cooperation with multiple parties concerned about this effort to save the earth.

Keywords: Natural distribution, Dipterocarpaceae, Degraded forest

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6. TF2026#33

Propagation of Various Species of Tropical Bamboo Through Tissue Culture Techniques in an Effort to Achieve the Sustainable Development Goals

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²Faculty of Forestry of Instiper Yogyakarta, Indonesia

Abstract

Tropical bamboo is an important species in tropical regions with great potential in supporting environmental sustainability, soil and water conservation, as well as supporting sustainable development and climate change mitigation. Bamboo development is often hindered by seed scarcity due to a very long flowering cycle (40 to more than 100 years) and the inefficiency of conventional vegetative propagation such as stem cuttings. This study presents a report on the successful propagation 42 species of tropical bamboo using tissue culture technology (Bamboo Biotechnology/BBiT) as a solution for providing high-quality mass seedlings. The methodology used in tissue culture techniques with a basic formula adjusted to 42 species to be propagated involves the stages of micropropagation through the selection of healthy parent plants, sterilization, in-vitro multiplication, and ex-vitro acclimatization in the greenhouse. The activities were carried out at the Tissue Culture Laboratory of PT Bambu Nusa Verde from the year 2016 until reaching a total of 42 tropical bamboo species. The results show that the tissue culture method is capable of producing thousands of plantlets from a single propagule in just one year. The seedlings produced are proven to be free from Bamboo mosaic virus and other pathogens. Compared to conventional cutting methods, tissue culture seedlings show a survival rate of up to 98%. In addition, root induction from the laboratory phase results in superior root structures, accelerates clump formation, and provides uniform biomass growth. The successful propagation of 42 tropical bamboo species has significant implications for the tropical forestry sector. The mass and sustainable availability of superior seedlings is essential to support the restoration of degraded land, carbon sequestration (10-30 tons CO₂/ha/year), as well as the fulfillment of raw materials for wood substitute industries, which contributes to the conservation of tropical forests by achieving the Sustainable Development Goals (SDGs).

Keywords: Plant propagation, tropical bamboo, tissue culture techniques, Sustainable Development Goals.

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7. TF2026#73

A Retrospective Thematic Analysis of Reforestation Paradigms in Oil Palm Landscapes

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Abstract

The discourse surrounding reforestation in oil palm plantations has evolved from reactive mitigation to proactive ecosystem management. However, empirical success remains fragmented. This study aims to analyse the core thematic drivers and determine how these paradigms have historically influenced restoration design and implementation. Using a retrospective thematic analysis (RTA), we synthesised 25 years of research (2000-2026) from various data sources, employing systematic screening to identify recurring paradigms in restoration literature and practice. The results from qualitative thematic approach reveal three dominant, often competing, themes: Technocratic capacity (minimalist ecological intervention), biological reductionism (prioritising ecosystem function without regard for biodiversity complexity), and integrated socio-ecological governance (an emerging paradigm focusing on community-led landscape restoration). The literature indicates a systematic shift of reviewing replanting as land-use change mitigation to prioritise landscape connectivity for resilience. We argue that future reforestation policy must move beyond species-richness counts to address social-ecological tensions inherent in large-scale plantations.

Keywords: Reforestation, Retrospective thematic analysis, Systematic analysis, Resilience

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8. TF2026#37

Do Bamboo Stands Restore Soil Functions? A Comparison of Soil Physicochemical Properties Between *Gigantochloa Atter* (Hassk.) Kurz and Secondary Forest in Tropical Sarawak

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Abstract

Bamboo-based ecosystems are increasingly recognised for contributing to ecological restoration and sustainable land management in tropical regions. Understanding how bamboo influences soil properties is pivotal for supporting the United Nations Sustainable Development Goals, particularly SDG 13 (Climate Action) and SDG 15 (Life on Land). This study evaluated soil physicochemical properties under *Gigantochloa atter* bamboo stands and secondary forest in Sabal, Sarawak, Malaysia. Soil samples were collected 1 m from bamboo clump peripheries at three depths (0-20, 20-40, and 40-60 cm) and analysed for soil bulk density, pH, electrical conductivity, moisture content, total carbon, and total nitrogen. Soils in both vegetation types were strongly to moderately acidic (pH 4.74-5.88), reflecting highly weathered tropical soils. Soil bulk density showed no significant differences between bamboo and secondary forest across all depths. However, soil moisture content and total nitrogen were significantly higher in secondary forest soils at all depths ($p < 0.05$), suggesting greater nutrient retention and organic matter accumulation. Total carbon differed significantly at deeper depths (20-40 and 40-60 cm), with higher values in secondary forests. Conversely, soil pH in deeper layers was slightly higher under bamboo stands compared with secondary forest. Overall, vegetation type influences soil physicochemical properties across soil depths. While secondary forests maintain higher soil nutrient status, bamboo stands can contribute to moderating acidity and supporting soil functions in tropical landscapes. These findings provide crucial evidence to inform sustainable land management strategies and policy initiatives promoting bamboo-based systems for ecosystem restoration and climate resilience in line with global sustainability goals.

Keywords: Tropical Bamboo, Soil physicochemical properties, Ecosystem restoration, Sustainable land management, Sarawak

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9. TF2026#50

Mitigating Peat Fire Risks: Evaluating Water Resource Limitations and Road Accessibility Performance in Sabah's Peat Swamp Forests, Malaysia.

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Abstract

Peat swamp forests are ecologically vital for carbon sequestration and hydrological regulation, yet they remain highly susceptible to ignition during drought periods. Suppressing peat fires in Binsuluk Forest Reserve, Sabah, relies heavily on the preparedness strategies of the Fire and Rescue Department of Malaysia (FRDM). Effective preparedness is crucial for efficient suppression effort as delays in responses allow fires to intensify. In addition, water shortages during dry season double the hurdles. Therefore, this research aims to determine the proximity score (γ) of water sources to burnt areas within the Binsuluk Forest Reserve by evaluating the spatial distribution of water sources and road accessibility. The proximity (γ) was analyzed using geospatial analysis followed by ground validation. Results indicate that water sources within the Binsuluk Forest Reserve have an average proximity score of 7.62, which is in moderate readiness. Travel times ranged from 9.12 to 49.38 minutes, highlighting significant accessibility constraints, as the standard FRDM response time is 10 minutes. Therefore, this research highlights the importance of physical infrastructure acting as a main constraint in firefighter readiness to control peat fires in peat swamp forests, particularly in protected forest areas. Overall, this study offers an understanding of the cruciality proximity in water sources and road access.

Keywords: Readiness Index assessment, Forest fire management, Peat swamp forest, Fire suppression.

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THEME 1B: NATURE TOURISM & RECREATION

1. TF2026#10

An Assessment of Tour Operators' Intention to Develop Community-Based Tourism (CBT) in Kota Belud, Sabah: Integrating Social Exchange Theory and Community Involvement Approach

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Abstract

The mangrove forests of Kota Belud, Sabah, represent vital ecological assets that provide essential ecosystem services while offering significant potential for sustainable socio-economic development through tourism. The mangrove corridor of Kota Belud has been increasing popularity for niche activities such as river cruises and the observation of fireflies and endemic proboscis monkeys. This study, therefore, to investigate the behavioral intentions of tour operators regarding the development of CBT at two primary sites: Kampung Nanamun and Kampung Rampayan Laut. Guided by an integrated theoretical framework comprising Social Exchange Theory (SET) and the Theory of Planned Behavior (TPB), this research conceptually explores the determinants of strategic decision-making among tourism stakeholders. Specifically, it examines how perceived costs and perceived benefits influence tour operators' intentions, with tour operator involvement serving as a mediating variable. The study employed a quantitative approach using a purposive sampling technique, where structured questionnaires were distributed to 101 identified tour operators operating within the Kota Belud mangrove corridor. The empirical findings reveal that that perceived benefits significantly enhance tour operators' intention toward CBT, while perceived costs have a weaker but notable effect. Moreover, tour operators' involvement plays a mediating role, strengthening the relationship between perceived benefits and behavioral intention. By aligning the business interests of tour operators with the socio-ecological needs of the Kampung Nanamun and Kampung Rampayan Laut communities, stakeholders can foster a more resilient and sustainable mangrove tourism sector in Sabah.

Keywords: Community-Based Tourism (CBT), Tour Operators, Social Exchange Theory (SET), Community Involvement, Behavioral Intention, Mangrove Forest

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2. TF2026#11

Integrating Economic Valuation and Community Livelihoods for the Sustainable Management of the Southeast Pahang Peat Swamp Forest, Malaysia

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Abstract

Tropical peat swamp forests represent critical natural capital, providing climate regulation, carbon storage, biodiversity conservation and ecosystem services that support human wellbeing. However, ongoing land-use pressures continue to threaten their sustainability. This study advances an integrated socio-economic approach to support sustainable governance of the Southeast Pahang Peat Swamp Forest (SEPPSF), Malaysia, by linking economic valuation with community livelihood analysis. The Contingent Valuation Method (CVM) was employed to estimate public willingness-to-pay (WTP) for peat swamp forest conservation, capturing the non-market value of its ecosystem services. In parallel, a socioeconomic survey of communities surrounding SEPPSF examined livelihood structures, forest dependency and the role of traditional ecological knowledge in peatland resource use. Results indicate a positive and statistically significant WTP for conservation, reflecting societal support for peatland protection and potential conservation financing mechanisms. At the same time, local and indigenous communities demonstrate continued reliance on peatland resources for subsistence, income diversification and cultural practices. The integration of economic valuation and livelihood evidence highlights the need for inclusive, human-centred forest governance. As a way forward, this paper proposes strengthening social forestry initiatives through community co-management arrangements, sustainable agroforestry and paludiculture practices, and incentive-based mechanisms such as payment for ecosystem services (PES). Institutional recognition of traditional ecological knowledge is essential to enhance adaptive capacity and long-term resilience. By integrating economic justification with community participation, this study contributes to advancing sustainable tropical forestry that aligns conservation objectives with human development goals.

Keywords: Peat swamp forest, Sustainable Forest Management, Social Forestry, Economic Valuation & Community Livelihood

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3. TF2026#14

**Recreation-Induced Vegetation and Soil Disturbance in a Tropical Forest:
Immediate Impact and One-Year Recovery in SFERA-UMS, Malaysia****Wilter Azwal Malandi**

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Abstract

Recreational camping is widely promoted for outdoor education and nature engagement; however, its ecological implications in tropical forests remain under-documented. This study evaluated vegetation disturbance and soil compaction associated with a 10-day high-density student camping program involving approximately 100 participants in the SFERA-UMS tropical forest, Malaysia. A before–after design was applied to quantify changes in understory vegetation cover and soil compaction within designated camping zones. Immediate post-camping measurements indicated significant vegetation suppression and increased soil compaction, particularly in tent and activity areas. A follow-up assessment conducted one year later revealed partial vegetation recovery, although soil compaction levels remained elevated compared to baseline conditions. The findings highlight differential recovery rates between biotic and abiotic components and emphasize the need for adaptive campsite management in tropical forest settings. This study contributes empirical evidence to support sustainable recreation planning and conservation-oriented use of forest landscapes.

Keywords: Recreation ecology, Tropical Forest, Camping Impact, Sustainable Recreation management, SFERA-UMS

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4. TF2026#17

Landscape Character of Scenic Trails in Lipis District**Rohana Mohd Firdaus ***, Wan Yusryzal Wan Ibrahim and Nurzuliza Jamirsah

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Abstract

Landscape character becomes an important asset for a district when its significance and uniqueness are recognised and provide unique experience. It is often expressed through scenic trails that allow the landscape to be experienced through various modes of travel, such as driving, walking, boat riding or by train. In Lipis District of Pahang the rural landscape setting highlights distinct landscape characters that can be classified into outstanding geological landform, lush vegetation and pristine hydrological resource, all of which contribute to promoting the district's rural ambience for tourism. This paper aims to map the landscape characters of Lipis District as perceived through travel experiences along scenic trails, focusing on the visual qualities and experiential value of the rural environment. A five-day field survey was conducted, during which geo-tagged photographs were collected using the SW Maps smartphone application while travelling across sub-districts. A total of 90 photographs, together with Digital Elevation Model (DEM) data were analysed using QGIS to evaluate the district's physical landscape characteristics. The findings indicate that scenic quality is strongly influenced by topography, with dense forest hills and wide rivers as the most prominent features. The dominance of natural settings is complemented by the rural living environment, primarily experienced through vehicular travel. The results also revealed that scenic qualities are not limited to isolated viewpoints but form a continuous visual experience across the landscape. The findings suggest that Lipis District functions as a cohesive landscape matrix that emphasises the integrated natural and cultural conservation to sustain national assets and for tourism development.

Keywords: Landscape Characters, Scenic Trails, Rural Landscape, QGIS

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5. TF2026#25

Community Participation and Benefit-Sharing in Ecotourism Development

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Abstract

The success of sustainable ecotourism development is intrinsically linked to the depth of local stakeholder integration, particularly in forest-dependent coastal enclaves. This research presents an empirical assessment of participation patterns and benefit-distribution dynamics within the ecotourism zones of Mersing, Johor Darul Ta'zim. Data were derived from 185 household surveys conducted in 2025 across eight diverse island and coastal communities. Through a multi-dimensional analysis assessing levels of participation across planning, implementation, monitoring, and benefit-sharing, the study identifies a distinct hierarchy in engagement levels (Index of Participation [IP] = 0.3887). Mean scores ($2.57 \leq M \leq 3.54$) suggest that while communities are integrated into the functional aspects of ecotourism ($M=3.54$), they remain marginalized in strategic oversight and monitoring phases ($M=2.57$). This disparity suggests a "participation gap" where involvement is confined to the periphery of management. The study concludes that the sustainability of the region's ecotourism sector depends on rectifying these structural imbalances. Moving forward, the implementation of more robust, bottom-up governance models is recommended to align local socioeconomic interests with conservation objectives.

Keywords: Community participation, Benefit-sharing, Ecotourism, Participatory, Coastal communities

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6. TF2026#26

**Strengthening Community Forestry through Community-Based Ecotourism:
Pantai Malindo Coastal Mangrove Forest, Penang.**

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Abstract

Community participation plays an important role in ensuring the sustainability of forest ecosystems and improving the socio-economic well-being of rural communities. In Malaysia, many communities living near forest areas still rely on natural resources for their livelihoods but often face limited economic opportunities. This study explores the development of a community forestry scheme aimed at strengthening the socio-economic resilience of local communities surrounding the coastal mangrove forest ecosystem of Pantai Malindo, Penang. The study adopts a mixed-method approach involving both primary and secondary data collection. Primary data were obtained through visitor surveys, household interviews, focus group discussions, and stakeholder consultations. The findings are focused to contribute to the development of a collaborative community forestry model that integrates conservation, ecotourism, and local enterprise development. The initiative aims to enhance community participation in forest conservation, the establishment of a physical community forestry model, create alternative income opportunities, and support sustainable forest management practices in Malaysia.

