MINISTRY OF NATURAL RESOURCES AND ENVIRONMENTAL SUSTAINABILITY

CLIMATE CHANGE & SUSTAINABILITY CONFERENCE 2026

21 – 22 APRIL 2026

M World Hotel, Petaling Jaya

CONFERENCE PROGRAMME BOOK

FOREWORD

Dato' Dr. Ismail Hj. Parlan
Director General, Forest Research Institute Malaysia

It is with great pleasure that I welcome you to this Climate Change and Sustainability Conference. At a time when the impacts of climate change are increasingly evident across the globe, gatherings such as this are more important than ever. They provide a vital platform for dialogue, collaboration, and the exchange of ideas that can shape a more resilient and sustainable future.

This conference brings together a diverse community of researchers, policymakers, industry, civil society and advocates who share a common commitment: to better understand the challenges we face and to develop meaningful, practical solutions. From advancing scientific knowledge to driving innovation and influencing policy, your collective efforts are essential in addressing one of the defining issues of our time.

Sustainability is no longer a distant goal—it is an urgent responsibility. The decisions we make today will determine the environmental, social, and economic well-being of future generations. This programme reflects that urgency, offering a rich array of discussions, insights, and perspectives that highlight both the complexity of the climate crisis and the opportunities for transformative change.

I encourage you to engage actively, question boldly, and collaborate openly. May this conference inspire new partnerships, fresh ideas, and renewed determination to act.

Thank you for being part of this important conversation, and I wish you a productive and impactful conference.

PROGRAMME

TUESDAY, 21st APRIL 2026

Venue: Lobby, 1st Floor

8.00 am Registration

Venue: Grand Ballroom, 1st Floor

9.00 am **Plenary Session 1: Climate Change, Land and Sustainability**

YBhg. Dato' Dr. Ismail Hj. Parlan
Director General, Forest Research Institute Malaysia

Panel Discussion 1: Unpacking Climate Change, Sustainability and Biodiversity

9.20 am

Moderator

Dr. Elizabeth Philip
Head of Environment and Climate Change Programme, Forestry and Environment Division, Forest Research Institute Malaysia

Panellist

Mr. Yin Shao Loong
Deputy Director of Research, Khazanah Research Institute

Ms. Meena Raman
Deputy Executive Director of Third World Network & President of Sahabat Alam Malaysia (Friends of Earth Malaysia)

Mr. S. Siva Kumar
Undersecretary, Biodiversity & Forestry Management Division, Ministry of Natural Resources and Environmental Sustainability

10.00 am Coffee break

PROGRAMME

OPENING CEREMONY & LAUNCHING OF NATIONAL CARBON MARKET POLICY

Venue: Grand Ballroom, 1st Floor

10.30 AM – 11.15 AM

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

National Anthem & Doa Recital

Welcome Remarks
YBhg. Dato' Dr Ismail bin Hj Parlan
Director General, Forest Research Institute Malaysia

Opening Speech & Conference Officiation
YB Dato' Sri Arthur Joseph Kurup
Minister of Natural Resources and Environmental Sustainability

Launching of the National Carbon Market Policy

Visit to Exhibition Booths by YB Dato' Sri Arthur Joseph Kurup

Press Conference

PROGRAMME

Venue: Grand Ballroom, 1st Floor

11.15 am **Plenary Session 2: Monitoring of National Climate Change Conditions**

YBrs. Dr. Mohd Hisham Mohd Anip
Director General, Malaysian Meteorological Department

Session 1: Advancing Climate Resilience through Adaptation

11.35 am **Session chair**

Dr. Mohd Zaki Hj. Abdullah
Director, Forestry & Environment Division, Forest Research Institute Malaysia

Paper 1 MyNAP: Towards a Resilient Nation

Mr. Noor Akmar Shah Mohd Nordin
Project Director, Malaysia National Adaptation Plan (MyNAP)

Paper 2 Adaptation and Resilience in the Forestry Sector: What is Needed for a Climate-Ready Future

Dr. Azian Mohti
Senior Research Officer, Forestry and Environment Division, Forest Research Institute Malaysia

Paper 3 Advancing Urban Climate Adaptation through Nature-Based Solutions: Insights from Penang and Other Malaysian Cities

Dr. Yogi Chellappan
Senior Manager, Climate Resilience, Think City Penang

Paper 4 Highlights and Economic Benefits of Climate Change Adaptation Initiative Melaka: City Case Study

Mr. Ismail Hj. Abdullah
President & Chief Sustainability Officer, International Green Trends Cockpit Sdn Bhd (IGTC)

12.35 pm Q&A

Venue: Indulge Coffee House, Ground Floor

1.00 pm Lunch

PROGRAMME

Venue: Grand Ballroom, 1st Floor

2.15 pm **Plenary Session 3: Long-Term Low-Carbon Strategies and Net Zero Road Map**

