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7th International Conference on Tropical Resources and Sustainable Science

*Tropical Nexus:
Integrating Science, Innovation, and Sustainability*

Abstract Book

Hotel Pangeran Pekanbaru,
Riau, Indonesia
& Hybrid Conference

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**ABSTRACT
BOOK**

***7TH International
Conference on Tropical
Resources and
Sustainable Science***

**Tropical Nexus: Integrating Science,
Innovation and Sustainability**

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KEYNOTE ADDRESS (PHYSICAL)

Sustainable Fisheries from a Marine Environmental Sedimentology Perspective

Prof. Dr. Ir. Rifardi

**Faculty of Fisheries and Marine,
Universitas Riau Pekanbaru, Indonesia.**



Something wrong in Fisheries...is not a new idea at all. The situation has been discussed for a long time by any personnel working in Fisheries industry, including fishermen themselves. Researchers and scientists have been also trying to give the scientific warning for a long time. This is the cover-page of Newsweek magazine on 1994, and may be the first case on the world-class mass-communication to give the sensational warning to the common people. The warning message is too many fishermen, and too few fish!. Future tasks in fisheries, as the solution to poverty, we should offer the sufficient job opportunity to the people and, as the solution to hunger, we should offer the sufficient fish for the people and, the establishment of job opportunity and food security should be done on the sustainable level of fisheries development, with the best environmental awareness by the people themselves (Arimoto presentation, 2005).

Degradation of aquatic resources is generally caused by quite high pressure on the waters and fish resources they contain in it, as a result of uncontrolled socio-economic activity. Activity the economy often produces waste that can pollute waters, resulting in ultimately it will affect fish resources. An increase in the concentration of suspended sediment in waters can be caused

by these activities and is natural processes. To conserve and sustainably use the oceans, sea and marine resources for sustainable development, All activities that cause increased sedimentation processes must be reduced to the level of natural waters conditions. If this level is reached, the negative impact of the sedimentation process on the biological, physical and chemical quality of waters can be prevented. This impact is shown by research results that the sedimentation process dominantly (87%) determines the percentage of live hard coral cover in the waters of Setan Island, West Sumatra, Indonesia, and high total Suspended Solid (TSS) range from 1,848 - 2,669 mg/l causes the loss of water's ability to absorb carbon 18.33 ton/ha/year at Bagan Estuary-Indonesia and also the decline in fisheries production in the estuary. The highest of suspended sediment concentration was distributed in the Rupert Strait from the mouth of the Mesjid River as far as ± 3.3 km, the concentration ranges between 0.0001 kg/m^3 - 0.0013 kg/m^3 (current velocity: 0.2 - 0.45 meters/second), indicating that suspended particles/sediment are very easily distributed even though the current is weak.

KEYNOTE ADDRESS (ONLINE)

Ethnopharmacology in the Asia-Pacific: A Journey Through Traditional Remedies and Modern Applications: The Case of Sabah (East Malaysia)

Assoc. Prof. Dr. Christophe Wiart
Institute of Tropical Biology and Conservation,
University Malaysia Sabah, Malaysia.



Sabah is home to a wide variety of ethnic groups, traditional medicinal practices, and endemic plant species, making it one of the most promising sources of potential drug discoveries. This lecture will present data on the historical background, the diverse ethnic communities, and the medicinal plants utilized by these groups. It will discuss the therapeutic potential of selected plant species and highlight a few promising candidates. The current state of knowledge regarding the toxicity of these plants will also be addressed. Finally, strategies for further research and development will be outlined.

INVITED SPEAKER I (ONLINE)

Theme: Sustainability and Technology

Biotechnological Strategies for Greenhouse Gas Mitigation toward a Sustainable Low-Carbon Future

Dr. Pankaj Kumar

**Head of the Department,
Department of Earth &
Environmental Science,
Faculty of Applied Sciences,
Parul University, India**



Innovative biotechnological solutions have been transforming nearly every field for the better, from medicine and agriculture to industry, food, and nutrition. While these advancements are driving significant progress and helping us achieve new milestones, they are also accompanied by unintended consequences. Chief among these is the rising release of greenhouse gases, which is placing an increasing burden on our planet and accelerating global climate change. Biotechnological solutions are revolutionizing efforts to reduce greenhouse gas emissions and support the transition to a sustainable, low-carbon economy. As rising levels of CO₂, CH₄, and N₂O continue to threaten global climate stability, integrated strategies involving the use of engineered microorganisms for carbon capture and utilization, enhancing photosynthetic efficiency in plants and algae, and converting agricultural and industrial wastes into valuable biofuels and bioproducts have emerged as tools for mitigating some of their effects. Advanced genomics is being applied to reduce methane emissions from ruminant livestock, while synthetic biology and environmental biotechnology are opening new possibilities for ecosystem remediation and long-term carbon sequestration. The synergistic adoption of these approaches, when aligned with supportive policies and the development of circular economies, has the potential to reduce GHG emissions significantly.