7. TF2026#27

Synergizing Traditional and Conservation: Community-driven Enhancement of Ecosystem Services in The Crocker Range Biosphere Reserve, Sabah, Malaysia

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Abstract

Global conservation strategies now widely acknowledge the essential role of Indigenous Peoples and local communities (IPLCs). This study aims to evaluate how synergizing traditional practices with formal conservation mandates enhances ecosystem services and livelihood resilience within the Crocker Range Biosphere Reserve (CRBR), Sabah, Malaysia. To achieve these objectives, we employed a mixed-methods approach comprising four qualitative focus group discussions with key informants and quantitative structured questionnaire surveys with 102 participants across local communities. The results demonstrate that traditional practices are perceived as vital for optimizing ecosystem service provisioning, notably through traditional farming and the sustainable harvest of non-timber forest products. Questionnaire data revealed a positive correlation between community participation in conservation and improved household socio-economic well-being. Furthermore, qualitative narratives indicated that acknowledging traditional practices and establishing co-management structures directly mitigate localized forest degradation through robust grassroots community protocols. In conclusion, this research empirically validates that reconciling forest resource preservation with human development necessitates inclusive, community-based governance. Synergizing traditional practices with formal conservation targets provides a scalable framework, proving that community-driven management is vital for the long-term sustainability of global biosphere reserves.

Keywords: Ecosystem services, Indigenous People and Local Community (IPLCs), Traditional practices, Participatory governance, Socio-ecological resilience

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8. TF2026#32

Integrating Cultural Ecotourism and Ecological Restoration: Community Narratives from High Conservation Value (HCV) Plantations in Sabah, Malaysia.

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Abstract

High Conservation Value (HCV) areas within plantation landscapes, yet often underutilized, opportunities to integrate biodiversity conservation, cultural heritage preservation, and sustainable livelihoods. This study explores the potential of utilizing HCV areas as cultural ecotourism sites, integrate plantation restoration to promote sustainable landscape revitalization in Sapong Plantation, Tenom, Sabah. Focusing of Bukit Tanah Pinisih as a local cultural heritage site and Sg Biah Waterfall as a nature-based ecotourism destination, the research adopts a qualitative approach through semi structured interview to capture in depth more from local community perspectives and narratives. The findings indicate that local communities perceive HCV areas as culturally significant and ecologically valuable landscapes with strong potential for low-impact ecotourism. Restoration activities including riparian rehabilitation and reforestation of degraded plantation restoration identified as critical for enhancing biodiversity, ecosystem services and landscape attractiveness. Furthermore, an analysis of social media engagement (TikTok) suggests that integrating cultural ecotourism into plantation restoration transform HCV areas into multifunctional landscapes. Such integrations support long-term conservation and community well-being. These insights provide valuable framework for developing community-based ecotourism and advancing.

Keywords: High Conservation Value (HCV) areas, Cultural ecotourism, Ecological restoration, Plantation landscapes, Community-based conservation, Sustainable livelihoods

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THEME 2A: FOREST DIVERSITY

1. TF2026#52

How Deep Is Deep Enough? Solum Depth Shapes Agroforestry Effects on Soil Function in Tropical Karst Landscapes

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Abstract

Climate variability poses risks to soil degradation in tropical karst landscapes with shallow solum, less water storage capacity and rapid subsurface drainage. While agroforestry has been widely promoted as a climate-resilient land-use strategy, its effectiveness under pedologically constrained karst conditions remains poorly quantified. We assessed the performance of agroforestry systems and monoculture with varying solum depth (shallow vs. deep) in karstic marginal landscapes. In southern Malang district, Indonesia, we compared monoculture sugarcane with simple (SAF) and complex (CAF) coffee-based agroforestry systems in the deep (>50 cm) and shallow (<50 cm) solum conditions (n = 24 plots; 3 land uses x 2 solum depths x 4 replicates). Soil physical, chemical and surface hydrological properties were analysed together with fine root traits in three soil depths (0–10; 10–20; 20–30 cm). Compared with sugarcane and especially under deep solum, agroforestry increased fine-root proliferation, specific root length, aggregate stability and infiltration. Solum depth was the main driver of soil organic carbon, and normalizations to pedological baseline potential (C_{org}/C_{ref}) clarified management-related gains in carbon. PCA accounted for 43.4% of variation (Dim1 = 23.6%; Dim2 = 19.8%) and revealed coordinated variation among root traits, structural properties related to carbon, and hydrological indicators, though land-use separation declined under shallow solum. Our results showcase that solum thickness modulated root-associated plant-soil feedback in karst agroecosystems. Deep soils allow for stronger feedback, while shallow soils limit functional gains. Our results call for integration of soil formation context into climate-resilient agroforestry design in marginal tropical landscapes.

Keywords: Coffee, Infiltration, Plant-soil feedback, Soil multifunctionality, Soil organic carbon

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2. TF2026#53

Deciphering the Relative Importance of Root Quality and Microclimate in Fine-Root Decomposition in Coffee Agroforestry

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Abstract

Agricultural intensification in marginal tropical lands often accelerates soil degradation and reduces soil organic matter. Agroforestry has been promoted as a more sustainable land-use system, yet the controls of fine-root decomposition in these systems remain unclear, despite its important role in supplying organic matter to the soil. This study evaluated the relative importance of root quality and microclimate in regulating fine-root decomposition across contrasting coffee agroforestry landscapes in Southern Malang, Indonesia. Research material using fine roots (<2mm) of five dominant species: Coffee (*Coffea arabica*), sugarcane (*Saccharum officinarum*), teak (*Tectona grandis*), coconut (*Cocos nucifera*), and *F. moluccana*, were incubated in 300 nylon bags across sugarcane monoculture (MT), simple coffee agroforestry (AFS), and complex coffee agroforestry (AFK). Root mass loss was monitored for 16 weeks. Root biochemical traits, including nitrogen, lignin, polyphenols were measured, while soil temperature and moisture were used to assess microclimatic conditions. Decomposition rates varied among root types, with coffee roots showing the fastest decomposition ($k = 0.0216\text{--}0.0328 \text{ week}^{-1}$) and the shortest half-life ($t_{50} = 22\text{--}34$ weeks). However, decomposition rates did not differ significantly among land-use systems despite clear differences in microclimate. Relationships between decomposition rates and measured root quality indicators, soil temperature, and soil moisture were generally weak ($R^2 = 0.12$). These findings indicate that root decomposition in this marginal tropical landscape was only weakly explained by the measured substrate quality and microclimatic variables. Fine-root decomposition was influenced more by species specific root characteristics than by agroforestry complexity or measured microclimate, highlighting the importance of species selection in designing resilient coffee agroforestry systems.

Keywords: Agroforestry; Fine-root decomposition; Karst; Root biochemical quality; Shallow solum

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3. TF2026#54

Canopy Gradients in Coffee Agroforestry: Vegetation Structure Modifies Microclimate and Physiological Responses

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Abstract

Global climate change, characterised by rising temperatures, presents a major challenge for the agricultural sector, including coffee cultivation in Indonesia. The implementation of agroforestry systems is one of the adaptive strategies in coffee cultivation as it creates a more stable microclimate, enhances soil fertility, sequesters carbon and provides direct economic benefits to farmers. Variations in vegetation structure within agroforestry systems from dense to open canopies have the potential to influence microclimate conditions, which in turn can affect chlorophyll content and the photosynthetic processes in coffee plants. This study was conducted in the villages of Klepu and Rembun, in the Sumbermanjing Wetan sub-district, Malang Regency. It examined three agroforestry systems: simple agroforestry, complex agroforestry and coffee-teak agroforestry. Each system was divided into four zones (core, middle, boundary and outer zones) to measure vegetation parameters (canopy density, solar radiation intensity, and chlorophyll content of coffee leaves), microclimate (air temperature, air humidity, soil temperature, soil moisture and vapour pressure deficit (VPD)) and coffee production (dry weight of coffee). There were significant differences ($p < 0,05$) between measurement zones for each variable, with increased canopy density reducing solar radiation intensity, air and soil temperature, and VPD, whilst simultaneously increasing air and soil moisture. Solar radiation intensity increased up to fourfold from the core zone to the outer zone, accompanied by a rise in air temperature of $\pm 3\text{--}4\text{ }^{\circ}\text{C}$. The complex agroforestry system (CAF) demonstrated the greatest ability to stabilise the microclimate, whilst the simple agroforestry system (SAF) with moderate canopy density (40–50%) produced the most balanced conditions. The highest leaf chlorophyll content was found in the coffee-teak agroforestry system (CTA), indicating the presence of moderate shading conditions that support the physiological acclimatisation of the plants. However, the relationship between canopy density, microclimate, and chlorophyll content with coffee production was relatively weak. This suggests that coffee productivity is not solely determined by microclimate factors but is also influenced by other factors such as plant age, nutrient availability, and management practices.

Keywords: Chlorophyll content, Dry weight, Vegetation structure, Vapour pressure deficit

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4. TF2026#72

Diversity of Bats in Small Caves at Lower Kinabatangan Wildlife Reserves, Sabah, Malaysian BorneoGo Xian Yun¹, **Azniza Mahyudin**^{1,2}, Mohammad Zahirul Hoque³ and Vijay Kumar Subbiah²¹Conservation Biology, Faculty of Tropical Forestry, Universiti Malaysia Sabah, Jalan UMS, 88400 Kota Kinabalu, Sabah²Biotechnology Research Institute, Universiti Malaysia Sabah, Jalan UMS, 88400 Kota Kinabalu, Sabah³Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Jalan UMS, 88400 Kota Kinabalu, Sabah**Abstract**

Caves provide critical roosting habitat for bats, yet the cave-dwelling bat fauna of the Lower Kinabatangan Wildlife Reserves in Sabah, Malaysian Borneo, remains poorly documented. This study assessed the diversity, community composition, guild structure, and conservation status of bats across six limestone caves (Batu Tulug, Batangan, Batu Materis, Bod Tai, Pang, and Kulamba). Over 660 trap-nights, bats were captured using mist nets and four-bank harp traps, measured, identified, and released. A total of 1,950 individuals representing 20 species in seven families were recorded. The assemblage was overwhelmingly insectivorous (99.8% of individuals), dominated by the family *Miniopteridae* (66.7%) and by a single species, *Miniopterus paululus* (1,168 individuals; 59.9%). Shannon–Wiener diversity was broadly similar among the well-sampled caves ($H' = 0.93–1.35$), but species richness differed significantly across caves ($\chi^2 = 13.14$, $p = 0.022$), reflecting the contrast between species-rich Batangan (14 species) and single-visit Kulamba (one species). Community composition also differed significantly (Kruskal–Wallis $H = 19.61$, $p = 0.002$); Bray–Curtis similarity was highest between Batangan and Bod Tai (62%) and lowest between Batu Materis and Kulamba (0%). All 20 species are IUCN Least Concern except *Miniopterus schreibersii* (Vulnerable), and none is protected under the Sabah Wildlife Conservation Enactment 1997. These findings provide a first cave-by-cave baseline for the reserve and highlight an urgent gap between ecological value and legal protection.

Keywords: bats, Lower Kinabatangan Wildlife Reserves, cave, diversity, species composition, conservation status

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5. TF2026#56

Diversity and Biogeography of Land Snail in Limestone Hills in Peninsular Malaysia**Hilda SW Tee**, Thor-Seng Liew

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Abstract

The limestone hills of Peninsular Malaysia are ecologically important landscapes that act as biodiversity hotspots, supporting a varied range of endemic land snail species. Because of their high species diversity, and limited dispersal capacity, land snails make excellent models for biogeographic studies. However, the biogeographical patterns of land snail diversity in Peninsular Malaysia's limestone hills remain largely understudied. Previous research on land snail biogeography in Peninsular Malaysia was limited to specific regions or only clusters of hills, leaving a knowledge gap in comprehending broader-scale biogeographic trends and land snail diversity. This study aims to: (1) document the diversity and species composition of macro land snail species across limestone hills in Peninsular Malaysia; (2) delineate biogeographical regions in Peninsular Malaysia based on macro land snail species composition. The total number of species recorded in 45 limestone hills is 130, with macro land snail species richness ranged from 10 to 33 species per hill. Cluster analysis further revealed clear biogeographical patterns, with four distinct clusters identified across Peninsular Malaysia. These clusters represent limestone hills located in (i) the northern region, (ii) the southern region, (iii) the western region, and (iv) the eastern region of Peninsular Malaysia. This study provides essential biogeographical evidence to guide conservation prioritisation and protect the unique land snail diversity of Peninsular Malaysia's limestone hills.

Keywords: Macro land snails, Species richness, Biogeographical pattern, Cluster analysis, Peninsular Malaysia

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6. TF2026#64

**Preliminary Checklist of Ground-dwelling Birds in a 50 Years of Naturally
Regenerating Forest in Sapong, Tenom**

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Abstract

Bornean tropical rainforests support high bird diversity and endemism, including ground-dwelling species that are particularly vulnerable to disturbance. Increasing habitat loss has impacted many of the species, yet the ecological value of regenerating secondary forests remains poorly understood. This study aims to document a preliminary checklist of ground-dwelling bird species recorded in a naturally regenerating secondary forest using camera traps. Six camera traps were deployed within the forest over eight months from July 2025 to March 2026. Cameras were relocated twice during this study period to maximise spatial coverage and improve detection probability. A total of 10 sampling stations were established, generating a cumulative sampling effort of 641 camera-trap days. Independent detections were defined as records of the same species separated by at least 30 minutes. Photographic records were identified to species level and compiled to produce a preliminary species checklist. A total of seven ground-dwelling bird species were recorded from 114 independent detections. Detected species included species of conservation concern, such as the Vulnerable *Lophura ignita* and *Rollulus rouloul*. Ground-dwelling birds are typically difficult to detect, highlighting the importance of long-term camera trapping. These findings are significant for future species diversity comparisons between secondary and primary forest habitats, as well as for monitoring biodiversity and emphasising the role of naturally regenerating forests as valuable reservoirs of bird diversity and ecosystem function.

Keywords: Ground-dwelling birds, Species diversity, Camera trapping, Secondary forest

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7. TF2026#65

Conservation of the endemic pig *Babyrusa babyrusa* on Buru Island, Indonesia

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Abstract

Endemic species are of interest to international conservation initiatives because their loss has a great consequence on global extinction rates. The hairy babirusa is an endemic pig with restricted distribution on the islands of Buru and Sula (Taliabu and Mangole). Preventing extinction of the species at a landscape scale has led to the designation of a priority conservation area of Buru, which effective conservation actions are critical since limited human and financial resources are significant constraints. One possible strategy to address this issue is identifying habitat use of the target species. Using occupancy analysis, our study aimed to (1) identify factors influencing habitat use of the hairy babirusa, (2) map its habitat use/distribution, and (3) propose evidence-based conservation strategies to maintain the long-term persistence of the species. Our top model showed that the detection probability of the species was influenced by camera models and canopy openness. Habitat use of the hairy babirusa was strongly affected by the proportion of forest cover. Our study was the first to uncover the ecology of the hairy babirusa in its natural habitat using robust field study. Based on the findings, safeguarding the hairy babirusa requires protecting forests of Buru. Several strategies were discussed to reduce the species' habitat loss on Buru Island.