YBhg. Datuk Nor Yahati Binti Awang
Deputy Secretary General (Environmental Sustainability), Ministry of Natural Resources and Environmental Sustainability

Panel Discussion 2: Unlocking Opportunities for Malaysia's Net Zero Future

2.35 pm **Moderator**

Mr. Ahmad Farid Mohammed
Undersecretary, Climate Change Division, Ministry of Natural Resources and Environmental Sustainability

Panellist

Ms. Shireen Jasmin Ali
Director, Industry ESG Division, MITI Malaysia

Mr. Supun Nigamuni
Managing Director, Control Union Malaysia & Papua New Guinea Control Union (M) Sdn Bhd

Mr. Abhishek Kumar
Executive Director|Head of Infrastructure Strategy, Sustainability & Transformation, KPMG Management & Risk Consulting Sdn Bhd

3.15 pm Thematic Paper Presentation*

Session 2: Advancing Climate Action: Mitigation Options for NDCs

4.00 pm **Session chair**

Dr. Mohd Khairun Anwar Uyup
Director, Forest Product Division, Forest Research Institute Malaysia

Paper 1

Malaysia's Nationally Determined Contributions

Mr. Mohd Ridzwan Ali
Sr Assistant Secretary, Climate Change Division, Ministry of Natural Resources and Environmental Sustainability

Paper 2

From Commitment to Impact: Yayasan Hijau Malaysia's Corporate Sustainability Journey

Mr. Azlan Jamil
CEO,Yayasan Hijau Malaysia

Paper 3

Potential of Carbon Pricing & Carbon Market Roles in Malaysia's NDC Mitigation Goal Attainment

Mr. Taisei Matsuki
Senior Climate Change Specialist, World Bank

4.45 pm Q & A

5.15 pm Coffee Break & End of Day 1

*please refer to thematic paper presentations for details

PROGRAMME

WEDNESDAY, 22nd APRIL 2026

Venue: Amber Jr. Ballroom

8.30 am Registration

9.00 am **Plenary Session 4: Beyond Carbon: Sarawak's Leadership in the Global Net Zero Transition**

YBrs. Dr. Kho Lip Khoon
Ministry of Energy and Environmental Sustainability, Sarawak

Panel Discussion 3: Technology and Innovation

9.20 am

Moderator

YBrs. Dr. Norwati Muhammad
Deputy Director General (Research), Forest Research Institute Malaysia

Panellist

Dr. Hamdan Omar
Senior Research Officer, Forest Research Institute Malaysia

Dato' Dr. Abdul Rashid Ab Malik
Technical Director, International Green Trends Cockpits Sdn Bhd

Dato' Tee Choon Hock
Executive Director, Eastern Steel Sdn Bhd

10.00 am Coffee break

10.30 am **Thematic Paper Presentation***

11.30 am **Plenary Session 5: Climate Change Governance**

Ms. Leah Samuel
Senior Associate, Messrs Steven Thiru Advocates & Solicitors, Kuala Lumpur

*please refer to thematic paper presentations for details

PROGRAMME

Venue: Amber Jr. Ballroom

Session 3: Climate Change Law and Related Policies

11.50 am **Session chair**

Dr. Elizabeth Philip
Head of Environment & Climate Change Programme, Forestry & Environment Division, Forest Research Institute Malaysia

Paper 1 Overview of CCUS Act 2025

Ms. Nik Nor Aiza Nik Abdul Aziz
Principal Assistant Director of Environmental Economic & Natural Resources Division, Ministry of Economy

Paper 2 Sabah Climate Change and Carbon Governance

Mr. Alexander Hastie
Interim Director, Sabah Climate Registry and Inventory Centre (SaCRIC)

Paper 3 Malaysia's National Climate Change Law

Dr. Mohd Hafdzuan Adzmi
Principal Assistant Secretary, Negotiation and Policy Unit, Ministry of Natural Resources and Environmental Sustainability

Paper 4 Malaysia's Carbon Tax

Mr. Maximilian Tariq Conrad
Principal Assistant Secretary, Economic and Fiscal Division, Ministry of Finance

12.35 pm Q & A

1.00 pm **Closing Ceremony**

YBrs. Dr. Norwati Muhammad
Deputy Director General (Research), Forest Research Institute Malaysia

Venue: Indulge Coffee House, Ground Floor

1.00 pm Lunch and networking

Thematic Paper Presentation

TUESDAY, 21st APRIL 2026

Venue: Grand Ballroom, 1st Floor

3.15 pm – 4.00 pm

Theme 1: Forest Science

Group 1

Session Facilitator:
Mr. Muhammad Affizul Misman

Paper 1

UAV Mapping in Forested Areas: A Climate-Integrated Approach to Forest Resilience and Sustainable Management

Sheriza MR, **Mohamad Aiman Irfan MS**, Adham Fayumi WS., David R.G.