INVITED SPEAKER 2 (ONLINE)

Theme: Geosciences

Geologic Hydrogen Potential from Ophiolitic Rock in Sulawesi, Indonesia: A New Perspective

Prof. Dr. Eng. Adi Maulana

**Vice Rector for Partnership,
Innovation, Business and
Entrepreneurship,
Universitas Hasanuddin, Indonesia**



The global shift toward low-carbon energy systems has increased interest in natural or geologic hydrogen as a clean, sustainable energy source. The main process for geologic hydrogen formation is serpentinization, where ultramafic rocks rich in olivine and pyroxene react with water, causing ferrous iron (Fe^{2+}) to oxidize into ferric iron (Fe^{3+}), producing magnetite and releasing hydrogen gas (H_2). Other pathways include water radiolysis from natural radioactivity, oxidation of reduced minerals like sulfides, thermal breakdown of hydroxyl-containing minerals during metamorphism, and degassing of reduced gases from the mantle or magmatic sources. Faults and fractures promote these reactions by allowing fluid movement, making serpentinized ultramafic environments especially favorable for hydrogen production.

Sulawesi, Indonesia, located at the tectonic boundary of the Australian, Eurasian, and Pacific plates, has extensive exposures of ultramafic rocks within major ophiolite belts such as the East Sulawesi Ophiolite. These rocks, mainly peridotites (harzburgite and lherzolite), show widespread serpentinization facilitated by tectonic fracturing and fluid infiltration, which create conditions favorable for hydrogen generation. Geological evidence from Southeast, Central,

and South Sulawesi shows high levels of serpentinization, active fault systems, and hydrogen-rich springs, highlighting the region's potential as a natural hydrogen resource.

This paper reviews the geological setting, hydrogen formation mechanisms, and exploration potential of Sulawesi's ultramafic terrains, focusing on serpentinization in the East Sulawesi Ophiolite. The findings emphasize the importance of integrated geological mapping, geochemical surveys, and targeted exploration to determine economic feasibility. Developing geological hydrogen resources in Indonesia could greatly support the country's clean energy goals and the global energy transition.

INVITED SPEAKER 3 (ONLINE)

Theme: Environmental Economics

Cultivation Innovation of Chinese Medicinal Herbs under Forest

Prof. Dr. Shi Rui

Vice Dean, College of Forestry,
Southwest Forestry University, China



Under forest cultivation of Chinese medicinal herbs leverages the forest's natural microclimate with moderate temperature, humidity, and reduced light intensity to support shade-tolerant species such as *Gastrodia elata*. This practice promotes sustainable agriculture by utilizing underused forest areas while protecting arable land and enriching ecosystem health. Medicinal herb root systems contribute to nitrogen fixation and soil improvement, enhancing forest stability and long-term agricultural resilience. Innovative techniques include intercropping herbs with varied growth cycles and nutrient requirements. Short-cycle herbs are harvested earlier, allowing longer-cycle species to mature, thereby improving land-use efficiency and diversifying income. Biological pest control using natural predators like ladybugs reduces chemical pesticide dependence and ensures product safety through ecological balance. Despite these advantages, practitioners face technical and market challenges. Limited expertise in seed selection, planting density, and field management underscores the need for targeted training programs. Market access is constrained by weak distribution channels. Collaborations with pharmaceutical and traditional medicine enterprises, combined with strategic branding, are essential for stable sales. Established regions such as Gansu for *Angelica sinensis* and Sichuan for

Chuanxiong dominate production, while new cultivation areas contribute to regional diversification. Growing demand in domestic and international markets increases the need for stringent quality control. Standardized practices for cultivation, origin verification, and postharvest processing are crucial to ensure competitiveness and regulatory compliance. High-quality development of the industry requires advances in four areas. First, genetic research should focus on high-yield, potent, and resilient herb varieties. Second, standardized protocols for cultivation and processing must be implemented. Third, upstream cultivation and downstream pharmaceutical sectors should be better integrated, with potential for cross-sector collaboration through e-commerce and tourism. Finally, professional talent must be nurtured through academic programs and continuous training to ensure adaptability and industry growth.