Keywords: camera trap, Babirusa Maluku, Occupancy, Distribution, Wild pig, Wallacea, Forest loss

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8. TF2026#67

Assessment of Street Tree Diversity and Species Composition in Kepong, Kuala Lumpur

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Abstract

Urban tree diversity plays a critical role in enhancing ecological stability, improving air quality, mitigating the urban heat island effect, and supporting biodiversity in built environments. This study assessed street tree diversity across 578 roads in urban and residential areas of Kepong, the northern part of Kuala Lumpur. Field data included species identity and origin (native versus exotic) were recorded. A total of 16,510 individual trees were identified, representing 230 species, 147 genera, and 54 families. Fabaceae was the most dominant family, comprising 3,411 individuals (20.66%). The most abundant species were *Syzygium myrtifolium* (1,540 individuals), *Mangifera indica* (1,438), *Peltophorum pterocarpum* (1,381), *Hopea odorata* (1,353), and *Tabebuia rosea* (1,294). Diversity indices indicated high species diversity, with a Shannon–Wiener Index ($H' = 5.541$) and Simpson's Index ($1 - D = 0.957$). However, low evenness (Smith and Wilson's $Evar = 0.165$) revealed a disproportionate distribution of individuals, with dominance by a few taxa. Native species comprised 45.7% of the population, while exotic species accounted for 54.3%, indicating a dominance of introduced species in the area. Despite the overall high diversity, this imbalance may increase susceptibility to pests, diseases, and environmental stressors. These findings establish a quantitative baseline for urban forest management and underscore the importance of more balanced species selection to strengthen ecological resilience and support long-term sustainability in tropical urban landscapes.

Keywords: Urban forestry, urban green spaces, tree inventory, tree species diversity, species composition

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9. TF2026#69

Camera Trap study of Mammalian Species Richness and Conservation Status at Crocker Range Biosphere Reserve, Sabah: Insights from Two Transitional Landscapes

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Abstract

This study explored mammal diversity and activity patterns and conservation status in two transitional landscapes in the Crocker Range Biosphere Reserve in Sabah. Camera trap surveys (Rovero and Zimmermann 2016) were used to compare mammal communities in KG Bolotikon (Forest and Plantation and Riparian habitats) with those in KG Ulu Senagang (Forest and Riverine and Recreational Trail and Forest Edge and Agriculture Boundary). Altogether 29 mammal species were noted across both locations (Payne et al. 2005 and Francis 2019). There were clear differences in species composition, abundance and habitats use. The findings highlight the critical role of forest habitats for mammal conservation, the complementary value of transitional habitats, and the urgent need for targeted conservation interventions for threatened species (IUCN, 2024).

Keywords: camera trapping, habitat use, species diversity, activity patterns, conservation status, Crocker Range, Sunda Pangolin, Bornean Clouded Leopard

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THEME 2B: SOCIAL FORESTRY

1. TF2026#12

The Political Ecology of Social Forestry Formation in West Sumatra, Indonesia: A Comparative Narrative of Community Mobilization, Environmental Shock and Institutional Support

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Abstract

Social forestry (SF) has been rapidly adopted as a policy tool in Indonesia against deforestation, rural poverty, and long-standing tenure conflict. However, the processes of local community adoption, negotiation, and institutionalization of social forestry are varied and little-studied on a micro scale. This aims at presenting the historical formation narratives of First Generation social forestry group consists of 28 unit in West Sumatra Province (dominated by Village Forest [*Hutan Nagari*] and Community Forest [*Hutan Kemasyarakatan*], with several People Plantation Foest (*Hutan Tanaman Rakyat*] schemes). We used qualitative method by interviewing SF group committee and doing observation at field level. The result of qualitative narrative analysis of group-level histories reveals recurring drivers of adoption: (1) environmental shocks and perceived risk (floods, landslides, water scarcity), (2) crisis of legitimacy as a consequence of illegal logging and extractive outsiders, (3) livelihood insecurity and the struggle for legal certainty for farming within the state forest boundaries, and (4) catalytic support provided by civil society organisations (notably WARSI, Qibar, and WALHI) and local governments. As conclusion, Social forestry formation in West Sumatra can be better understood as both political-ecological and organic, where the communities apply ecological vulnerability and conventional norms to generate formalized rights and novel organizational forms. We suggest an analytical model that draws an association between environmental phenomena, institutional brokerage, and customary governance and the emergence of popular action. Policy implications comprise the necessity of long-term facilitation, mediation of conflict between social forestry institutions and nagari (village) governments, and adaptive strategies in livelihood that reduce dependence on timber extraction.

Keywords: Social Forestry; West Sumatra; institutional alteration; political ecology; collective action.

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2. TF2026#18

Land Cover Change Dynamics Across Social Forestry Schemes: Evidence from Multi-Period Spatial in West Sumatra, Indonesia

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Abstract

This paper investigates the land cover dynamics in Indonesia's Social Forestry program by comparing multi-period land cover maps (baseline/0 year, 5 years, and 10 years after permit) using satellite images and with community interviews among 28 social forestry groups (SFC) in West Sumatra. Three SFC schemes -Village Forest (VF), Community Forest (CF), and Community Plantation Forest (CPF) - are compared in the study. The authors investigate the relationship between scheme design, forest function, and local socio-economic pressures and changes in the forest cover. Descriptive findings indicate that VF dominates the overall managed area and is located entirely under protection forest, and all CPF is fully in production forest and in a positive relationship to plantation expansion. Aggregated land cover demonstrates a net decrease in secondary dryland forest in VF and expansion of mixed dryland agricultural activities, with shrubs and dryland primary forest, over baseline to year 10, and provides evidence for varied processes of forest loss and restoration between VF sites. CF shows a severe drop in 'Shrubland' and with moderate increases in open land and mixed dryland agriculture. CPF demonstrates a rise of 'Plantation' as supported by interview accounts on oil palm use, land disputes, and enforcement shortfall. Responses to interviews often mention illegal logging, agricultural expansion, oil palm conversion, and replanting/seedling initiatives as major drivers. Our findings demonstrate scheme-specific governance and livelihood mechanisms that shape land-use outcomes and suggest that enhanced safeguards against plantation conversion are critical, as are improvements in incentive, monitoring, and conflict resolution mechanisms for all schemes.

Keywords: Social forestry, Land cover change, Community forestry, Indonesia, West Sumatra

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3. TF2026#19

Planning Documents and Organizational Task Allocation in First-Generation Social Forestry Groups in West Sumatra, Indonesia: A Cross-Scheme Descriptive Analysis

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Abstract

Community-based forest governance relies not only on formal tenure arrangements but also on everyday organizational capacity, planning habits, role definition, and mechanisms through which collective action can be effective on the ground. In this study we examine the organizational planning and task allocation characteristics of 28 first-generation Social Forestry (Perhutanan Sosial) groups in West Sumatra, Indonesia, grouped under three schemes: Village Forest Hutan Nagari (HN), Hutan Kemasyarakatan (HKM), and Hutan Tanaman Rakyat (HTR). Employing a dataset that has been compiled from the documentation of the groups and interviews with the leaders, we compare (i) presence of 10-year and annual workplans at the group level, (ii) the existence and practical use of planning documents within the management, (iii) the use of such documents, and (iv) perceived clarity and effectiveness of assigned work. By descriptive analysis, the formal planning document is more widely available to the HN and HKM groups, but less commonly used in the HTR groups. Task clarity and effectiveness are most strongly reported in HKM groups, while in HTR groups unclear or inadequate division of labour is reported more often. The results indicate that "having" plans and "using" plans are analytically distinct, and that use of routine planning seems intertwined with group dynamics, external engagement (e.g., KPH/forest management units), and continuity of leadership. We analyse the implications for capacity-building interventions on plan use, organizational learning, and adaptive governance.

Keywords: Social forestry, Organizational capacity, Planning documents, Collective action, West Sumatra

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4. TF2026#21

Study on the Management of Permanent Nursery by BPDAS SOP in Providing Free Seedlings to the Community

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Abstract

A permanent nursery managed by BPDAS SOP in the Tahura Bunder area, Gunung Kidul Regency, Yogyakarta. The nursery was built as a response to the increasing degradation of forests and land in the Central Java region, especially in the Serayu, Opak, and Progo watersheds. The damage is indicated by erosion, sedimentation, and declining land productivity, which necessitates the provision of quality and sustainable seedlings. The permanent nursery serves as a seedling production centre by supporting forest and land rehabilitation programs as well as community empowerment. Nursery management has standard operating procedures that cover stages from production planning to distribution. The nursery layout is adjusted according to nursery standards in terms of topography, water availability, accessibility, and the availability of labour and infrastructure. The growing media is modified to maintain aeration, nutrient availability, and to preserve soil texture and structure to support growth. The types of seedlings produced include timber forest products, non-timber forest products, conservation, fodder plants, and also ornamental plants, with species selection based on communication results with multiple parties who will be the target recipients of the seedlings around the BPDAS SOP working area. Seedling distribution is carried out through a forest rehabilitation activity proposal mechanism in cooperation with the local government, forest farmer groups, and the general public. The total seedling planted and distributed was 350.000 seedling/year. Seedling distribution through the mechanisms and administrative requirements stipulated by the Ministry of Forestry, in this case the Directorate General of Watershed and Rehabilitation (Ditjen PDAS RHL), includes verification of the planting location and the readiness of the seedling recipients to ensure that the seedlings will be properly planted. BPDAS SOP not only functions as a seedling provider but also as a strategic instrument in supporting watershed conservation as well as forest and land rehabilitation.

Keywords: Permanent nursery, Providing free seedlings, Forest and land rehabilitation program

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5. TF2026#24

Facilitation Patterns in First-Generation Social Forestry Groups in West Sumatra, Indonesia: A Comparative Analysis by Scheme

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Abstract

Social Forestry (Perhutanan Sosial) in Indonesia is implemented through multiple schemes—including Hutan Nagari (HN), Hutan Kemasyarakatan (HKm), and Hutan Tanaman Rakyat (HTR)—with facilitation by non-governmental organizations (NGOs), government extension officers, and forest management units. However, empirical comparisons of facilitation trajectories across schemes remain limited, particularly for first-generation groups that have persisted for more than a decade. Using a compiled interview-and-documentation dataset covering 28 first-generation Social Forestry groups in West Sumatra Province, this article compares (i) spatial distribution, (ii) types of facilitators involved during proposal and operational stages, (iii) duration of NGO facilitation, (iv) coverage of government facilitation, and (v) leadership profiles. Results show scheme-specific patterns: HN groups are strongly associated with long-term NGO accompaniment dominated by WARSI (median 13.5 years), while HKm groups rely more on short-term facilitation centered on QBAR/Qibar and mixed networks (median 2 years). HTR groups exhibit heterogeneous support, including cases with minimal NGO accompaniment and more uneven documentation of government support. Across schemes, government facilitation via forestry extension and KPH presence is reported for most groups, but its content is concentrated on planning documents (RKU/RKT/RKH), socialization, mapping, and capacity building. Leadership remains highly gender-skewed, with only one female respondent occupying a leadership/committee role among the 28 groups. The findings underline the importance of sustained, adaptive facilitation as an institutional asset for long-lived Social Forestry organizations and point to policy needs for strengthening inclusive leadership and harmonizing facilitation standards across schemes.

Keywords: Social forestry, Facilitation, NGO accompaniment, Forest extension

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6. TF2026#29

Sustainability Potentials of First-Generation Social Forestry Groups in West Sumatra, Indonesia A Comparative Cross-Scheme Qualitative Synthesis

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Abstract

Indonesia's Social Forestry (*Perhutanan Sosial*) policy is intended to improve rural livelihoods while strengthening community based forest governance and conservation outcomes. This paper analyzes a dataset of qualitative field summaries for 28 first-generation Social Forestry groups in West Sumatra Province, comparing sustainability potential across three schemes: Village Forest (*Hutan Nagari* [HN]; n=10), Community Forestry [HKM]; n=14), and People Forest Plantatiion (*Hutan Tanaman Rakyat* [HTR]; n=4). The data were collected by interviewing the FS Group Management Committees using open question focusing on social, economic and ecological aspect of forest management. Using qualitative content synthesis, we examine patterns in social (collective action and institutions), economic (Social Forestry Community Enterprise [*Kelompok Usaha Perhutanan Sosial* [KUPS] and value chain readiness), and ecological (forest condition, threats, and protection actions) dimensions. Results show that moderate sustainability potential dominates across schemes (HN: 6/10; HKM: 9/14; HTR: 1/4), while HTR exhibits the sharpest polarization (1 top-performing, 2 bottom-performing). Across schemes, the most consistent correlates of higher sustainability potential are (i) leadership bridging to nagari governance and customary authorities, (ii) routine participation and monitoring (patrols, boundary maintenance, documentation), and (iii) at least one functional collective enterprise (KUPS) linked to markets. The most recurrent constraints are internal conflict and organizational inactivity, insufficient follow-up support, weak market access and processing capacity, and persistent illegal extraction or land-use conversion pressures. We discuss implications for policy design: a differentiated support strategy that couples institutional strengthening with targeted KUPS acceleration and community-based ecological monitoring may improve long-term outcomes.

Keywords: Social forestry; sustainability; institutions; livelihoods; KUPS

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7. TF2026#48

Linking Landscape Change and Community Well-being in Limestone Karst Areas: A Case Study of Kinta Valley, Perak

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Abstract

Limestone karst landscapes in Kinta Valley, Perak, Malaysia, are increasingly influenced by quarrying and tourism development, creating complex interactions between environmental change and community well-being. This study examines how long-term habitat degradation affects both ecological conditions and local communities. The objectives are: (1) assess changes in limestone hill extent and forest cover over the past 50 years; (2) evaluate rates of loss, time to depletion and future persistence of limestone resources; and (3) examine forest decline, limestone quarry and its socio-environmental implications for nearby villages. A multi-method approach was applied by integrating spatial analysis with community-based surveys to examine historical and current patterns of limestone and forest loss, annual rates of change and projected depletion trends. In addition, surveys conducted in selected villages were used to assess the social and environmental implications, including local perceptions, livelihood impacts and awareness of environmental change. Results indicate substantial decline in both limestone hill extent and forest cover, with several sites showing critical depletion risks within the coming decades. These environmental changes are reflected in community experiences, where respondents reported concerns related to environmental degradation, reduced ecosystem quality and uneven socioeconomic benefits from quarrying activities. While development has contributed to economic opportunities, its benefits remain limited and unevenly distributed. The findings highlight the need for more inclusive and balanced management strategies that integrate environmental conservation with community participation. This study provides insights for sustainable planning by linking spatial environmental change with local socioeconomic realities in limestone karst regions.

Keywords: Limestone karst, socio-environmental impacts, community perception, habitat changes

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8. TF2026#70

**Visual Landscape Preference: A Case Study in Teluk Likas Public Park (TLPP),
Kota Kinabalu, Sabah**

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Abstract

Rapid urbanisation has contributed to psychological isolation and a heightened sense of uncertainty among urban residents. The aesthetic quality of landscapes plays a vital role in promoting psychological restoration and physical stress relief. Urban parks provide diverse visual landscapes that can help individuals recover from the pressures of a busy environment. This study investigated visual landscape preferences and the key information-processing variables influencing preferences in Teluk Likas Public Park (TLPP), Kota Kinabalu, Sabah. A photo-questionnaire survey was employed to collect data from 226 conveniently sampled park visitors. The Content Identification Methodology (CIM) was used to elicit people's preferences and evaluations. The analysis identified the five most preferred visual landscapes within TLPP, all of which exhibited strong elements of mystery, coherence, and complexity. Mystery, coherence and complexity were the main information processing variables that affect the visual landscape preferences for TLPP as the result from multiple progressive regression analysis. The findings underscore the importance of incorporating these perceptual qualities in park design and management to enhance users' psychological well-being and overall aesthetic experience. This study provides useful insights for urban planners, landscape architects, and local authorities in designing and maintaining urban green spaces that promote restorative experiences and environmental appreciation. Moreover, preserving aesthetic diversity and maintaining balanced visual elements in park landscapes can support the creation of more liveable, resilient, and psychologically beneficial urban environments.