Paper 2

The Survival, Growth & Biomass Estimation of *Dryobalanops oblongifolia* in Ex-tin Mine

Law TD, Ho WM, Rosdi K, Fakhri I, Mohd-Nazri MA, Mior-Muhd-Fizree-Najmudin AR & Halmi, BA

Paper 3

Physiological Responses of Two Dipterocarp Species to Free-Air CO^2 Enrichment (FACE) at Tekam Forest Reserve, Malaysia

Ho WM, Azian M, Mohd Rizal MK & Nurul Ain AM

Theme 2: Applied Mitigation & Products

Session Facilitator:
Mr. Tan Sek Aun

Paper 1

Driving Climate Change Mitigation via R&D Innovations in Sustainable Furniture Design and Manufacturing

Sharmiza A, Suffian M, Rafeadah R, Hashim WS, Khairul M, Yanti AK, Noor Azrieda AR

Paper 2

Wood in Climate Action: Dynamic Carbon Pathways through Circular Use

Geetha R & Khairul A

Paper 3

Carbon Footprint Evaluation of Wooden and Plastic Chairs: A Preliminary Analysis

Yanti AK, Sufian M, Sharmiza A, Noor Azrieda AR, Khairul M, Siti Zaliha A

PROGRAMME

Thematic Paper Presentation

WEDNESDAY, 22nd APRIL 2026

Venue: Amber Jr Ballroom

10.30 am – 11.30 am

Theme 1: Forest Science

Session Facilitator: Mr. Mohd Azahari Faidi

Group 1 — **Session Facilitator: Mr. Mohd Azahari Faidi**

Paper 1

Litter C Stocks in Varying Tropical Forest Ecosystems of Peninsular Malaysia

Jeyanny V, Norsheilla MJC, Nurmi RAH, Azian M, Siti Aisah S, Mohamad Fakhri I & Muhammad Asri

Paper 2

Deadwood Dominates Soil Organic Carbon (SOC) Dynamics Across Tropical Forests

Norsheilla MJC, Jeyanny V, Philip E, Hamdan O, Nur Hajar ZS, Azian M & Mohd Zaki A

Group 2 — **Session Facilitator: Mr. Tan Sek Aun**

Paper 1

Assessment of Forest Dynamics in Sarawak Using Multi-Temporal sentinel-2 Imagery

Sariee MNF, Omar H, Hasan NH & Yahya MS

Paper 2

Microclimate and Maternity Roost Preferences of Synanthropic *Scotophilus kuhlii* in Buildings

Nur Atiqah AR, Azhar B, Shahfiz MA & Zubaid A

Paper 3

Estimation of Soil C Stocks & Changes in Selected inland Primary Forests in Malaysia

Jeyanny, V, Mohamad Fakhri I, Philip E, Azian M, Norsheilla MJC, Mohd Syamin Aizat MY & Muhammad Asri L

PROGRAMME

PROGRAMME

Thematic Paper Presentation

WEDNESDAY, 22nd APRIL 2026

Venue: Amber Jr Ballroom

10.30 am – 11.30 am

Theme 3: Quantifying and Mitigating Greenhouse Gas Emissions in Agriculture, Forestry and Other Land Use

Session Facilitator: Mr. Muhammad Affizul Misman

Paper 1	**Quantifying The Climate Footprint: Historical GHG Emission Profiles in Malaysian Agriculture** **Mohd Saufi B**, Rozimah MRI, Mohd Aziz R, Mohd Fairuz MS & Sub-working Group GHG Inventories for Agriculture Sector
Paper 2	**Climate Smart Agriculture: Experiences from Asia** **Sing Yun Chin**, Srijita Dasgupta, Arnaud Costa, Muhammad Faheem, Bryony Taylor, Pascale Bodevin, Hong Mei Li
Paper 3	**Improving National GHG Inventories Through Cropland Carbon Stock Accounting: Impacts and Mitigation Pathways for Cropland-to-Settlement Conversion in Malaysia's LULUCF Sector** **Norsheilla MJC,** Philip E, Muhammad Afizzul M, & Wan Mohd Shukri WA
Paper 4	**Refining Enteric Methane Emission Estimates for Beef Cattle: Implications for Climate Reporting in Malaysia** **Azizi AA**, Marini AM, Mohd-Rosly S, Mohd-Hafiz AW, Mohd-Saufi B & Mohd-Fairuz MS

Assessment of Forest Dynamics in Sarawak Using Multi-Temporal Sentinel-2 Imagery

Sariee, M.N.F[1,2], Omar, H[3], Hasan, N.H[1] & Yahya, M.S[1*]