Biological Diversity and Conservation

Plant and animal ecology,
taxonomy, genetics, forest
management



BC-001 Assessing the Status of *Rafflesia* Populations and Their Threats in the Lojing Highlands, Kelantan

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Abstract. Malaysia, recognized as one of mega-diverse hotspots, is currently facing a decline of many endangered and rare species due to natural and anthropogenic factors. Despite being threatened, the population of *Rafflesia kerrii* in Lojing Highlands is still present, but in smaller numbers compared to a decade ago. Therefore, an intensive survey was conducted in *Rafflesia* Conservation Park, Lojing Highlands, covering three main sites (Beirus-Dawai; Cebur; Cebur-1Malaysia) to assess the status and threats of *Rafflesia*. A standard criterion status was employed to classify the population into four categories, namely: (i) Active; (ii) Poorly active; (iii) Dormant; and (iv) Extinct. Results show that *R. kerrii* populations in the study areas are still promising with a total of 20 populations and 52 clusters recorded. Of these, 92.31% were classified as active, 5.77% as poorly active, and 1.92% as dormant, found at elevation ranging from 930 to 1,054 meters above sea level (asl.). Despite the positive population indicators, the survey revealed irresponsible action, including the cutting of *Rafflesia* host plants. This factor causes the threats to the long-term viability of *Rafflesia* populations. Therefore, an effective management plan for *Rafflesia* should be implemented to ensure the sustainable protection of *R. kerrii* in this area.

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BC-002 Species diversity of butterflies (Lepidoptera: Rhopalocera) in an urban forest ecosystem, Hutan Bandar Jeli, Kelantan

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Abstract. Urban green spaces are vital refuges for biodiversity within an expanding cityscapes, yet butterfly diversity in these settings remains insufficiently documented in Malaysia. This study presents the first checklist of butterflies (Lepidoptera: Rhopalocera) in Hutan Bandar Jeli, Kelantan. Field sampling was conducted for 15 consecutive days using fruit-baited traps and aerial nets. In total, 246 butterflies belonging to 38 species from 11 subfamilies were recorded. *Mycalesis mineus* was the most abundant species, accounting for 41 individuals suggesting its strong ecological adaptability to urban forest environments and potential as an indicator species for habitat quality in disturbed landscapes. Meanwhile, 15 species were recorded as singletons reflecting the presence of rare or less commonly encountered taxa. Diversity indices indicates a moderately high species richness and a relatively even distribution of individuals across species (Shannon-Wiener Index (H') = 2.81; Margalef's Richness Index (D_{mg}) = 6.72; Pielou's Evenness Index (J') = 0.77). The species accumulation curve (SAC) reached an asymptote, suggesting sampling adequacy and that most species present were detected. These findings provide essential baseline data for ecological monitoring and support the conservation value of urban green spaces. The results further emphasize the importance of integrating biodiversity considerations into urban planning and green space management.

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BC-003 Mangrove Checklist in the Sulaman Lake, Tuaran, Sabah

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Abstract. Sulaman Lake is located in Tuaran-Kota Belud, Sabah has a direct connection to the ocean. The village has benefitted from the lake's resources, which include mangrove forests and seafood. The aim of this survey is to create a list of the mangrove species found around Sulaman Lake. The survey was conducted at Zone 1 within Sulaman Lake and Sungai Kindu, Zone 3 located in Kampung Serusop, and Zone 4 is at Sungai Betutai. Most trees were identified in the field while, voucher specimens were used for species identification for trees that require further. A total of 24 mangrove species were identified throughout this floral survey with 12 species were exclusive mangroves, while the remaining 12 species were associate mangroves. Kampung Serusop was noted for having the greatest number of mangrove species found (18 species), followed by Sungai Betutai with 9 species identified, Sungai Kindu with 7 species of mangroves, and Sulaman Lake region with 5 species identified.