Keywords: Visual landscape preference, Public parks, Content identifying methodology

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THEME 3B: INTERDISCIPLINARY APPROACHES

1. TF2026#90

Oil Palm-based Agroforestry and Soil Health in Indonesia: Food and Habitat as Essentials for Earthworms and Microbial Biomass

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Abstract

In modifying standard practices in oil palm monocultures by intercropping or agroforestry, soil health impacts of early stages can guide practices, while life-cycle scale economic, social and environmental performance criteria are emerging. We compared existing oil palm plantations with remnant natural forest and mature (multistrata) rubber agroforests in two villages in Central Kalimantan on mineral soils to quantify loss, and locally achievable recovery, of soil health. Regenerative practices applied in older (productive) or young (early production) oil palm stands focus on litter management and increased external organic inputs replacing mineral fertilizer. More radical change is expected where oil palm is part of mixed-species agroforestry. Soil conditions, depending on prior plus current land use, influence soil biota by modifying food resources, habitat or both. Our intensive sampling campaign in six land use practices with four replicates each assessed above- and belowground factors. Pedotransfer functions for soil carbon were used to adjust for inevitable differences in soil texture between plots. Results show that microbial biomass C (MBC) and N (MBN) are closely linked to standing litter layer, while earthworms, soil porosity and soil organic matter are closely linked. Remnant natural forest had the highest MBC and MBN, while mature rubber agroforests harboured the largest earthworm biomass. Conventional oil palm had 40% less microbial biomass and 80% less earthworms than these more forest-like comparators. Early stages of regenerative oil palm agroforestry are on track towards meeting the current list of 'healthy soil' indicators with existing rubber agroforest as target for sustainable use options.

Keywords: Indicators, Mineral soil, Restoration, Rubber agroforest, Soil health

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2. TF2026#83

A Review of The Current Status of Forest Certification for Plantation Forests in Asia:
Challenges and Way Forward**Siti Radiah Mohamad**^{1,2} and Walter Lintangah^{2&}¹Sabah Forestry Department, Mile 6, Labuk Road, 90000 Sandakan, Sabah, Malaysia²Faculty of Tropical Forestry, Universiti Malaysia Sabah, Jalan UMS, 88400 Kota Kinabalu, Sabah, Malaysia**Abstract**

Forest certification has emerged as a key instrument for promoting sustainable forest management and ensuring timber legality amid increasing global concerns over deforestation and environmental degradation. In Asia, the growth of forest certification has been strongly influenced by international demand for legally and sustainably sourced timber products. Despite increasing studies on forest certification, limited reviews have focused specifically on plantation forests in Asia. This study reviews the development of forest certification systems in plantation forests across Asian countries, with particular emphasis on Southeast Asia. The study employed a systematic literature review and thematic policy analysis to examine the effectiveness, challenges, and future direction of certification systems in the region. Relevant information was collected from academic publications, government policies, certification standards, and reports from certification bodies such as the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC). The findings show that PEFC-endorsed national certification schemes are widely implemented in Southeast Asia due to their flexibility and adaptability to local regulations. Countries such as Malaysia, Indonesia, China, Vietnam, India, and Japan have developed their own certification systems to strengthen sustainable forest management and timber legality verification. Several best practices were identified, including reduced impact logging, biodiversity conservation, restoration programs, community-based forest governance, and smallholder group certification. Despite these positive developments, several challenges limit the wider adoption of forest certification. These include high certification costs, complex administrative procedures, difficulties complying with environmental standards, limited financial returns, and weak market demand for certified products in the region. In addition, restrictions on certifying plantations established after December 2010 under FSC certification policies have reduced incentives for investment in reforestation and sustainable plantation development, even in degraded areas. Overall, the study highlights that forest certification has contributed positively to improving forest governance and responsible forest management practices in Asia. Future certification frameworks should adopt more flexible, inclusive, and economically viable approaches that support smallholders, encourage sustainable plantation development, and strengthen regional market recognition for certified forest products.

Keywords: Forest certification, Sustainable Forest Management, Plantation forests, Timber legality, Forest governance

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3. TF2026#84

Foraging Ecology of the Sunda Pangolin at Termite Nests in SFERA@UMSCarmen Adros¹, Normah Awang Besar¹, Maria Lourdes Lardizabal¹, **Jephte Sompud^{1,2*}**¹Faculty of Tropical Forestry, University Malaysia Sabah²Pangolin Research Group, Faculty of Tropical Forestry, University Malaysia Sabah**Abstract**

Understanding the dietary ecology of the Critically Endangered Sunda pangolin is fundamental to informing conservation strategies, yet detailed information on termite prey composition in fragmented secondary forests remains limited. This study investigated the foraging ecology of the Sunda pangolin at termite nests within the Sustainable Forest Education Research Area (SFERA@UMS), Sabah, focusing on termite species consumed and characteristics of feeding bouts in relation to nest architecture. Camera traps were deployed at nine active termite nests over six months (June–December 2023), generating 976 trapping nights. Termite specimens were collected from feeding sites and identified using standard morphological keys with expert verification. Two termite species were confirmed at pangolin feeding sites: *Macrotermes gilvus* and *Prohamitermes mirabilis*. Four independent feeding events were recorded, demonstrating active exploitation of both species. Although visitation frequency did not indicate clear prey species preference, feeding duration differed according to nest structure. Prolonged foraging bouts were observed at *M. gilvus* termitaria characterized by thick, compacted outer crusts requiring sustained excavation, whereas shorter bouts occurred at *P. mirabilis* nests located at the base of fallen logs with looser soil matrices. These findings indicate that nest architecture, rather than termite species identity alone, may influence foraging effort. The study provides baseline evidence of termite prey composition in a small forest fragment and underscores the importance of maintaining active termite microhabitats to support pangolin persistence in human-modified tropical landscapes.

Keywords: Termite prey species, *Macrotermes gilvus*, *Prohamitermes mirabilis*, Foraging bout duration, Nest structure

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4. TF2026#92

Rehabilitation of Degraded Peat Swamp Forest: Growth Performance and Survival of Peat Swamp Tree Species

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Abstract

Peat Swamp Forests (PSF) are waterlogged forests ecosystem which grows on a layer of organic matters that accumulated and can reach up to 20 meters thick. Their environmental functions and economic roles are significant and recognized. Previous studies conducted in Peninsular Malaysia, found that logged-over PSFs and those burnt PSF, require restoration or rehabilitation. Rehabilitation is needed to assist faster recovery and also to enrich the areas with native commercial tree species. The purpose of this study is to identify the PSF species that exhibits better growth performance and survival. Approximately 1.65ha of degraded PSF at Raja Musa Forest Reserve (RMFR) was planted with 900 tree saplings comprised of 5 PSFs species namely *Calophyllum ferrugineum*, *Calophyllum retusum*, *Gonystylus bancanus*, *Durio carinatus* and *Melicope lunu-ankenda*. Growth performance and survival rate were monitored at periodically basis. At 37 months after planting, the overall survival rate was recorded at 72%. *G. bancanus* showed the highest survival rate at 77%, whereas *C. ferrugineum* and *D. carinatus* both recorded the lowest survival rate of 67%. On average, *C. retusum* recorded the highest mean annual increment (MAI) in height at 95.25 cm yr⁻¹, whereas *C. ferrugineum* showed the highest diameter MAI at 9.27 mm yr⁻¹. Nevertheless, at 37 months after planting, the saplings planted in the study area survived well in an extremely wet and flood conditions.

Keywords: degraded peat swamp forest, Raja Musa Forest Reserve, rehabilitation, peat swamp forest species, burnt peat swamp forest (limit to 5 keywords only)

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5. TF2026#91

Prevalence of Parasites among Fishes at Darau River, Kota Kinabalu, Sabah, Malaysia

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Abstract

Fish are very important to humans as a source of protein, but they may also act as vectors for several human pathogens. Five years ago, there were several issues of canned sardine products from China being contaminated with worms that were reported in the mainstream press. Awareness of parasitic infections in fish should have been raised long ago, and this project was proposed to assess the level of infection among river and marine fishes. A river fish survey was conducted in several areas of the Lower Darau River, Kota Kinabalu Sabah from 25-30 August 2025. Fish were caught using seines, traps/nets with local fishermen. Twenty-one species and eleven families were recorded with a total of 408 individuals. These fish were dominated by *Arius sagor* (26.9%) followed by *Oreochromis niloticus* (17.3%), *Epiplatys suratensis* (16.3%) and many more. The overall parasite infection was estimated at 6.6% (n=27). The highest prevalence was in bony carp (*Epiplatys suratensis*; 60%) followed by moonfish (*Megalops cyprinoides*; 50%). So far, some nematodes have not been identified, and the good news is that the infection rate is still low less than seven percent. This study needs to continue until the presence of zoonotic parasites is identified.

Keywords: Prevalence, Parasites, Fishes, Darau river, Kota Kinabalu

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6. TF2026#96

Spatial Variation in Wildlife Distribution across Substations of Tawau Hills Park, Sabah, Malaysia

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Abstract

Tawau Hills Park, Sabah, Malaysia, represents one of Borneo's most ecologically significant lowland–montane forest complexes, harbouring a high diversity of vertebrate taxa including over 300 bird species, diverse primates, and a rich assemblage of amphibians and mammals. This study synthesises recent biodiversity survey data (2022 to 2025) to evaluate wildlife distribution patterns across key substations within the park, namely Andrassy, Balung, Merotai, and Headquarters (HQ-Bombalai) with an emphasis on spatial variation in species richness and detection frequencies. Spatial variability in detection curves, particularly the wider mid-interval ranges observed across substations, indicates fluctuating encounter rates likely driven by microhabitat heterogeneity, elevation, and survey effort. Collectively, these findings demonstrate that peripheral substations such as Andrassy and Balung function as critical biodiversity reservoirs, whereas centralised administrative zones exhibit comparatively diminished wildlife presence. This study underscores the necessity of substation-level monitoring frameworks for effective conservation management in tropical protected areas. The integration of multi-taxa survey approaches provides a robust baseline for long-term ecological monitoring and highlights priority zones for conservation intervention within Tawau Hills Park. Future research should incorporate longitudinal datasets and advanced technologies such as automated acoustic sensors and camera trapping to refine species distribution models and enhance conservation outcomes in this biodiversity hotspot.

Keywords: Tawau Hills Park, Wildlife distribution, Spatial variation, Biodiversity monitoring, Species richness

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7. TF2026#85

**Current Progress on the Taxonomy and Conservation Assessment of Bornean
Ardisia subgenus *Pyrgus* (Primulaceae)**

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Abstract

Ardisia subgenus *Pyrgus* (Primulaceae) represents a diverse understorey plant group in Borneo, but its taxonomy remains poorly understood due to historical misidentifications and complex species delimitation. This study reviews the taxonomy of the subgenus across Borneo through detailed morphological examination of herbarium specimens and field collections to clarify species boundaries and update their conservation status. The revision confirmed the presence of nine taxa of *Ardisia* subgenus *Pyrgus* in Borneo, all endemic to the island, including four species restricted to Sabah, one of which is newly described. Conservation assessments based on the IUCN Red List Categories and Criteria indicated that several taxa fall within threatened categories due to restricted distributions and occurrences outside protected areas. The findings provide updated taxonomic and conservation data for Bornean *Ardisia* subgenus *Pyrgus* and contribute important baseline information for future floristic and conservation initiatives, including the Flora of Sabah and Sarawak project.

Keywords: *Ardisia*, Conservation status, Myrsinoideae, Understorey, Subgenus *Pyrgus*

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THEME 4B: BIODIVERSITY & CONSERVATION

1. TF2026#13

Effects of Organic Litter Mulch on Seedling Survival and Growth in an Urban Secondary Forest

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Abstract

Seedling planting is a common active restoration approach to enhance a degraded area. However, these planted seedlings often experience water stress under rain-fed conditions, which may lead to wilting and mortality during prolonged drought. Mulching is therefore commonly applied to reduce the stress. This study evaluated the effects of on-site forest litter mulch on seedling survival and growth. In total, 720 seedlings comprising *Durio zibethinus*, *Artocarpus heterophyllus*, *Artocarpus integer* and *Artocarpus odoratissimus* were subjected to three treatments: mulching, mulch removal and control. Seedling survival and growth (height and diameter relative growth rate) were recorded for 13 months. A total of 221 seedlings died, with the highest mortality (96 seedlings) occurring in the mulch removal treatment. Furthermore, the Subdistribution Hazard Ratio (SHR) showed that giving mulch significantly reduced the drought-related mortality compared with mulch removal ($p < 0.001$). The SHR further indicated that *D. zibethinus* was more susceptible to drought stress than the three *Artocarpus* species ($p < 0.001$). Growth analysis using Gaussian Generalised Linear Mixed Models (GLMMs) showed a significant effect of mulching on seedling height ($p < 0.01$). Mulched seedlings exhibited a higher height growth than seedlings under control and mulch removal treatments ($p < 0.05$). However, there was no significant effect of mulch treatments on the diameter growth ($p > 0.05$). Additionally, species factor and monthly mean temperature were found to affect the seedling growth ($p < 0.001$), whereas monthly total rainfall influenced only the diameter growth ($p < 0.001$). These findings supported the use of on-site forest litter mulch as a practical and sustainable technique for enhancing seedling establishment in restoration.

Keywords: Competing Risk Analysis, Drought stress, Mulching effect, Tree planting

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2. TF2026#30

A Preliminary Diagnostic Survey of Herbivory Symptoms in Four Newly Planted Native Tree Saplings in a Forest Restoration Project at Deramakot, Forest Reserve, Sabah.

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Abstract

The initial establishment phase is a vital period for seedlings planted in forest restoration projects. During this time, young plants are highly vulnerable to biotic stressors, particularly insect herbivory. However, there remains a lack of comprehensive data regarding herbivory patterns during the initial stages of tropical forest restoration. This study recorded baseline herbivory symptoms in four native seedlings species that were planted in a 1.5-year-old restoration project at Deramakot Forest Reserve (Compartment 109), Telupid. The species investigated were *Pterospermum subpeltatum* (Bayur), *Nauclea orientalis* (Bangkal), *Dryobalanops aromatica* (Kapur), and *Terminalia catappa* (Ketapang). A total of 368 seedlings representing Bangkal (n = 100), Bayur (n = 101), Kapur (n = 93) and Ketapang (n = 74) were assessed for herbivory damage and feeding symptoms during the early establishment stage. Herbivory damage was quantified by visually estimating the ratio of damaged leaves to the total leaf count per seedling, which was then categorized into percentage range. Herbivory damage on the seedlings were categorized into six classes (Class 0 = 0%, Class 1 = 1–5%, Class 2 = 6–15%, Class 3 = 16–25%, Class 4 = 26–50%, Class 5 = >50% leaf damage) based on procedures adapted from Dirzo & Domínguez, 1995; Johnson *et al.*, 2016. Herbivory symptoms observed in the field were categorized as window feeding, free feeding, pin-hole feeding, skeletonizing, and mine feeding. Preliminary results revealed that the level of insect damage differed significantly among species (Kruskal-Wallis $\chi^2 = 79.74$, df = 3, $p < 0.001$). Mean herbivory levels ranged from $9.8\% \pm 7.4$ SD in Kapur to $26.3\% \pm 9.0$ SD in Ketapang, while Bangkal ($17.6\% \pm 11.9$ SD) and Bayur ($19.5\% \pm 11.7$ SD) showed intermediate values. The proportion of seedlings experiencing higher herbivory damage (damage class ≥ 3) differed significantly among species ($\chi^2 = 89.62$, $p < 0.001$), with Ketapang showing 85.1% compared to Kapur which is only 10.8%. Higher herbivory damage was observed in seedling showing free feeding ($\chi^2 = 96.65$, $p < 0.001$) and skeletonizing symptoms ($\chi^2 = 54.92$, $p < 0.001$). These findings provide baseline information on herbivory severity and feeding symptoms among the four native tree species during the early restoration activities in Deramakot Forest Reserve.