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ABSTRACT

Tropical forests play a vital role in various ecosystem services, including carbon storage and providing habitat for wildlife, yet this sensitive biome is under constant threat from anthropogenic disturbances and the accelerating impacts of climate change, such as rising temperatures, shifting rainfall patterns, and increased frequency of extreme weather events. Therefore, spatial assessment of forest structural dynamics is essential for evaluating forest vegetation conditions and structural changes. This study aims to quantify and map forest structural stability, disturbance, and regrowth in selected regions of Sarawak, between 2015 and 2025, using multi-temporal Sentinel-2 satellite imagery. Surface reflectance data were pre-processed to ensure radiometric consistency and minimise atmospheric and cloud effects. Vegetation indices, including the Normalized Difference Vegetation Index (NDVI), Normalized Burn Ratio (NBR), and Normalized Difference Moisture Index (NDMI), were derived to enhance the detection of vegetation conditions and structural changes. A Random Forest machine learning algorithm was applied to classify forest structural conditions, and time-series analysis was conducted to identify spatial and temporal transitions among stable forests, disturbed forests, and regrowth areas. The results demonstrate the capability of Sentinel-2 time-series data for monitoring tropical forest structural dynamics and provide spatial information to support sustainable forest management and long-term ecological monitoring in Sarawak.

Keywords: remote sensing, ecosystem services, anthropogenic disturbance, sustainable management,

UAV Mapping in Forested Areas: A Climate-Integrated Approach to Forest Resilience and Sustainable Management

Sheriza, M. R.[1*], Mohamad Aiman Irfan, M. S.[1], Adham Fayumi, W. S.[2] &David R, G. [2]
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A climate integrated approach has been adopted due to negligence of humans towards the security of the forested area. Therefore, accurate, frequently monitoring, low-cost and easy learned mapping techniques are required to enhanced resilience against climate variability and anthropogenic disturbances. The topic covers research using Unmanned Aerial Vehicle (UAV) in mapping of Korbu Perak Arboretum & Rainforest Center (KPARC) in Perak, and monitoring of climate variability using Internet of Things (IoT) in Miri, Sarawak and bamboo trees in INTROP, UPM. Integrating climatic datasets enhances the detection of stress regimes within mapped forest landscapes. Furthermore, the outputs are designed for integration into digital forest intelligence platforms, such as Rymba, enabling real-time visualization and risk assessment based on vegetation, soil and health indices. This climate-integrated UAV framework provides a scalable and cost-effective solution for forested area mapping, carbon management, and sustainable land-use planning in tropical forest environments.

Keywords: climate adaptation, synanthropic species, thermal ecology, environmental gradients, urban biodiversity conservation

ABSTRACT

The Survival, Growth and Biomass Estimation of *Dryobalanops Oblongifolia* in Ex-Tin Mine

Law, T.D.*, Ho, W.M., Rosdi, K., Fakhri, I., Mohd-Nazri, M.A., Mior-Muhd-Fizree-Najmudin, A.R., & Halmi, B.A.

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Carbon sequestration through afforestation activities have been conducted in an ex-tin mining site in Bidor, Perak to assist in restoration of the degraded tailings. One of the indicators on the state of restoration is the accumulation of biomass. Carbon sequestered in ex- tin mine area supports national carbon sequestration target under REDD+ framework. The survival, height and diameter increment of Dryobalanops oblongifolia was assessed to determine the growth performance of the species in afforestation of the ex-tin mine. The above ground biomass accumulated was then estimated by using allometric equations with predictors of height and diameter measurements and wood density derived from global database. The 26-year-old plot with planting density of 500 trees/ha recorded mean annual increment of height (MAIH) and diameter at breast height (MAID) of 1.0 ± 0.2 m/yr and 1.4 ± 0.5 cm/yr respectively. The biomass accumulated in this study was compared with other studies to indicate the biomass accumulation performance in relative to other plantation and natural forest. Therefore, the afforestation using D. oblongifolia can be concluded success in ex-tin mine based on the biomass estimated.

Keywords: growth, biomass, dipterocarp, carbon sequestration, ex-tin mine

ABSTRACT

Physiological Responses of Two Dipterocarp Species to Free-Air CO_2 Enrichment (FACE) at Tekam Forest Reserve, Malaysia

Ho W.M.[1*], Azian M.[2], Mohd Rizal M.K.[2] and Nurul Ain A.M.[3]

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ABSTRACT

Rising global temperatures and increasingly unpredictable climate patterns have intensified interest in understanding the impacts of climate change on forest ecosystems. Forests play a critical role in climate mitigation by sequestration carbon dioxide (CO_2) in both biomass and soils. Although elevated CO_2 is often associated with increased photosynthesis and plant growth, responses under natural conditions remain uncertain. This study was initiated to investigate the effects of elevated CO2 on tropical dipterocarp species using a Free-AirCO2 enrichment (FACE) system compared to a natural forest environment in Tekam Forest Reserve. Two species, Rubroshorea leprosula and R. lepidota, were examined under FACE condition and compared with trees in a natural forest as control. Net photosynthetic rate (Pn), stomatal conductance (Gs) and transpiration rate (Tr) were measured using LI-6400 portable photosynthesis system. Results Revealed distinct light-response curves between treatments, with control trees exhibiting higher Pn and Gs, resulting in greater water-use efficiency (WUE). This finding suggest that elevated CO_2 does not necessarily enhance physiological performance under field conditions, highlighting the complexity of plant responses in tropical forests.