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BC-004 Advertisement Calls of Seven Species of Sarawak Frogs from Family Megophryidae

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Abstract. The vocalization patterns of frogs in the family Megophryidae from Sarawak, Malaysia, play a crucial role in their behavioural ecology. This study aims to document and analyse the advertisement calls of seven Megophryidae species across diverse habitats in Sarawak. Using field recordings and acoustic analysis, distinct call characteristics, including frequency, duration, and temporal patterns, were identified. Advertisement calls were recorded and analysed using SoundRuler Acoustic Analysis (ver. 0.9.6.0) and Praat Acoustic Software, allowing for species differentiation based on call parameters. The results revealed species-specific variations in vocalization, with pulse note count, note repetition rate, and dominant frequency emerging as the most distinguishing features. *Leptobrachium ingeri* exhibited the highest number of pulse notes per call, while *Leptobrachella gracilis* demonstrated the fastest note repetition rate, and *Leptobrachella mjobergi* produced the highest dominant frequency. These findings enhance our understanding of species-specific vocalizations and their ecological significance, particularly in mate selection, territorial defence, and environmental adaptation. This study underscores the importance of acoustic monitoring in biodiversity conservation and provides a foundation for future research on amphibian communication in tropical ecosystems.

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BC-006 Evaluating Microclimate Impacts on Post-Fire Vegetation Recovery in BRIS Soils

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Abstract. This study investigates vegetation recovery patterns in fire-affected coastal sandy (BRIS) soils at Taman Rimba Ilmu Tanah BRIS, UniSZA Besut Campus. Analysis of 12 study plots reveals that these nutrient-poor soils (pH 6.6-7.0, 0-1.5% moisture) maintain high humidity (72.4% average) through coastal influences, creating favourable conditions for post-fire regeneration despite challenging edaphic conditions. The recovering vegetation community demonstrates strong dominance by fire-adapted pioneer species. *Acacia mangium* and *Melaleuca cajuputi* emerge as successful colonizers, while *Catunaregam tomentosa* shows universal presence across all plots, confirming its fire resilience. Plot 4 exhibits advanced recovery with mature trees (25 cm in diameter and 17.4 m in height), indicating either fire survival or accelerated growth. Variable ground cover (3-50%) reflects spatial heterogeneity in fire impacts. The coastal microclimate critically supports post-fire ecosystem recovery by maintaining high humidity levels that counteract the rapid drainage of sandy BRIS soils, creating favourable conditions for vegetation regeneration. This humidity buffering enables both rapid colonization by pioneer species and the persistence of mature trees with field data showing particularly robust growth under these microclimatic conditions. These findings directly inform that coastal restoration strategies by highlighting the importance of selecting native, fire-resilient species, while underscoring the need for future research to examine long-term successional patterns and climate change impacts on these recovery dynamics.

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BC-007 Potential Effect of Growing *Melastoma malabathricum* with the Addition of Bamboo Biochar (BB) and EDTA in Removing Soil Heavy Metals Contamination

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Abstract. A study was conducted to investigate the potential effect of growing *Melastoma malabathricum* with the addition of bamboo biochar (BB) and ethylenediaminetetraacetic acid (EDTA) in reducing soil heavy metals. Soils from the Chini watershed, a Man and Biosphere Reserve by UNESCO, which faces mining activities, were collected, analysed, and used for a greenhouse experiment. The experiment was set up with five treatments by growing *M. malabathricum* with BB and/or EDTA, a control, and blank (organic soil). *M. malabathricum* demonstrated robust growth throughout the experiment, displaying no common phytotoxic symptoms when growing with the contaminated soil. Applying BB and EDTA gradually increased 50% of plant height and biomass, among other treatments. Similar treatment also enhanced the uptake of heavy metals such as Fe (42%), As (62%), Pb (83%), Cr (88%), and Al (5%) compared to the control. Furthermore, this treatment also had the highest efficiency in phytoextraction and reduction of 1.67-fold Fe, 3-fold As, 4-fold Pb, 5-fold Cr, and 1.38-fold Al from the soil compared to the control. Growing *M. malabathricum* with BB and EDTA additions was a promising method in reducing soil heavy metals, making it beneficial for restoration efforts at ex-mining sites, particularly at the Chini watershed in future

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BC-008 Determination of Macroinvertebrates Benthic Ecological Index for River Health Assessment