Keywords: Insect herbivory, Feeding symptoms, Forest restoration

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3. TF2026#86

Diversity and Taxonomy of Schismatoglottideae (Araceae) of Sabah, Malaysia

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Abstract

The tribe Schismatoglottideae represents one of the most diverse and taxonomically complex groups of Araceae in Borneo. In Sabah, Malaysia, this diversity is characterized by high levels of endemism and specialization to specific geological substrates. Recent intensive field surveys have expanded the known diversity through the description of numerous site-specific endemics, including *Schismatoglottis imbakensis* and several species of *Borneoa* and *Ooia*. These efforts have revealed that Schismatoglottideae diversity is far higher than previously estimated, with many species restricted to single forest reserves. The high degree of site-local endemism identified in these studies underscores the urgent need for site-specific conservation strategies in Sabah.

Keywords: Araceae, Schismatoglottideae, Sabah, Taxonomy, Endemism, *Schismatoglottis*.

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4. TF2026#42

Impacts of Land Degradation on Soil Microbial Activity Mediated by Soil Moisture in a Bornean Tropical Forest

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Abstract

Recent studies by Kitayama and colleagues reported that logging-induced disturbance in Southeast Asian tropical production forests can lead to a transition from forest to degraded vegetation, resulting in the loss of forest recovery capacity. This phenomenon may have important implications for greenhouse gas dynamics. In addition to the loss of carbon sequestration by trees, reduced evapotranspiration following forest degradation may increase soil moisture, potentially accelerating soil carbon loss, decreasing methane (CH₄) uptake, and increasing nitrous oxide (N₂O) emissions. To test this hypothesis, we measured soil greenhouse gas fluxes (CO₂, N₂O, and CH₄) using the closed chamber method in the Deramakot Forest Reserve in Borneo. Microbial functional diversity was also assessed using Biolog EcoPlates. The results indicate that land degradation altered soil moisture conditions, which in turn controlled microbial functional diversity. These results suggest that hydrological changes associated with forest degradation may influence soil greenhouse gas dynamics through shifts in microbial functions.

Keywords: Greenhouse gas, Hydrological changes, Microbial functional diversity

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5. TF2026#44

Developing Conservation Strategies for *Dipterocarpus gracilis* in Java through Genetic and Silvicultural Integration

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Abstract

Genetic diversity and silvicultural attributes are fundamental components in developing effective conservation strategies for rare and threatened tree species. *Dipterocarpus gracilis*, an endemic member of the Dipterocarpaceae family native to Java, has experienced a noticeable population decline due to limited natural regeneration and increasing environmental pressures, particularly within monsoon forest ecosystems. This study aims to formulate management strategies for *D. gracilis* by integrating information on genetic diversity and silvicultural characteristics to support long-term population persistence in the Kecubung Ulolanang Nature Reserve, Central Java. The results indicate that reduced genetic diversity, mainly driven by genetic drift and potential inbreeding, may decrease population viability across several developmental stages, including seed production, germination, and the establishment of seedlings and saplings. From a silvicultural perspective, seedling survival and growth are strongly influenced by environmental conditions such as water availability, soil moisture, and canopy openness, with the dry season representing the most critical limiting factor. The weak regenerative capacity of *D. gracilis* is reflected in the limited recruitment of seedlings into the pole stage, which may gradually alter population structure and demographic stability over time. Based on these findings, several management strategies are recommended. These include strengthening connectivity among habitat zones to maintain gene flow, transferring seedlings between zones with contrasting heterozygosity levels, and conserving rare alleles through habitat enrichment programs. In addition, ex situ conservation through nursery cultivation, the establishment of demonstration plots with canopy openness ranging from 20–60%, and enrichment planting under existing forest canopies are suggested to accelerate forest structural recovery. The integration of genetic and silvicultural approaches presented in this study provides an important scientific basis for policy development and sustainable conservation management of *D. gracilis* in the monsoon forests of Java today.

Keywords: conservation management; forest restoration; genetic diversity; silvicultural management

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6. TF2026#46

Soil Physical and Chemical Properties in Different Forest Structures at Sapong Estate, Tenom, Sabah

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Abstract

Soil physical and chemical qualities are critical in preserving forest ecosystem health, especially in tropical climate such as Sabah, Malaysia, where land use changes threaten biodiversity and soil fertility. Different forest structures, such as riparian areas and natural forests, at Sapong Estate in Tenom, Sabah, display unique soil properties that may affect vegetation growth and water retention. The purpose of this study was to identify the physical and chemical characteristics of the soil in riparian and natural forest areas. Ten 0.1 ha sampling plots were established (five per forest structure). Soil samples were randomly collected from each plot within each forest structure. Two types of soil samples were collected which are mixed composite soil samples and soil bulk density samples at depths of 0-10 cm, 10-30 cm, 30-50 cm and 50-100 cm. Soil samples were then analyzed for moisture content (MC), texture, bulk density (BD), pH, organic matter (OM), cation exchange capacity (CEC), and CHN content. Soil texture analysis reveals that riparian soil ranged from sandy loam to sandy clay and sandy clay loam to clay loam in natural forest. Preliminary data shows both soil types exhibits a similar acidic pH (3.74 - 4.28) across all depths, while MC (10.67% - 15.59%), BD (1.17 - 1.48 g/cm³), OM (1.89% - 4.51%), CEC (15.08 - 15.44 meq/100), C (3.43% - 4.23%), H (0.72% - 0.79%) and N (0.02% - 0.1%) varied by depths with decreasing trends. The study found substantial variations ($p < 0.05$) at riparian areas where higher OM (up to 4.51%) and MC (up to 15.59%), but lower pH compared to natural forest. In contrast, CEC, CHN and BD did not differ significantly amongst structures. These findings illustrate the impact of forest structure on soil fertility and moisture dynamics, emphasizing the necessity of preserving riparian buffers to improve soil quality and ecosystem resilience in Sabah's forests.

Keywords: Sapong Estate, Soil properties, Riparian areas, Natural forest, Ecosystem resilience

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7. TF2026#65

A Checklist of Rhopalocera (Butterflies) at Sapong Estate, Tenom Sabah

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Abstract

High conservation value (HCV) area serves as vital refugia for biodiversity within oil palm plantation landscape, mitigating the ecological stressors of monoculture agriculture by providing essential diverse habitats for flora and fauna, including insect communities. Butterflies (Rhopalocera) diversity was surveyed in November 2024, July, August, November 2025 and February 2026 in the High Conservation Value area of Sapong Estate, Tenom Sabah. This research aimed to provide preliminary checklist, assess the community structure and diversity of butterflies within the designated HCV area. Butterflies sampling was conducted through net opportunistic sampling using sweep net and aerial nets. A total of 205 individuals were recorded, representing 87 species across 5 taxonomic families. The Rhopalocera community within the HCV area exhibited high diversity ($H' = 4.085$), and species richness ($D_{mg} = 16.16$), complemented by a high Simpson's index ($1-D = 0.9734$) and moderate species evenness ($J = 0.6833$). Significant findings include the occurrence of the iconic Malaysia's National Butterfly; *Trogopnotera brookiana*, *Troides helena*, *Idea stoll*, *Lamproptera curius*, *Pachliopta acuta antiphus* and *Graphium* spp. The presence of forest dwellers alongside generalist species indicates that the area maintains essential micro-climatic conditions and host plant availability. This study provides a baseline for long-term monitoring and highlights the role of HCV area in mitigating the impact of land-use change on tropical entomofauna.

Keywords: Butterflies, Checklist, Diversity, Conservation

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THEME 5B: FORESTRY & TECHNOLOGY

1. TF2026#49

Community Participation as a Primary Predictor of Effective Forest Conservation: Case Study of Community Forest Management in Sabah, Malaysia

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Abstract

Tropical forests face unprecedented anthropogenic and social-economic challenges, making ecological resilience a critical global priority. Increasingly, decentralized forest governance approaches are widely promoted as a conservation strategy, like community forest management (CFM) being recognized for their potential to align ecological sustainability with local livelihood needs. This study investigates the role of local participation in environmental stewardship, positioning community participation as the primary predictor of effective forest conservation. Focusing on a case study of CFM initiatives in Sabah, Malaysia, this research employs a mixed-methods approach, integrating quantitative socio-ecological analysis with qualitative data from field observation and semi-structured interviews with local stakeholders, community leaders, and forestry officials. The findings indicate a strong positive correlation between high levels of active community participation, specifically in decision-making, resource monitoring, and benefit-sharing, and improved conservation outcomes. Sites with robust community governance exhibited significantly lower rates of illegal and deforestation compared to state-managed protected areas without local community. Furthermore, securing land tenure and providing capacity-building resources were identified as essential catalysts for sustaining community involvement. The study concludes that community participation is not merely a supplementary component, but the fundamental driver of conservation efficacy. For forest conservation policies to be successful and sustainable in Sabah and similar tropical regions, they must prioritize.

Keywords: Ecosystem services, Indigenous People and Local Community (IPLCs), Traditional practices, Participatory governance, Socio-ecological resilience

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2. TF2026#55

Linking Social Drivers, Water Quality, and Economic Value in Fragmented Spring Forest

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Abstract

Spring ecosystems in fragmented forest landscapes provide important environmental services, yet their economic value is rarely incorporated into management decisions. This study evaluates the economic value of spring ecosystem services, identifies factors influencing visitors' willingness to pay (WTP), and examines their relationship with ecological conditions across forest fragment types. Observations were conducted at sixteen spring sites in East Java, Indonesia, representing combinations of fragment size and management orientation. Instrumental management emphasizes economic use, whereas relational management prioritizes ecological and socio-cultural values. Social and biophysical variables were analyzed using principal component analysis, and economic efficiency was assessed using an adjusted land equivalent ratio. WTP is primarily influenced by visit experience, trust in management, and perceived benefits, while demographic factors are not significant. WTP differs significantly across fragment categories ($p < 0.001$), with higher values in instrumental fragments reaching 0.8–1.0 USD and lower values in relational fragments ranging from 0.2–0.5 USD. Instrumental fragments also show higher economic efficiency. Biophysical conditions differ significantly across management types. Dissolved oxygen is highest in large relational fragments ($6.67 \pm 0.15 \text{ mg L}^{-1}$) and lowest in large instrumental fragments ($4.46 \pm 0.05 \text{ mg L}^{-1}$), while total dissolved solids show the opposite pattern, reaching $194.73 \pm 4.87 \text{ mg L}^{-1}$ and $115.12 \pm 3.93 \text{ mg L}^{-1}$, respectively. These findings indicate a clear trade off between economic performance and ecological condition, highlighting the need to integrate social, ecological, and governance dimensions in sustainable spring management.

Keywords: Conservation financing, Contingent valuation, Management orientation, Water quality, Social perceptions

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3. TF2026#57

Linking Microclimate to Vanilla Productivity in Agroforestry Systems under Contrasting Rainfall Regimes

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Global climate change, characterized by increased variability in rainfall and temperature, contributes to a decline in vanilla (*Vanilla planifolia*) productivity in tropical regions. Both excessively high and low rainfall can disrupt flowering, pollination, and pod formation. Therefore, adaptive cultivation systems, such as agroforestry, are needed to modify the microclimate as a mitigation strategy to increase vanilla production under varying rainfall conditions in Malang Regency, East Java, Indonesia.

This study employed survey and interview methods in areas with high (3532 mm) and low (2172 mm) rainfall, using complex agroforestry (CAF), simple agroforestry (SAF), and vanilla monoculture (MNV) systems. Microclimate parameters included canopy cover, light intensity, air temperature and humidity, as well as soil temperature and moisture. Production parameters included the number flower's bunch per plant, pollination success rate, number of pods per plant, number of pods per plot, super-grade pods fraction, fresh weight per plant and fresh weight per hectare. Results indicate that microclimate indicators such as light intensity, soil moisture, air temperature and humidity varied significantly ($p < 0.05$) across climate regimes. Meanwhile, production parameters, such as the number of fresh pods per plot, super-grade fresh pods, and total vanilla production per hectare were significantly different ($p < 0.05$) across climate regimes. Pollination success was influenced by air humidity ($r = -0.41$; $R^2 = 0.17$) while the proportion of super-grade pods was influenced by light intensity range ($r = 0.33$; $R^2 = 0.11$). Whereas, fresh weight per hectare was influenced by soil moisture range ($r = 0.36$; $R^2 = 0.13$) and light intensity ($r = 0.34$; $R^2 = 0.12$). This results imply that proper tree planting management can regulate microclimate in agroforestry systems as one of the adaptive strategy to enhance vanilla production under varying rainfall regimes.

Keywords: Agroforestry; micro-climate; production; rainfall; vanilla

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4. TF2026#51

Understanding Decomposition Dynamics in Marginal Coffee-Agroforestry: Interplay Between Litter Quality and Microclimate Indicators

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Abstract

The drivers of litter decomposition are a key component for sustaining nutrient cycling in marginal agricultural landscapes. But the empirical evidence correlating litter quality, microclimate and microbial biomass with decomposition dynamics impacting home field advantage (HFA) in simple (AFS) and complex coffee-based agroforestry (AFK) against sugarcane monoculture (M) in karst landscape is still lacking. We performed litter transfer experiment to quantify decomposition rate and evaluate HFA effects and associated changes in soil carbon (C), nitrogen (N), and microbial biomass. The main finding was that microclimate diverged widely among land-use systems, and that agroforestry reduced maximum air and soil temperatures and increased soil moisture relative to monoculture. Litter chemical characteristics differed: agroforestry litter had higher N concentrations and lower C:N ratio and (L+P):N ratios compared to monoculture litter. Overall, AFK decomposed faster and showed a clear HFA effect; the rate was maximal when decomposing in its native substrate ($k = 0.023 \text{ week}^{-1}$). Litter chemical traits (lignin and polyphenols) were better predictors of decomposition than microclimate indicators or microbial biomass. The faster litter decomposition resulted in higher soil organic C accumulation, while the turnover of soil N remained relatively stable under agroforestry. Thus, these results indicate that complex vegetation enhances decomposer specialization and litter quality, and buffered microclimates leading to efficient nutrient cycling. These structurally complex agroforestry systems can, therefore, potentially give rise to more effective internal nutrient cycling and long-term soil resilience in marginal karst landscapes.