Keywords: elevated CO_2, carbon assimilation, meranti, carbon sequestration, adaptation

ABSTRACT

Driving Climate Change Mitigation via R&D Innovations in Sustainable Furniture Design and Manufacturing

Sharmiza Adnan*, Suffian Misran, Rafeadah Rusli, Hashim W Samsi, Khairul Masseat, Yanti A Kadir, Noor Azrieda Abd. Rashid

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Abstract

Malaysia remains a global leader in furniture exports, reaching an export value of MYR 10.6 billion in 2025. However, as climate change becomes a pivotal concern in global markets, new non-tariff trade barriers have emerged. To address these challenges and prepare the Malaysian furniture industry for the global stage, FRIM was awarded a 12th Malaysian Plan Development Project Grant titled 'Driving the Growth of the National Green Furniture Industry for Domestic and International Markets Through Research, Technology and Product Certification'. The project's scope encompassed the design and prototyping of green furniture, a pilot study for industry-level certification, the establishment of built- in furniture specifications for development projects and the creation of a green furniture database. This five-year research initiative successfully produced over 200 green furniture designs, with nearly 100 prototypes manufactured and performance-tested against internationally recognized standards. In collaboration with various stakeholders, technical criteria documents for green furniture and doors were published to guide the industry in meeting green market requirements. Several local manufacturers have since achieved certification under these criteria, demonstrating the Malaysian furniture industry's readiness to adopt climate change mitigation strategies. Consequently, FRIM's green furniture certification scheme is now recognized as an official verification partner for the MyHijau program. Furthermore, the project successfully initiated the development of new Malaysian Standards for green furniture and conducted preliminary Carbon Footprint assessments for several product types. Despite these achievements, implementation revealed challenges that necessitate further research. Notably, the lack of baseline information for Life Cycle Assessments (LCA) of local products makes it difficult for manufacturers and consumers to benchmark market offerings. Consequently, future R&D must focus on establishing these baselines to empower the Malaysian furniture industry to collectively reduce its product carbon footprint.

Keywords: green furniture, innovation, climate change mitigation, green certification

Wood in Climate Action: Dynamic Carbon Pathways through Circular Use

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Wood is a renewable and sustainable material that contributes to climate change mitigation by storing carbon absorbed during tree growth. Beyond primary production, the circular use of discarded wood products provides additional environmental benefits by extending material life, reducing demand for solid wood, minimizing waste, and lowering greenhouse gas emissions associated with disposal. By reprocessing used wood into new products, carbon already stored in the wood is preserved, and resources are used more efficiently, aligning with circular economy and sustainability principles. This study focuses on the transformation of discarded school furniture into new, valuable wood products in Malaysia, demonstrating practical applications of circular timber strategies. Carbon content and service life of the reused products were quantified, and dynamic modeling was applied to project carbon storage and avoided emissions over multiple lifespans. Results demonstrate that reuse preserves significant carbon stocks while reducing emissions associated with waste management and new timber production. These findings highlight the potential of circular timber practices to support sustainable resource management, low carbon, and national climate action goals. By integrating carbon storage with efficient material use, the circular reuse of discarded wood provides a scalable and practical approach to enhance the climate benefits of the timber sector.

Keywords: carbon storage, circular economy, sustainability, climate, wood

ABSTRACT

ABSTRACT

Carbon Footprint Evaluation of Wooden and Plastic Chairs: A Preliminary Analysis

Yanti AK [1] *, Sufian M.[1], Sharmiza A.[1], Noor Azrieda AR.[1], Khairul M.[1], Siti Zaliha A.[1], Hashim WS. [1], Rafaedah R.[1], Ghazali T.[2], Edlan R.[2].

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This preliminary study evaluates the Product Carbon Footprint (CFP) of wooden and plastic chairs to quantify greenhouse gas emissions associated with their manufacturing processes. Two representative products were assessed: a plastic chair (MS938C Magnum Side Chair) made from virgin polypropylene homopolymer, and a wooden chair (Hevea wood Primary School Chair). A cradle-to-gate system boundary was applied to the plastic chair, while a gate-to-gate approach was used for the wooden chair. Emission inventories were developed using secondary data databases, complemented by local electricity grid emission factors. The results indicate that the wooden chair exhibits carbon footprint, estimated at 5.21 kg CO_2e per functional unit and 7.01–11.99 kg CO_2e for the plastic chair. Emissions from the wooden chair are relatively balanced between material processing (53%) and manufacturing (47%). In contrast, emissions from the plastic chair are dominated by raw material production, contributing approximately 85% of total emissions. The study highlights distinct emission hotspots, providing a baseline for future life cycle assessments and supporting more sustainable material selection in furniture design and manufacturing.