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Abstract. To ensure the sustainability of rivers, relying solely on physicochemical water quality parameters as indicators is insufficient. This approach primarily assesses the quality of water, overlooking the fact that rivers possess their unique ecosystems, with aquatic life being a critical component beyond just the water itself. Consequently, the health of a river is better assessed through the status of its aquatic life. To address this issue, a study was conducted to develop an Ecological Index based on macrobenthos as a reliable indicator for evaluating river health. Three rivers in the state of Johor have been chosen as sources for this study was Sungai Mengkibol, Sungai Madek, and Sungai Dengar, each representing distinct types of land use. Reference and impaired sites have been identified based on various criteria, including physicochemical parameters, instream features, and the quality of the riparian habitat. A total of eight sampling stations were established, which included six impact stations and two reference stations. To collect benthic macroinvertebrates, a Surber net with a mesh size of 500 microns, combined with a rectangular quadrat measuring 30 cm x 30 cm (0.09 m²), was utilized. Various ecological indices were employed to calculate diversity (Shannon-Wiener Index), richness (Margalef Index), evenness (Hill Index), and dominance (Simpson's Index). The findings demonstrate that benthic macroinvertebrate diversity and abundance decrease significantly in areas affected by saltwater intrusion, with the upstream site (Station 1) recording the highest species richness (10 species, 141 individuals). In comparison, the downstream site (Station 3) had only three species and 41 individuals. Ecological indices further support this pattern for healthy river conditions, the Diversity Index was greater than 1.8, the Dominance Index was below 0.2, the Richness Index exceeded 2.0, and the Evenness Index was above 0.8. In contrast, polluted and degraded sites showed Diversity Index values below 1.0, Dominance Index above 0.5, Richness Index under 1.0, and Evenness Index below 0.6. These results clearly suggest that benthic macroinvertebrates serve as effective bioindicators for assessing both the extent of saltwater intrusion and overall river health, making them valuable tools for ongoing environmental monitoring and management.

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BC-010 A Pilot Study on the Relationships Between Tree Characteristics and Perceived Value Dimensions in Urban Tree Retention

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Abstract. This pilot exploratory study investigates the relationships between tree characteristics and perceived value in the context of tree retention on construction sites. Twenty certified arborists specializing in tree assessment and urban landscape planning participated as expert respondents. Data were gathered via a structured questionnaire evaluating key tree attributes, including aesthetic qualities of plant parts, species origin, tree category, growth habit, health condition, and life expectancy. Spearman's rank correlation analysis identified several significant associations, notably a very strong negative correlation between aesthetic value plant's part and symbolic perception ($r_s = -0.979$, $p = 0.00$), and a very strong positive correlation between life expectancy and utility perception ($r_s = 0.870$, $p < 0.05$). These findings indicate that biological and morphological characteristics substantially shape expert evaluations of tree value, which may subsequently inform decision-making processes regarding tree conservation in urban development. The results provide a preliminary foundation for future research and the development of integrated frameworks to support effective tree retention planning.

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BC-011 Diversity Assessment of Tree Species in Mount Mayapay, Buenavista, Agusan Del Norte, Philippines

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Abstract High tree species diversity is generally considered a positive indicator of ecosystem health and resilience. This study provides the diversity assessment of the tree species in the part of Mount Mayapay situated in Barangay Sangay, Buenavista, Agusan del Norte including its conservation status. The assessment documented a total of 23 different species belonging to 17 different families. *Falcataria falcata*, *Swietenia macrophylla*, and *Polyscias nodosa* were the most abundant species in the area and majority of the species belongs to Moraceae family. Notably, the *Pterocarpus indicus*, which is listed as Endangered by the IUCN Red List and Vulnerable under DENR Administrative Order 2017-11, and *Litsea philippinensis* categorized as Near Threatened by the IUCN, were recorded, highlighting key local conservation priorities. A Shannon–Wiener Index of 2.829 indicates moderate floristic diversity, while importance value analysis identified *F. falcata* and *S. macrophylla* as the most ecologically significant species. The random distribution pattern and dominance of small trees suggest a relatively young stand shaped by both natural regeneration and deliberate planting. These findings provide crucial insights into species composition, ecological significance and diversity, and they underscore the need for comprehensive research across the entire area—including steep slopes—to guide conservation strategies for threatened species in the area.

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BC-012 Aboveground Biomass and Carbon Sequestration Potential of Tree Species in Kraefi-Sumile Botanical and Zoological Garden

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Abstract. Forest ecosystem plays a vital role in mitigating global climate change by functioning as both carbon sources and sinks, regulating the flow of carbon dioxide (CO₂) in the atmosphere. This study was conducted to estimate the above-ground biomass and carbon sequestration potential of tree species within the Knights of Rizal Agricultural Endeavor Foundation, Incorporated (KRAEFI) Sumile Botanical and Zoological Garden in Butuan City, Philippines. A stratified random sampling design was applied to accurately represent the tree population. The assessment involved tree identification, measurement of diameter at breast height (DBH), and total tree height. Using an allometric equation, data from 18 plots revealed a total of 115 individual trees representing 12 families. Among them, *Swietenia macrophylla*, *Gmelina arborea*, and *Acacia mangium* recorded the highest Importance Value at 180.76, 47.26, and 14.84, respectively, while *Eucalyptus deglupta* had the lowest at 1.77. The total above-ground biomass in the study area was 53,219.6 kg. Based on this biomass, the estimated total carbon sequestered was 86.46 Mg/ha. The study emphasized the critical influence of tree size and age on carbon sequestration potential, with older, larger trees storing more carbon. These findings are essential for guiding botanical garden management, restoration planning, and the selection of tree species with high carbon storage capacity to support climate change mitigation efforts.