Keywords: Kars marginal; microorganism; microbial biomass; microclimate; sugarcane

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5. TF2026#61

Carbon Recovery in Restored Riparian Forests: Implications for Aboveground Biomass and Climate Mitigation**Nur Nazatul Hashima Binti Jaafar** and Elia Godoong*

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Abstract

Riparian forests are critical carbon sinks that provide essential ecosystem services but have been widely degraded by anthropogenic disturbances such as agriculture, logging, and urban expansion. Ecological restoration is increasingly implemented to recover these ecosystems, yet the effectiveness of restoration in rebuilding aboveground carbon stocks remains insufficiently documented. This study synthesizes evidence from restored riparian forests, comparing restored sites with degraded and reference forests across multiple studies. Tree structural attributes were measured in permanent plots, and aboveground biomass (AGB) was estimated using species-specific allometric equations, with aboveground carbon (AGC) calculated following international guidelines. Restored forests accumulated substantially higher carbon than degraded sites, with mean AGB of $250 \pm 100 \text{ Mg ha}^{-1}$ and mean AGC of $120 \pm 50 \text{ Mg C ha}^{-1}$, whereas reference forests exhibited higher carbon stocks (AGB: $400 \pm 120 \text{ Mg ha}^{-1}$; AGC: $200 \pm 60 \text{ Mg C ha}^{-1}$). Carbon accumulation increased with restoration age, highlighting the progressive nature of biomass recovery over time. Despite this improvement, restored forests have not yet reached the carbon storage levels of undisturbed reference forests, indicating that full recovery is a long-term process requiring continued protection, management, and monitoring. These findings demonstrate that riparian restoration contributes meaningfully to carbon sequestration, enhances ecosystem function, and provides important climate mitigation benefits. By documenting typical biomass and carbon ranges in restored riparian forests, this synthesis offers critical insights for conservation planning and supports the prioritization of restoration as a strategy to rehabilitate degraded riparian landscapes while mitigating greenhouse gas emissions.

Keywords: Riparian restoration, Aboveground biomass, Carbon stock recovery, Forest regeneration, Climate change mitigation.

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6. TF2026#62

Forest Fragmentation and Restoration in Tropical Asia: Impacts on Carbon and Biodiversity

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Abstract

Forest fragmentation in tropical Asia significantly alters above- ground carbon (AGC), vegetation structure, and biodiversity. This review synthesizes findings from more than thirty empirical and theoretical studies across Southeast and South Asia to compare fragmented and continuous forests while evaluating restoration approaches. Fragmented forests stored 25–40% less AGC ($85 \pm 10 \text{ Mg C ha}^{-1}$) than continuous forests ($140 \pm 15 \text{ Mg C ha}^{-1}$), with smaller average tree diameters (18 cm vs. 28 cm), lower basal area (22 vs. $35 \text{ m}^2 \text{ ha}^{-1}$), and reduced species richness (45 vs. $70 \text{ species ha}^{-1}$), often dominated by early- successional species. These changes were linked to edge effects, selective logging, and land- use conversion, and were most pronounced in dipterocarp- dominated forests of Malaysia and Indonesia, with similar patterns observed in India, Cambodia, and the Philippines. Restoration strategies such as assisted natural regeneration, enrichment planting, and improved landscape connectivity produced measurable gains, with AGC increasing by 10–20% over two decades and species richness rising by up to 30% under favourable conditions. Case studies from the Philippines and Thailand highlight the success of assisted natural regeneration in accelerating recovery, while enrichment planting in Vietnam and India improved structural complexity and species diversity. Despite these advances, long- term recovery trajectories remain uncertain, as outcomes are strongly influenced by landscape context, socioeconomic pressures, and climate variability. Overall, restoration in tropical Asia demonstrates considerable potential to mitigate the impacts of fragmentation, but sustained monitoring and integrated management strategies are essential to secure carbon and biodiversity benefits over the coming decades.

Keywords: Forest fragmentation, Above-ground carbon (AGC), Vegetation structure, Biodiversity, Restoration strategies

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7. TF2026#63

Ecological Responses of Native Dipterocarps to Environmental Variation in Tropical Riparian LandscapesAwing Ahip and **Elia Godoong***

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Abstract

Riparian ecosystems are critical for maintaining biodiversity, regulating water quality, and supporting ecological connectivity in tropical landscapes. However, land-use conversion associated with oil palm expansion has altered riparian conditions and constrained the natural regeneration of native tree species. This study evaluated the effects of land-use type on the survival and early growth performance of native dipterocarp seedlings to inform restoration strategies. A total of 3,260 seedlings representing ten native species were established across 20 experimental plots (30 × 20 m) at Sapong Estate, Sabah, Malaysia, using a factorial design incorporating planting spacing, fertilizer application, and land-use type. In forest riparian zones, overall survival was 67.0% (95% CI: 64.4–69.5%), compared to 60.85% (95% CI: 58.7–63.0%) in oil palm riparian zones. Statistical analysis indicated a significant effect of land-use type on early growth performance ($p < 0.05$), with higher mean growth increments observed in forest riparian zones. These findings indicate that land-use type influences early seedling establishment, with forest riparian environments providing more favourable conditions for survival and growth relative to oil palm systems. However, variability in species responses suggests that performance is not uniform across taxa. Therefore, site-specific environmental conditions and species selection should be carefully considered to enhance restoration effectiveness in modified tropical landscapes.

Keywords: Riparian restoration, Native dipterocarp, Seedling survival, Land-use effects

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8. TF2026#09

Spatial Analysis of Land Cover Change and Ecosystem Service Dynamics in The Crocker Range Biosphere Reserve (CRBR), Sabah

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ABSTRACT

Spatial monitoring of land cover change provides important evidence for understanding ecosystem service (ES) dynamics in biosphere landscapes. This study assessed land cover transitions and their implications for ecosystem service supply within the Crocker Range Biosphere Reserve (CRBR), Sabah, using an integrated approach combining remote sensing, GIS-based spatial analysis, and community-informed assessment. Multi-temporal Landsat imagery from 1991 to 2025 was classified using supervised maximum likelihood classification to generate land cover maps and quantify changes across major land cover categories, including primary forest, secondary forest, shrubland/grassland, agriculture, and water bodies. Ecosystem service potential was evaluated using an ES matrix model, complemented by community dependency assessments. Focus group discussions involved 75 local experts from eight villages surrounding the study area, while household surveys were conducted with 118 heads of households from five villages within CRBR. Land cover classifications achieved overall accuracies exceeding 80%, with Kappa coefficients above 0.70 across all temporal datasets, indicating reliable mapping performance. Results showed considerable forest cover dynamics throughout the monitoring period. Primary forest declined from 175,103 ha in 1991 to 169,631 ha in 2001 and further to 167,033 ha in 2010, before increasing to 174,148 ha in 2018. The 2025 land cover assessment indicated continued stability of core forest areas, with primary forest increasing by approximately 16%, while secondary forest experienced substantial transitions of around 50%, reflecting ongoing landscape restructuring. The ES matrix identified primary forest as the principal hotspot for ecosystem service supply, particularly for regulating services, comprising nine sub-services, followed by provisioning and cultural services with six sub-services each. Human-modified land cover classes generally exhibited lower ES potential. Overall, the findings demonstrate that land cover change strongly influences ecosystem service capacity, with conversion of high-value forest areas potentially reducing ES supply. Maintaining forest-dominated landscapes is therefore essential for sustaining ecosystem functions and supporting communities that depend on these services within the CRBR.

Keywords: Ecosystem service matrix modelling, Community dependency assessment, Remote sensing change detection, Adaptive conservation planning

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THEME 6B: INTERDISCIPLINARY APPROACHES

1. TF2026#60

Preliminary Assessment of Anuran Diversity at Universiti Malaysia Sabah

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Abstract

Anurans are widely recognized as sensitive bioindicators of ecosystem health and habitat integrity. Despite their ecological significance, baseline data on campus-level amphibian diversity remain limited in Malaysian. Universiti Malaysia Sabah (UMS), characterized by a mosaic of aquatic and terrestrial habitats, provides an ideal setting for baseline biodiversity assessments. This study presents a preliminary evaluation of anuran diversity across selected habitats within the UMS campus to support ecological monitoring and conservation awareness. Nocturnal visual encounter surveys and auditory call identification were conducted in ponds, marshes, streams, and landscaped areas. Species identification was based on morphological characteristics and Frogs of Borneo field guide, while relative abundance and habitat associations were recorded to describe community composition. A total of eight species representing six genera were documented, where aquatic habitats supported higher species richness compared to modified landscapes. Key species recorded include *Hylarana erythraea*, *Hylarana nicobariensis*, *Polypedates leucomystax*, *Fejervarya limnocharis*, *Kaloula pulchra*, *Hylarana glandulosa*, *Limnonectes kuhlii* complex, and *Ingerophrynus divergens*. These findings highlight UMS as a microcosm of amphibian diversity in Sabah, supporting both widespread and ecologically significant taxa. The study establishes essential baseline data and emphasizes the importance of integrating biodiversity conservation into campus management. Continued and more comprehensive surveys are recommended to refine species inventories and strengthen long-term monitoring efforts.

Keywords: Anuran diversity, Conservation baseline, Preliminary survey, Universiti Malaysia Sabah

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2. TF2026#71

Feasibility Study of Integrating Low-Carbon Emission Cocoa with Oil Palm**Albert Ling Sheng Chang¹**, Ahmad Kamil Hj. Mohd. Jaaffar², Norasekin Tamchek¹, Girish Ramachandran³, Ee Wei Yuan³¹Malaysian Cocoa Board, 5th, 6th, 7th Floor, Wisma SEDCO, Lorong Plaza Wawasan, Off Coastal Highway, Locked Bag 211, 88999 Kota Kinabalu, Sabah, Malaysia²Fakulti Perhutanan Tropika, Jalan UMS, 88400 Kota Kinabalu, Sabah³27 Advisory, 63-2, Jalan Bangkung, Bangsar Baru, 59100 Kuala Lumpur, Malaysia**Abstract**

Malaysia's cocoa industry has experienced a significant decline, with cultivated areas shrinking from 414,236 hectares in 1989 to just 6,580 hectares in 2025. This contraction—primarily driven by pest outbreaks and a national economic shift toward oil palm—presents both critical challenges and emerging opportunities. In light of the European Union Deforestation Regulation (EUDR) and increasing global sustainability demands, there is renewed interest in revitalizing cocoa cultivation through low-carbon emission (LCE) plantation models that integrate cocoa with oil palm. To explore this potential, the Malaysian Cocoa Board (MCB) has commissioned a feasibility study to evaluate the agronomic, economic, and environmental viability of cocoa-oil palm integration under a low-carbon framework. The study is being conducted by an independent consultant using a multi method approach, combining stakeholder consultations, technical assessments, financial modelling, carbon analysis, and benchmarking of existing integration practices. Primary data sources include industry surveys, focus group discussions, and site-based technical evaluations of current cocoa intercropping systems. Preliminary findings indicate that integrating cocoa with oil palm—via row intercropping or mixed cropping—can reduce farm-level greenhouse gas emissions and enhance net carbon sequestration by up to twofold compared to oil palm monocropping systems. Economically, the integrated model strengthens resilience against palm oil price volatility while leveraging Malaysia's strategic position as a regional cocoa processing hub. Over a 25-year cycle, cocoa-oil palm integration is projected to yield at least 20% higher profits than conventional oil palm monoculture, with further upside depending on planting models and site conditions. However, the study also identifies key implementation challenges, including nutrient competition, high establishment costs, labour requirements, and policy gaps. The financial feasibility of the model can be significantly improved through strengthened value chain integration, targeted incentives, and coordinated institutional support to facilitate broader adoption of sustainable cocoa-oil palm intercropping in Malaysia.

Keywords: Cocoa, Oil palm, Low-carbon emission plantation, Crop integration, Economic diversification*** Corresponding author**Full name : Dr. Albert Ling Sheng Chang¹

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3. TF2026#59

Early Growth Performance of Dipterocarps Under Varying Planting Strategies in Sapong Forest Estate, Tenom

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Abstract

Dipterocarp tree species play a critical role in restoring degraded tropical forests in Sabah, Malaysia, yet optimal planting strategies remain underexplored. This study evaluated the performance of nine dipterocarp species from the genera *Hopea*, *Shorea*, and *Parashorea*, using four-year-old seedlings, under varying spacing-planting strategies at Sapong Forest Estate, Tenom. A total of 1,440 seedlings were planted using structured enrichment planting across four spacing treatments: single seedling at 3 m x 3 m, single seedling at 5 m x 5 m, three-seedling cluster 5 m x 5m, and three-seedling cluster 5 m x 10 m. Seedling performance was assessed based on survival rate, height increment, and root collar diameter. Survival varied significantly among spacing treatments, with the three-seedling cluster planting at 5 m x 5 m achieved the highest survival rate (84.2%). A Pearson Chi-square test indicated a significant association between spacing and survival ($\chi^2 = 12.48$, $df = 3$, $p = 0.006$). Height and diameter growth did not differ significantly across spacing treatments (one-way ANOVA, height, $p = 0.634$; diameter, $p = 0.528$), with the highest mean height growth observed under single seedling at 5 m x 5 m (3.30), whereas the highest mean diameter growth under three-seedling cluster planting at 5 m x 10 m (3.92). Tukey post hoc analysis further confirmed that there were no significant pairwise differences among treatments for both height and diameter growth parameters ($p > 0.05$). Two-way ANOVA showed that height growth was significantly affected by species ($p = 0.001$), but not by spacing or their interaction ($p > 0.05$). In contrast, diameter growth was only affected by the interaction between species and spacing ($p = 0.022$), indicating that species responded differently to spacing treatments. Cluster planting at 5 m x 5 m improved dipterocarp seedling survival, while growth was primarily influenced by species rather than spacing. These findings highlight the importance of combining appropriate planting design with species selection to enhance forest restoration success in degraded tropical landscapes.

Keywords: Dipterocarps, Enrichment planting, Spacing treatments, Seedling survival, Forest restoration

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4. TF2026#36

Plot-level Time-series Assessment of Enrichment Planting in Sow-a-Seed Project, Sabah

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Abstract

Tropical forests remain central to international restoration agendas given their critical role in carbon sequestration, biodiversity conservation, and sustaining local livelihoods. Among the various approaches, enrichment planting where tree seedlings are introduced into degraded forests to accelerate recovery has become a common practice across the tropics. The lack of long-term data constrains our ability to evaluate the true effectiveness of restoration through planting. In this study, we analyzed plot inventory data at the enrichment planting sites within the Sow-A-Seed project in Sabah. Specifically, we compared tree inventory data 15–19 years after planting with a remeasurement 22–25 years after planting. Through this approach, the survival and aboveground biomass accumulation of planted trees were evaluated, thereby providing an assessment of their contribution to long-term forest restoration outcomes. Our results indicate a difference in performance of planted seedlings planted at two degradation levels. Continued assessments of planted trees should provide valuable information for forest restoration projects.

Keywords: Forest restoration, Dipterocarps, Aboveground biomass

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5. TF2026#58

Assessing Hydrological and Erosional Impacts of Forest Restoration in the Sapong Estate, Sabah

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Abstract

Forest restoration in tropical regions like Sabah, Malaysia, addresses land degradation from logging and agriculture, aiming to restore biodiversity, soil stability and hydrological functions. Sapong Estate, managed by Sime Darby Plantation, features secondary forests with various restoration treatments amid oil palm plantations. This study assesses soil erosion intensity across forest restoration treatments in Sapong Estate, Sabah and evaluates its relationship with local slope gradient using exclusively the Modified Laser Erosion Bridge (MLEB) method. Ground height changes were measured at 10-15 replicates per plot with 390-1,400 points total per site. Four restoration sites with one control sites were monitored over three months, where there are changes to the soil profile where deposition or erosion which excess ground surface soil or to refill the ground holes while transitioning toward surface stability. The findings reveal a high degree of spatial heterogeneity in sediment transport across the monitoring period. Results show that the maximum net erosion is +0.113m in Treatment 1 and maximum net deposition is -0.118m in Treatment 4. The most stable zone in between Control sites and Treatment 2 with average net fluctuations of 0.003m. The MLEB method proved highly effective for quantifying micro-scale soil movement, providing essential high-resolution data for assessing the hydrological recovery of restored tropical landscapes within oil palm-dominated estates. Despite these findings, this study represents a snapshot of early-phase restoration dynamics. Longer term monitoring is essential to further validate these preliminary findings.