Keyword: Product Carbon Footprint

Litter C Stocks in Varying Tropical Forest Ecosystems of Peninsular Malaysia

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Litter is an important fraction related to soil carbon where the turnover and mineralization provides accumulation of soil carbon. Different forest ecosystems accumulate litter on the ground. The current study compiled the leaf litter C stocks in various ecosystems, mainly mangroves, peat swamps, inland and plantation forests. A 100 x 100 m plot was established in each ecosystem, where litter was collected using a 1m^2 frame yielding 5 replicates to represent each ecosystem. Leaf litter samples were oven-dried for 72 hours at 65°C and later ground for C analysis, and then converted to litter C stocks according to forest types. Overall, litter C stocks ranged between 0.36 6.53 tC ha^{-1}. The current median litter C stock value was 1.00 tC ha^{-1}, which was common for the tropics. Litter stocks were governed by amount of litterfall, rate of decomposition, climatic variables, litter quality, vegetation, species diversity and soil macrofauna.

Keywords: organic material; leaf litter; tropics; carbon assessment

ABSTRACT

Estimation of Soil C Stocks and Changes in Selected Inland Primary Forests in Malaysia

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ABSTRACT

Undisturbed primary inland forests are known to accumulate carbon stocks, close to 200 tC ha^{-1} over long periods where soils are known to accumulate at least 1/3 of the value (± 66 tC ha^{-1} in 30 cm depths due to limited soil mixing, low erosion rates, and the preservation of soil aggregates that physically protect organic carbon from decomposition. These ecosystems play a crucial role in the global carbon cycle, acting as either a significant carbon sink or source. This study aims to compile historical and current data on soil carbon stocks in Malaysia's primary inland forests and assess changes over two different periods to provide baseline information on the annual fluctuations in soil organic carbon stocks. Soil carbon stocks were calculated by multiplying the organic C (%) with depth interval (cm) and the bulk density values (g cm^{-3}). Stock change method was used to estimatecarbon stocks betweenthe two periods according to carbon stock change per unit area. Values in negative represented carbon sinks and values in positive as carbon source. Overall, soil C stocks ranged between 34.12 93.21 tC ha^{-1} and the annual soil C stock change recorded between -0.32 to - 1.88 tC ha^{-1} yr^{-1} as carbon sinks. The current median soil C stock value of 62.30 tC ha^{-1} was 3 fold higher, compared with historical findings (22.50 tC ha^{-1}). However, concrete efforts are needed for long term conservation strategies for primary inland forest to sequester carbon for climate change mitigation.

Keywords: carbon sequestration potential; soil organic carbon; climate change mitigation; undisturbed forest; stock change method

Deadwood dominates Soil Organic Carbon (SOC) Dynamics across tropical forests

Norsheilla MJC.[1*], Jeyanny V[2], Elizabeth P[1], Hamdan O[1], Nur Hajar ZS[1], Azian M[1]& Mohd Zaki A[1]

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ABSTRACT

Abstract: *Deadwood represents a critical pathway for carbon transfer from living biomass to soil organic carbon (CSOC), yet it remains poorly quantified in tropical forest carbon budgets and is largely omitted from Land Use, Land-Use Change and Forestry (LULUCF) greenhouse gas (GHG) inventories. This omission contributes to uncertainty in emissions estimates, particularly in systems experiencing disturbance and rapid biomass turnover. Despite its recognized ecological role, the contribution of coarse woody debris to soil carbon formation and stabilization has not been consistently integrated into carbon accounting frameworks. Here, we assess CSOC dynamics associated with deadwood across five tropical ecosystem types: inland virgin forest, logged forest, state land, peat swamp forest, and mangrove systems. In inland virgin forests, CSOC exhibited high temporal variability (0.1037–0.3888), driven by gap-phase dynamics in which mortality of emergent trees generates episodic inputs of coarse woody debris and localized soil carbon enrichment. Logged forests showed a pronounced non-linear (U-shaped) trajectory, with CSOC declining sharply from 0.1763–0.5288 to 0.0658–0.1974 within the first decade post-harvest due to transient decomposition pulses that exceed short-term sequestration capacity, followed by recovery (0.073–0.219) as secondary forest structure and productivity increase. In contrast, stateland systems maintained persistently low CSOC levels (0.018–0.057), reflecting sustained disruption of detrital carbon inputs through biomass removal. Peat swamp forests demonstrated high sensitivity to hydrological disturbance, with degraded systems experiencing rapid CSOC losses (0.078–0.548 to 0.021–0.15) within one year following drainage, driven by accelerated aerobic decomposition. Conversely, mangrove ecosystems exhibited the highest CSOC retention, where anoxic, waterlogged, and saline conditions suppress decomposition and enhance long-term carbon stabilization. These findings demonstrate that deadwood is a dominant mediator of carbon transfer to soils, regulating both short-term carbon fluxes and long-term sequestration across tropical forest systems. The exclusion of deadwood-mediated carbon pathways from LULUCF accounting frameworks risks systematic misrepresentation of soil carbon stocks and fluxes, particularly in disturbed and hydrologically altered landscapes. Incorporating deadwood pools and their decomposition dynamics into national GHG inventories is therefore essential to reduce uncertainty, improve emission estimates, and strengthen the scientific basis of climate mitigation strategies in tropical regions.*

Keywords: coarse woody debris, soil organic carbon, carbon transfer, LULUCF, greenhouse gas

Microclimate and Maternity Roost Preferences of Synanthropic *Scotophilus kuhlii* in Buildings

Nur Atiqah A.R.[1,4*], Azhar, B. [2,3], Shahfiz, M.A.[1]& Zubaid, A.[4]

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The lesser Asiatic yellow bat (Scotophilus kuhlii) is an insectivorous species that provides essential ecosystem services by regulating local insect populations. As a synanthropic bat, it commonly uses building structures as roosting sites. Buildings act as critical, warm maternity roosts for bats, boosting survival by fostering juvenile development. Ecological information on this species in Malaysia remains limited, particularly regarding microclimate in roost selection. This study investigated the influence of microclimate on roost-site selection by comparing temperature and relative humidity across occupied and unoccupied buildings within oil palm plantations and suburban landscapes; data were recorded using HOBO Pro Series loggers in Selangor and Pahang, Malaysia. Results showed that S. kuhlii consistently preferred roosts characterised by higher temperatures and lower humidity for both landscapes. In oil palm plantation, preferred roosts exhibited a mean temperature of 29.4 ± 0.4°C and relative humidity of 71.7 ± 1.5%, whereas in suburban landscape selected roosts averaged 28.4 ± 0.2°C and 77.7 ± 1.5%. The female S. kuhlii were documented to utilise similar day roosts as maternity sites as the buildings provided a higher temperature and more thermally stable microclimatic conditions relative to ambient temperature. By demonstrating that S. kuhlii selectively occupies specific microhabitats within anthropogenic structures, this study provides the baseline parameters necessary to design artificial roosts for the species in modified environments.

Keywords: Roost selection, anthropogenic landscapes, human–wildlife interactions, Chiroptera conservation, reproduction

ABSTRACT

Quantifying the Climate Footprint: Historical Greenhouse Gas Emission Profiles in Malaysian Agriculture

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Over the last three decades, greenhouse gas (GHG) emissions from Malaysia's agricultural sector have climbed by 14.9% relative to 1990 levels. Driven primarily by intensified production to meet the food security needs of a growing population, this upward trend is most visible in the sharp rise of nitrous oxide (N_20) and carbon dioxide (CO_2), which increased by 45.7% and 38.7%, respectively. Key emission pathways include from managed soils and nitrogen leaching, methane (CH_4) from flooded rice cultivation and enteric fermentation, and various manure management systems. By 2021, the sector generated 7,310.04 Gg-CO_2 equivalent, representing 2.20% of Malaysia's national GHG profile. Although the total volume is relatively modest, the sector's high concentration of potent non-CO_2 gases, specifically, CH_4 (55%) and N_2O (39%), marks it as a critical priority for climate mitigation. As Malaysia's population surpasses 37 million, the resulting pressure on food systems necessitates integrated strategies that balance emission reductions with the essential goals of agricultural productivity and national self-sufficiency.

Keywords: greenhouse gas, agriculture methane, climate change, managed soils, rice cultivation