Keywords: Erosion, Modified Laser Erosion Bridge Method, Secondary forest, Forest restoration

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6. TF2026#93

Tropical Seedling Performance Under Drought: A Functional Trait Approach for Species Selection in Restoration

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Abstract

Tropical rainforests experience seasonal variations in water availability, with dry periods resulting in severe soil water scarcity that critically affects seedling performance. A functional trait-based approach, focusing on morphological characteristics, provides a practical means of identifying drought-tolerant tropical woody species for restoration initiatives. This study aimed to evaluate the effects of drought stress on the early establishment of seven tropical woody seedling species and to identify the traits that contribute to seedling performance under these conditions. A greenhouse experiment was conducted to assess seedling responses to varying drought levels, measuring seedling performance (survival rate, relative growth rate, and wilting state) along with traits related to resource acquisition and allocation. The 12-week experiment revealed that drought significantly reduced soil moisture and seedling performance, with species-specific responses. Principal component analysis reveals a shift in trait importance under drought, suggesting altered resource allocation strategies. The root-to-shoot ratio and leaf mass per area emerged as critical indicators of seedling survival during drought, with larger seed and higher leaf dry matter content initially promoting growth but diminishing in effectiveness under severe drought conditions. Larger seeds exhibited greater drought tolerance, as evidenced by lower wilting rates. Although a functional trait-based approach offers valuable information, our results indicate that it may not be fully predictive of seedling performance under all drought scenarios. These findings underscore the importance of selecting species based on their sensitivity to drought stress for specific restoration strategies.

Keywords: Direct seeding, Drought stress, Forest restoration, Functional traits, Seedling survival

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POSTER PRESENTER'S ABSTRACTS

1. TF2026#28

Automated Urban Forest Inventory: Integrating Vision-Language Models (VLM) and QGIS Atlas Based on High-Resolution Remote Sensing and Ground Truth GPS

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Abstract

Effective Urban Forest management requires inventory data beyond simple coordinates, demanding in-depth qualitative information on vegetation conditions. However, a methodological gap exists between spatial data collection and efficient botanical interpretation. This research bridges this gap by integrating a GIS-based spatial inventory with botanical interpretation based on a Vision-Language Model (VLM). The novelty lies in the positional validation workflow; where the model operates based on field survey coordinates using Handheld GPS, verified against high-resolution satellite imagery to ensure accuracy. The methodology involved an inventory of 26 trees in Alun-Alun Kidul, Yogyakarta, featuring species such as Ringin Wok (*Ficus benjamina*), Ringin Iplik (*Ficus retusa*), Gayam, Tanjung, and various Mango varieties. The technical workflow includes: (1) Defining analysis units based on coordinates; (2) Automated image extraction via QGIS Atlas for consistent scale and spatial extent; and (3) Synchronization of geospatial metadata into the AI engine. Results indicate this integration generates accurate automated narratives regarding crown morphology while identifying anomalies, such as the parasite Mahang (*Macaranga tanarius*), surpassing conventional remote sensing methods. This study concludes that "self-describing maps" significantly enhances urban ecosystem monitoring by providing precise, valid, and automated qualitative data for management authorities.

Keywords: Urban Forest, Positional Accuracy, GPS Handheld Survey, QGIS Atlas, Vision-Language Model, Georeferenced Description.

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2. TF2026#31

Balancing Forest Resource Use and Conservation: Community Adaptation in The Vicinity of Croker Range Biosphere Reserve, SabahSiti Nur Aisyah Binti Mohamed Surin and **Dr. Walter Lintangah***

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Abstract

Forest ecosystems provide essential ecological services and livelihood resources for rural communities, particularly in biodiversity-rich hotspots such as the Crocker Range Biosphere Reserve (CRBR), Sabah, Malaysia. However, balancing forest resource utilization with conservation objectives remains a major challenge in protected landscapes. This research examines community adaptation strategies for balancing forest resource use and ecosystem conservation, focusing on several villages within CRBR. The villages involved in this study include Kg. Tudan, Kg. Buayan, Kg. Tiku, and Kg. Ulu Senagang. A structured questionnaire survey was conducted, yielding responses from 102 participants, with Kampung Buayan accounting for the largest proportion. Descriptive and inferential statistical analyses were applied to assess community dependence on forest resources, participation in forest governance, and perceptions of conservation practices. The results indicate that a significant proportion of respondents (79%) continue to depend on forest resources for their livelihoods, highlighting the continued socio-economic importance of forest ecosystems. In addition, community members demonstrate awareness of conservation initiatives and actively participate in forest governance activities. These findings suggest that local communities have developed adaptive strategies that allow them to sustain resource use while supporting conservation goals. Strengthening community participation and collaborative governance mechanisms is therefore essential for promoting sustainable forest management and enhancing socio-ecological resilience in protected areas. This research provides policymakers and conservation practitioners with important insights for integrating community-based approaches into forest management strategies in Sabah.

Keywords: Community Adaptation, Livelihoods, Forest Resource Use, Conservation, Sustainable Forest Management

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3. TF2026#34

Contrasting Forest Recovery Trajectories Between FSC-certified and Conventionally Logged Forests in Sabah: Insights From 20 Years of Monitoring

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Abstract

Sustainably managed production forests, including those under FSC certification, are increasingly recognized as essential complements to protected areas for biodiversity conservation, yet long-term empirical data validating their ecological outcomes remain scarce. At Deramakot Forest Reserve, the earliest FSC-certified tropical production forests, we established multiple 0.2-ha plots and one 2-ha plot in each of three forest types (primary, RIL, and conventionally logged (CL) forests) and conducted long-term monitoring (2005–2025) of tree communities, dipterocarp regeneration, and carbon stocks. Tree species diversity did not differ significantly between primary and RIL forests, whereas CL forests showed marked declines. Similarly, tree species composition did not differ significantly between primary and RIL forests, whereas CL forests showed a markedly different composition. Dipterocarp seedling density was governed by parent tree density and masting events: RIL maintained parent tree density above the threshold required for stable seedling recruitment, while CL fell below it, resulting in near-zero seedling density between masting events. Ecosystem carbon stock was 16% lower in RIL and 49% lower in CL forests than in primary forest approximately 20 years after logging, indicating that RIL reduced carbon loss by 70% relative to CL. Biomass recovered in both logged forests over the monitoring period, but CL recovery was not significantly greater than RIL, owing to the high mortality of dominant pioneer species. Accordingly, FSC-certified production forests effectively maintain forest structure, diversity, and regeneration potential, offering a viable pathway for reconciling timber production with biodiversity conservation in the tropics.

Keywords: Reduced-impact logging, sustainable forest management, production forest, dipterocarp regeneration, mast fruiting

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4. TF2026#40

Monitoring Resilience of Tropical Forest Biodiversity Using Tree Functional Group Ratio and Remote Sensing

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Abstract

Achieving nature-positive outcomes by 2030 necessitates the development of innovative monitoring systems for tropical forest biodiversity that are both cost-effective and extensive in spatial and temporal scale. A major challenge of this objective is the absence of universally applicable biodiversity indicators and the high costs associated with ground truthing. Here, we propose the mixing ratio of tree functional groups as an indicator of biodiversity resilience because of its general applicability, simplicity, and feasibility. We present an algorithm that utilizes this indicator with minimal ground truthing expenses. By integrating 500 forest inventory datasets from various years and forest management units (FMUs) across Sabah, we employed an ensemble machine learning model to predict the indicator in the FMUs using Landsat reflectance variables. The model exhibited satisfactory accuracy ($R^2 = 0.56$) even in areas with sparse data (<20 plots within a 15-km radius), demonstrating the feasibility of biodiversity indicator monitoring at a fine scale (30-m resolution) with limited ground data from a single FMU. However, when extrapolated to FMUs lacking training data, model accuracy decreased ($R^2 = 0.26$), suggesting the significance for expanding ground truthing. Our findings highlight the importance of collaborative biodiversity data collection across years and regions to significantly reduce ground truthing costs, crucial for advancing tropical forest biodiversity monitoring efforts.

Keywords: Remote sensing, machine learning, sustainable forest management, production forest, ecosystem services

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5. TF2026#43

Repeated Intense Selective Logging Induces Loss of Resilience in a Bornean Timber Production Forest

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Abstract

It is believed that tropical forests can recover after disturbances through secondary succession, thereby providing ecosystem services during the recovery process. However, dense thickets of ferns and vines often persist for decades without signs of recovery in Bornean timber production forests, suggesting limited potential to provide ecosystem services. Understanding the factors that drive the establishment of such vegetation is crucial for elucidating the spatial variation in resilience across tropical landscapes. We conducted spatial analyses to examine the effects of terrain and local logging history on the distribution of areas dominated by ferns and vines in Tangkulap Forest Reserve, Sabah (FMU17A). Terrain variables were derived from a global digital terrain model, whereas logging history variables were obtained from Landsat time series analyses using the LandTrendr algorithm. A vegetation map showing the distribution of fern/vine in 2019 was overlaid with these variables, and the extracted values were used to model vegetation distribution. Logging history variables had a much stronger effect on the distribution than terrain variables. Intense loggings were repeated without sufficient recovery in between for those pixels classified as fern/vine, while past logging was milder for extant disturbed forests. Succession seems to have been arrested in fern/vine thicket due to the past legacy effects. Our analyses demonstrate that repeated intense logging can shift vegetation regimes and lead to a loss of forest resilience.

Keywords: Arrested succession, mixed dipterocarp forest, belukar, remote sensing, sustainability

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6. TF2026#68

Soil Microbial Community Shifts and Their Effects on Soil Enzyme Activities Along a Logged-over Tropical Forest Degradation Gradient

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Abstract

Soil bacteria and fungi have distinct but interrelated functions in producing extracellular enzymes that drive organic matter decomposition. In Malaysian Borneo, forest degradation caused by selective logging reduces litter inputs, leading to declines in soil organic carbon (SOC), the C/N ratio, and soil enzyme activities. However, the link between soil microbial community composition and enzyme activities under forest degradation remains poorly understood. Reduced SOC may affect microbial communities and subsequently influence enzyme activities during forest degradation. To test these linkages, four extracellular enzymes involved in carbon, nitrogen, and phosphorus cycling were measured. Bacterial and fungal communities were examined using 16S and ITS amplicon sequencing, and their absolute and relative abundances were quantified via ergosterol extraction and quantification. The forest degradation gradient was represented by principal coordinates analysis axis-1 values derived from tree genus composition across forest plots. Our results showed that fungal community composition shifted due to divergent responses of fungal phyla to SOC quality under reduced litter input, whereas bacterial composition remained stable owing to sustained labile substrates from fungal decomposition. Decreased substrates altered fungal composition, which further regulated the activities of acid phosphatase, β -glucosidase, and leucine aminopeptidase, suggesting that soil carbon, nitrogen, and phosphorus availability shaped fungal communities under forest degradation, which in turn feeds back to enhance the efficiency of soil enzymes involved in phosphorus and nitrogen mineralization.

Keywords: Selective logging, Soil microbial activities, Soil microbial community, Forest degradation

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7. TF2026#74

Review of Mangrove Species Composition, Diversity, and Biomass in Malaysia and Bornean Mangrove Forests

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Abstract

Mangrove ecosystems in Malaysia and Borneo are among the most productive coastal forests, providing essential ecological functions such as biodiversity support, shoreline protection, and carbon storage, yet they are increasingly threatened by anthropogenic pressures including land conversion and coastal development. This review synthesizes existing knowledge on mangrove species composition, biodiversity patterns, and biomass dynamics, with a focus on Malaysian and Bornean mangrove forests, while also identifying key ecological drivers and research gaps relevant to conservation and management. A narrative review approach was adopted, drawing on eight peer-reviewed studies that incorporate field-based vegetation surveys, biodiversity assessments, and biomass estimation methods using both allometric models and remote sensing techniques. The findings show that mangrove forests in the region are generally dominated by a limited number of species, particularly within the Rhizophoraceae family, although moderate biodiversity is maintained in areas with higher environmental heterogeneity. Biodiversity patterns are influenced by salinity gradients, tidal regimes, and disturbance history, while aboveground biomass varies significantly across sites, with higher values typically observed in Bornean mangroves due to favorable hydrological and nutrient conditions. Overall, this review highlights the importance of integrating species composition, biodiversity indices, and biomass assessments to better understand ecosystem dynamics, and emphasizes the need for improved monitoring frameworks and advanced remote sensing applications to support sustainable mangrove management and conservation strategies.

Keywords: Mangrove forests, species composition, aboveground biomass, carbon storage

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8. TF2026#77

Restoration of Degraded Forest - Physiological Aspects of Selected Species Planted Using Innovative Techniques

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Abstract

Restoration through tree planting is a key strategy for rehabilitating degraded tropical forest. This study evaluated three dipterocarp species namely *Neobalanocarpus heimii*, *Hopea odorata* and *Anthoshorea roxburghii* planted across three spacing regimes (5 × 3 m, 4 × 4 m, and 3 × 3 m) within the degraded landscapes of the Besul Forest Reserve, Terengganu. The growth performance and physiological responses of saplings planted were evaluated through 34 months after planting. Data analysis revealed that *A. roxburghii* consistently exhibited superior growth and physiological vigor compared to the other species across all treatments. The highest growth increments were recorded for *A. roxburghii* in the 3 × 3m spacing, reaching a mean height increment of 204.73 cm and a diameter increment of 41.56 mm. Physiologically, this species also dominated, achieving its peak net photosynthetic rate (9.64 $\mu\text{mol m}^{-2}\text{s}^{-1}$ and stomatal conductance 245.70 $\text{mmol m}^{-2}\text{s}^{-1}$ at the 4 × 4 m spacing, alongside a maximum Water Use Efficiency (WUE) of 2.51 $\mu\text{mol mmol}^{-1}$ in the 3 × 3 m plot. In contrast, *N. heimii* showed the most conservative growth profile, with height increments ranging between 50.17 cm and 63.75 cm. *H. odorata* displayed moderate performance, showing steady growth but failing to match the gas exchange efficiency of *A. roxburghii*. These results indicate that *A. roxburghii* possesses a high capacity for resource acquisition and biomass accumulation, making it a highly suitable candidate for reforestation.

Keywords: Silviculture, Net Photosynthesis, Stomatal Conductance, Timber Growth, Planting Spacing.