ABSTRACT

Climate Smart Agriculture: Experiences from Asia

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Climate change is exerting increasing pressure on all ecosystems in the planet, including agricultural systems across Asia. Rising temperatures, erratic rainfall, and more frequent extreme weather events are disrupting crop production, degrading soil, and intensifying water scarcity and pest outbreaks. Erratic changes of weather related to climate change threaten food security, rural livelihood, and socio- economic development. Climate-Smart Agriculture (CSA) has emerged as an integrated framework to address these challenges by simultaneously enhancing productivity, strengthening adaptive capacity, and reducing greenhouse gas emissions. Evidence from projects conducted by CAB International (CABI) demonstrates its potential and effectiveness as a context specific and system-based approach in addressing the compounding climate change risks. The "Pest Smart" initiative in Laos, Cambodia, and Vietnam has supported farmers through ecological engineering in rice fields and nature-based solutions driven pest management, use of plant clinics to support farmer queries, and early warning systems, resulting in reduced pesticide use and improved knowledge. In Indonesia, climate-resilient coffee farmer groups have been developed with focus on women's participation, Farmer Group Educator (FGE) training sessions, and the introduction of biochar technologies that improve soil health, utilize agricultural waste, and contribute to carbon sequestration. Additional innovations, such the Pest Risk Information Service (PRISE) and plant disease risk mapping using Earth observation and climate data support timely decision-making for farmers by forecasting the risk of crop pest outbreaks. The findings underscore CSA as a flexible, context-specific and scalable pathway that integrates technology, knowledge, and institutional support to build more resilient, sustainable, and inclusive agricultural systems in the face of climate change.

Keywords: climate change, food security and livelihoods, agricultural resilience, sustainable food system, farmer adaptation

ABSTRACT

Improving National GHG Inventories Through Cropland Carbon Stock Accounting: Impacts & Mitigation Pathways for Cropland-to-Settlement Conversion in Malaysia's LULUCF Sector

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ABSTRACT

Accurate representation of land use change emissions is essential for robust national greenhouse gas (GHG) inventories under the Land Use, Land-Use Change and Forestry (LULUCF) sector. Croplands constitute a significant managed carbon stock within terrestrial systems, and their conversion to settlements results in direct carbon stock loss and measurable CO_2 emissions. However, this transition remains insufficiently captured in current accounting frameworks, creating uncertainty in national emission estimates and limiting the effectiveness of land-based mitigation strategies. Strengthening cropland carbon stock quantification and integrating land conversion dynamics into GHG reporting therefore represents a key opportunity to enhance inventory accuracy and policy relevance. This study quantifies CO_2 emissions associated with cropland-to-settlement conversion across Malaysia from 2014 to 2018 using the 2006 IPCC Guidelines (Tier 2 methodology), supported by satellite-derived land use change analysis. The assessment covers major cropland systems, including oil palm, rubber, and mixed agricultural landscapes (paddy, cocoa, coconut, vegetables, grassland, and home gardens), all of which store significant carbon prior to conversion. Results indicate that conversion was predominantly driven by "other crops," reflecting the high vulnerability of smallholder and mixed farming systems to urban expansion. Over the study period, approximately 0.1 million hectares of cropland were converted to settlements, resulting in increasing emissions from 1,019 $GgCO_2$ in 2015 to 2,241 $GgCO_2$ in 2018. This trend demonstrates that cropland conversion is a growing and important contributor to LULUCF sector emissions and highlights the need for improved tracking of land use transitions in national GHG inventories. These findings provide a direct basis for strengthening national GHG inventory systems and informing mitigation actions. Integrating cropland carbon stock mapping into LULUCF accounting can support low-carbon land use zoning and help identify high- carbon agricultural areas that should be prioritized for conservation. Where land conversion is unavoidable, compensatory mitigation measures such as urban greening, peri-urban afforestation, and mandatory landscape restoration can be implemented to offset carbon losses. In addition, incorporating cropland carbon data into planning regulations can enable carbon-informed development approval systems, ensuring that emission impacts are considered in land conversion decisions. Finally, expanding satellite-based monitoring and embedding cropland carbon accounting into national reporting frameworks will improve transparency, reduce uncertainty, and strengthen Malaysia's capacity to implement evidence-based climate mitigation policies.

Keywords: IPCC Tier 2, carbon accounting, climate mitigation

Refining Enteric Methane Emission Estimates for Beef Cattle: Implications for Climate Reporting in Malaysia

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Accurate estimation of enteric methane (CH_4) emissions is essential for improving national greenhouse gas inventories and informing mitigation strategies. This study compares enteric CH_4 emission factors (EF) and emission intensities between Elite Kedah-Kelantan (KK) and Brakmas cattle under local conditions. Brakmas cattle generally exhibit higher EFs than Elite KK, except in the grower/finisher stage, where differences are influenced by shorter production duration (90 days vs. 140 days). Emission intensity for growers is slightly lower in Elite KK (0.367 kg CH_4/kg live weight) compared to Brakmas (0.371 kg CH_4/kg live weight), with similar average daily gain. Pooled EF values across age groups are lower than the IPCC default, with Elite KK at 38.7 kg CH_4/head/year (21.5% lower) and Brakmas at 41.3 kg CH_4/head/year. However, using EFs from mature animals results in higher emission estimates, with Elite KK and Brakmas exceeding IPCC-based estimates by 9.58% and 24.8%, respectively. These findings highlight the importance of adopting country-specific emission factors to improve accuracy in emissions estimation and support targeted methane mitigation strategies in the livestock sector.

Keywords: emission factor, beef cattle, methane, emission intensity, country specific

ABSTRACT

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