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9. TF2026#78

Cultivating Pro-Environmental Behaviour: An Analysis of Public Synergy in Malaysia's 100 Million Tree-Planting Initiative

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Abstract

The Malaysia Greening Programme: 100 Million Tree-Planting Campaign (2021–2025) serves as a national benchmark for integrating environmental conservation with societal empowerment. This study evaluates the effectiveness of the campaign in fostering public synergy and ensuring the strategic sustainability of forest landscapes through the lens of human society. Employing a mixed-method approach, data were gathered from a survey of 971 respondents and Focus Group Discussions (FGD) involving 27 diverse stakeholder agencies. The findings reveal an exceptional level of environmental consciousness, with 99.4% of the public recognising the necessity of tree planting for ecological balance. Furthermore, 92.6% of respondents reported a significant increase in environmental awareness, while 95.4% expressed a strong commitment to future planting initiatives, indicating a successful internalisation of green values. Beyond ecology, the programme demonstrated substantial socio-economic synergy, with 96.6% of participants acknowledging its contribution to local economies through the supply of seedlings and job creation. Strategic analysis with stakeholders highlighted the transition toward high-impact sustainability, emphasising the need for survival-based monitoring and digital integration, such as geo-tagging, to ensure long-term stewardship. This research underscores the programme's success in transforming a forestry mandate into a resilient social movement, offering a strategic framework for global tropical forestry initiatives that prioritize human-nature coexistence

Keywords: Malaysia Greening Programme, Public Synergy, Human Society, Strategic Sustainability, Environmental Stewardship

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10. TF2026#79

The Effectiveness of Recreational Park Facility Provision in Kota Kinabalu Based on the Kota Kinabalu Landscape Master Plan 2002: An Assessment of User Satisfaction and Importance of Playground Equipment

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Abstract

This study evaluates the effectiveness of recreational park facility provision in Kota Kinabalu based on the Kota Kinabalu Landscape Master Plan 2002, with a focus on users' perceptions of importance and satisfaction. The study is significant as the master plan has expired since 2012, while current practice continues to emphasise physical facility provision rather than the actual needs and experiences of users. A mixed-method approach was adopted, guided by the Expectation-Confirmation Theory (Oliver, 1980). The study involved two public parks, namely Teluk Likas Public Park and Ujana Rimba Tropika Park, with 768 respondents through structured questionnaires. Overall satisfaction was measured using the Customer Satisfaction Index (CSI), while the relationship between importance and performance was analysed using Importance-Performance Analysis (IPA). Findings for Ujana Rimba Tropika Park indicate a good level of satisfaction, with CSI values ranging from 76.67% to 80.52%. However, a gap exists between importance (3.83–4.03) and performance (2.97–3.22), with the quantity attribute located in Quadrant I, indicating a critical area requiring immediate attention. Durability and serviceability fall within Quadrant II and should be maintained. For Teluk Likas Public Park, satisfaction levels are moderate, with CSI values between 63.60% and 65.69%. Although user importance is high (3.25–4.31), performance remains low (2.74–2.82), indicating significant gaps, particularly in serviceability and quantity. Overall, the findings show that recreational park facilities in Kota Kinabalu are generally satisfactory, but there are still clear gaps between user expectations and actual provision. Improvements are therefore needed, particularly in maintenance, service quality, and facility adequacy, to ensure playground facilities remain relevant and useful for users. More importantly, this study provides useful user feedback that can guide future master plans.

Keywords: Landscape Master Plan, Recreational Facilities, User Satisfaction, Customer Satisfaction Index (CSI), Importance-Performance Analysis (IPA)

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11. TF2026#80

**Effects Of Coconut Leaf Sheath Mulch and Watering Frequency on Okra
(*Abelmoschus Esculentus*) Fruit Production and Soil Water Content**

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Abstract

This polybag study investigated the combined effects of coconut leaf sheath mulch and watering frequency on okra production and soil water content. The experimental design was a factorial Completely Randomized Design (CRD). The two factors were 4 organic mulch layering [ML] (0, 2, 3 and 4 layers) and 3 watering frequencies [WF] (twice and once a day, and once in 2 days). Each treatment combination was replicated 4 times. Daily soil water content was measured early morning before watering the plants. After harvest, the number of fruits and weight of okra fruits were measured. Data were subjected to a two-way analysis of variance (ANOVA) using SPSS version 28 followed by mean separation using LSD (Least Significant Difference) test at 5% probability level. There was significant interaction between ML and WF on Okra fruit production with Treatment 6 (ML2, WF3) resulting in the highest mean number of fruits (10.3). The lowest mean number of fruits (6.0) resulted from treatment 12 (ML4, WF3). There was significant interaction between ML and WF for okra fruits weight with T6 showing the highest mean (113.9g), while T12 showed the lowest mean fruits weight (57.4g). For percent soil moisture content (SMC), the highest mean resulted from 2 layers of mulch (17.8%) and the lowest was for the no mulch treatment (15.8%). It can be concluded that Treatment 6 (ML2, WF3) was the best practice for optimizing resource use and boosting productivity. The interaction between mulching layers and watering frequency needs further investigation under field conditions.

Keywords: Okra, Mulch, Watering, Soil moisture, Productivity

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12. TF2026#81

Bioactive Potential of *Dendrobium anosmum*: A Sustainable Tropical Forest Bioresource from Borneo

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Abstract

Dendrobium anosmum Lindl., an endemic epiphytic orchid native to Sabah, Malaysia, remains largely underexplored for its medicinal potential despite its longstanding use in traditional practices and the well-documented bioactive properties of related *Dendrobium* species, and this study therefore aims to characterize its phytochemical composition and antioxidant activity across leaves, stems, and petals while determining the correlation between its major bioactive compounds and radical scavenging activity. Ethanolic extracts were prepared via maceration and subjected to qualitative phytochemical screening using Mayer's, Molisch's, Froth, Salkowski's, Alkaline Reagent, and Ferric Chloride tests, while Total Phenolic Content and Total Flavonoid Content were determined using the Folin-Ciocalteu and Aluminium Chloride colorimetric methods respectively, and antioxidant activity was evaluated using the 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging assay. Leaves recorded the highest Total Phenolic Content at 9.11 mg GAE/g and Total Flavonoid Content at 39.74 mg QE/g alongside flavonoids, glucosides, phytosterols, phenolics, and tannins, while stems showed moderate values with alkaloids and carbohydrates additionally present, and petals, despite having the lowest phenolic and flavonoid content, demonstrated superior DPPH radical scavenging activity at 98.05%, outperforming ascorbic acid at 97.31%, suggesting synergistic contributions from non-phenolic bioactives such as glycosides or phytosterols. These organ-specific findings position *D. anosmum* as a promising tropical forest bioresource for nutraceuticals, anti-inflammatory agents, and cosmeceuticals, while underscoring the need for sustainable harvesting and biotechnological propagation to safeguard wild populations amid ongoing habitat loss in Sabah.

Keywords: Antioxidant activity, *Dendrobium anosmum*, medicinal orchid, phytochemical screening

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13. TF2026#82

SMASTING: Smart Glasses Harvesting for Oil Palm Ripeness Detection in SEAT Urban Forest

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Abstract

Increasing oil palm production is achieved by improving harvesting quality through technological upgrades and enhanced occupational safety. One of the developed technological innovations is SMASTING (Smart Glasses Harvesting), a pair of smart glasses designed to detect the ripeness of oil palm fresh fruit bunches. The implementation of SMASTING is expected to improve harvester efficiency, increase crop yields, and minimize harvest losses. This study aims to evaluate the implementation and performance of the device at the SEAT Urban Forest, Unggaran Research and Experimental Station (KP2). The SMASTING system utilizes an Arduino as the primary microcontroller. An infrared sensor serves as an object focus pointer for remote areas, while the TCS3200 color sensor detects fruit ripeness based on color intensity received through binocular lenses. All components are integrated into glasses that also function as Personal Protective Equipment (PPE). The ripeness indicator consists of a buzzer that activates when red (ripe) fruit is detected and remains silent for unripe fruit. Performance test results indicate that SMASTING functions effectively, although it has a maximum operational range of 1–2 meters due to the limitations of the TCS3200 sensor regarding light intensity. Technical data shows the RGB range for unripe fruit as: Red (60–67), Green (57–64), and Blue (70–87); while ripe fruit ranges are: Red (19–21), Green (25–28), and Blue (24–27). Field application still faces challenges regarding signal interference (noise). Future development suggests the use of an ESP32 camera integrated with Artificial Intelligence (AI) to improve detection accuracy.

Keywords: Glasses, oil palm, harvester, urban forest

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14. TF2026#38

Evaluating the Role of Community Governance in Forest Management within the Crocker Range Biosphere Reserve in Kampung Ulu Senangang, Keningau

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Abstract

The Crocker Range Biosphere Reserve (CRBR) is an important ecosystem in Sabah, Malaysia, supporting high biodiversity and providing essential ecosystem services to surrounding communities. Effective protected area management requires meaningful community participation, given their close dependence on forest resources for livelihoods and cultural practices. This study examines community participation in forest governance in Kampung Ulu Senangang, Keningau, located within the CRBR's core zone. A mixed-methods approach was applied, including Focus Group Discussions (FGDs), face-to-face interviews, and questionnaires, involving 51 respondents. Descriptive statistics and Spearman's rho correlation analysis were conducted. The results in this study indicate that only 36.17% of respondents are directly involved in community forestry activities, while 63.83% are not, reflecting low active participation despite relatively high meeting attendance (62.79% formal; 58.14% informal). Land ownership is positively associated with perceptions of leadership responsiveness ($r_s = 0.332$, $p = 0.026$) and communication effectiveness ($r_s = 0.331$, $p = 0.026$). On the other hand, the number of times someone enters the forest is negatively related to their satisfaction with decision-making ($r_s = -0.307$, $p = 0.036$), communication transparency ($r_s = -0.365$, $p = 0.012$), leadership performance ($r_s = -0.341$, $p = 0.019$), and overall governance effectiveness ($r_s = -0.419$, $p = 0.003$). Overall, although governance mechanisms exist, stronger inclusive participation, improved communication, and enhanced forestry awareness are needed to support sustainable forest governance within the Crocker Range Biosphere Reserve.

Keywords: Community Participation, Forest Governance, Crocker Range Biosphere Reserve, Biodiversity, Sustainable Development

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15. TF2026#41

Development of a UAV-based Model for Dipterocarp Crown Identification in Lowland Tropical Forests

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Abstract

Dipterocarps are foundation tree species, constituting about half of the aboveground biomass in lowland tropical forests in Borneo. However, increasing global timber demand has led to intensive logging, raising concerns about dipterocarp population decline. Because dipterocarp fruits experience strong predation pressure, reduction in reproductive adults and limited landscape seed production hinder regeneration of the species. Therefore, assessing dipterocarp population density at landscape-scale is essential, but no reliable method has been developed. This study developed a deep learning model capable of identifying dipterocarp crowns from unmanned aerial vehicle (UAV) imagery. UAV surveys covering 700 ha were conducted in timber production forests in Sabah, Malaysia. Orthomosaic images were generated, individual crowns were segmented, and each crown was classified into five categories: Dipterocarpaceae, three pioneer species (*Macaranga gigantea*, *M. pearsonii*, and *Neolamarckia cadamba*), and other species. The model achieved approximately 75% overall accuracy and an 80% F1 score for dipterocarp classification. The total dipterocarp crown area estimated by the model within tree inventory plots was positively correlated with the total dipterocarp basal area in the corresponding plots. We then applied the model to landscapes of production forests. Dipterocarp crown area was lower in areas with higher logging intensity than area with lower logging intensity, even in plots with high aboveground biomass. These results indicate that the model developed in this study has a potential for large-scale assessment of dipterocarp populations in a manner consistent with ground-based measurements, and it is expected to contribute to sustainable forest management.

Keywords: UAV, Deep Learning, Dipterocarpaceae, Deramakot Forest Reserve, Forest management

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16. TF2026#94

Seed Germination Variability and Its Association with Functional Traits in Submontane Tropical Forest Species of Indonesia: Recommendations for Direct Seeding

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Abstract

Seed germination is a crucial component of the reproductive cycle of plants, and thus, knowledge of germination strategies plays a vital role in species selection for seed-based forest restoration. Conducting germination testing for tropical species requires enormous resources. Therefore, a functional trait-based approach is needed to predict germination success based on seed traits. However, there is a lack of comprehensive information on germination and the correlation between functional traits and germination for tropical native species. In this study, we assessed seed traits and conducted germination assays for 31 woody plant species from the submontane tropical forest of West Java, Indonesia. Our results indicated that seed functional traits and germination varied among the species examined. Germination clustered into five categories: early-high, early-medium, early-low, late-low, and failed. Specific seed traits can be used to predict both germination percentage and mean germination time. Variability in seed coat ratio and seed dormancy explains differences in germination percentages, while mean germination time is primarily influenced by seed mass and seed coat thickness. This study presents valuable germination data for ten woody tropical native species that germinate readily without the need for special treatments, including *Acer laurinum*, *Aphanamixis polystachya*, *Engelhardia serrata*, *Ficus fistulosa*, *F. ribes*, *Gaultheria leucocarpa*, *Maoutia diversifolia*, *Ormosia penangensis*, *Phyllanthus emblica*, and *Saurauia pendula*. Incorporating a trait-based approach in species selection strategies may reduce the number of seeds required for direct seeding and enhance the germination success of direct seeding efforts.

Keywords: Direct seeding; Forest restoration; Functional traits; Mean germination time; Seed coat ratio; Seed germination variability; Tropical native species

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**Wildlife Tracking in the Wildlife Corridor in a Forest Plantation in
Sapulut, Sabah, Malaysia**
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Abstract

Forest fragmentation is still a major threat to biodiversity due to excessive land-use conversion, especially in Sabah, Malaysia. JAWALA Plantation Industries Sdn. Bhd. (JPISB) has set aside a wildlife corridor (340.43 Ha) within the area that is part of FMU14, as the license holder of SFMLA 02/2015, connecting the Sapulut and Pensiangan Forest Reserves. However, there have been no scientific studies conducted regarding this demarcation since 2022, and almost no studies have been conducted, especially within an FMU area. This study is designated for: (1) assessing the corridor's overall wildlife community richness and conservation values, (2) investigating wildlife community structure across its three compartments of the corridor, and (3) determining the correlation between wildlife distribution and vegetation structure. Camera traps were deployed along seven transect lines, collecting a total of 4,479 camera days between October 2024 and September 2025. Species diversity was analysed via the ShannonWiener Index (H') and the Relative Abundance Index (RAI), as Spearman's rank correlation was used to examine wildlife-vegetation relationships. A total of 19 wildlife species were recorded from 313 independent detection events. CPT 30 has the highest species richness ($S = 16$) and diversity ($H' = 2.28$). In contrast, CPT 27 and 25 showed a medium diversity ($H' = 1.87$ and 1.89 , respectively). The Southern Pig-tailed Macaque (*Macaca nemestrina*) shows dominance as it appears in large numbers across the corridors, and there are 13 of 19 species detected in two or more compartments, which indicates that there are movements of wildlife along the corridor. Rare species such as the Bornean Sun Bear (*Helarctos malayanus*), Hose's Civet (*Diplogale hosei*), and Sabah Grey Langur (*Presbytis hosei*) was also detected. The analysis of the vegetation structure showed that the proportion of large mature trees (>60 cm DBH) had a very strong positive correlation ($r_s = 1.0$) with wildlife diversity and abundance, suggesting that forest stratum and structure are the vital points for the availability of wildlife activity. Overall, the results indicate that the wildlife corridor is ecologically functional and it does support a diverse wildlife community within a forest plantation, as well as providing an impactful baseline for future biodiversity in the management of FMUs in Sabah.

Keywords: biodiversity, camera trapping, forest plantation, Relative Abundance Index, Shannon-Wiener diversity index, species richness, vegetation texture, wildlife corridor, Sabah, Borneo

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