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BC-013 The Growth Performance of *Rhizophora mucronata* Lam. and *Rhizophora apiculata* Blume in Freshwater Ecosystem

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Abstract. Mangroves play an important role in providing habitat for faunas such as fishes and aquatic invertebrates and they also serves as natural boundary for natural disasters like tsunami and floods. This research focused on evaluating the growth of two *Rhizophora* species, *Rhizophora mucronata* and *Rhizophora apiculata*, when grown in freshwater. The study assessed growth by measuring the number of leaves produced, the height increase, and the number of roots developed, comparing the growth patterns between the two species. Each mangrove species had five replicates planted in freshwater-filled aquariums, with swordtail fish aiding in oxygen production and providing natural fertilizer. Results showed that *R. apiculata* exhibited superior growth, achieving a higher mean height (45.76cm vs. 36.04cm) and greater root development (mean of 12 vs. 7) compared to *R. mucronata*. While the difference in leaf count for both species was not statistically significant ($p=0.610$). However, a statistically significant differences was observed in height ($p=0.000$) and number of roots ($p=0.005$), favoring, *R. apiculata*. The findings suggest that *R. apiculata* is better suited for freshwater environments, highlighting its potential for mangrove restoration and plantation in areas with low salinity. It recommends utilizing this species for freshwater tree planting programs due to its noticeable growth performance.

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BC-014 Species Diversity, Biomass Estimation, and Dust Retention Capacity of Urban Trees Along Roadside in Tandag City, Philippines

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Abstract. Urban trees play a vital role in mitigating air pollution and enhancing environmental quality in metropolitan areas. This study assessed the species diversity, richness, and composition of roadside trees in Tandag City, Philippines, while also estimating aboveground biomass and identifying species with the highest dust retention capacity. Field surveys were conducted along primary roads using a standardized plot size of 100 m × 1 km. A total of 203 individual trees were recorded, representing 26 species, 24 genera, and 17 families. *Mangifera indica* was identified as the most abundant species across plots. Species diversity analysis using the Shannon-Wiener Index yielded a value of 2.721, indicating moderate species diversity along the city's primary roadside. Aboveground biomass was estimated using non-destructive allometric equations, with the highest values recorded for *M. indica* (52.547 Mg) and *Antidesma bunius* (45.765 Mg). Dust retention analysis revealed that *Chrysophyllum cainito* (Caimito) and *Ziziphus* sp. (Agdao) exhibited the highest particulate capture, attributed to morphological leaf traits such as large surface area, specific leaf shape, and the presence of trichomes. These findings highlight the ecological and functional importance of tree species selection in urban greening programs and their potential contribution to air quality management.

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BC-015 Linking Soil Physicochemical Properties and Tree Diversity Across Elevational Zones in the Agricultural Ecosystems of Tagnote Falls, Remedios T. Romualdez (RTR), Philippines

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Abstract. The Philippines is distinctively acclaimed for its remarkable biodiversity due to the unique archipelagic features of the country and the variety of climate it experiences, which shapes a unique range of tree species. This paper explores the connection between the soil physicochemical properties and tree species diversity relative to altitude levels in selected agricultural ecosystems at Tagnote Falls, Barangay San Antonio, RTR, Agusan del Norte. The composition of tree species and the soil properties of the studied area were evaluated for three elevation ranges: low 0–200 m asl, moderate 201–400 m asl, and high 401–600 m asl. A total of 17 species of common trees were found, with the lower range plot exhibiting the greatest species richness and evenness. It was demonstrated that, despite the presence of measurable differences in the soil's pH and texture across elevations, statistically there is no significant relationship between these soil parameters and tree diversity. These results indicate that other factors like microclimate, topography of the landscape as well as biotic factors might control extent the distribution of trees in the region. The research also suggests assessing general cultivation in the zones of farmland to see how agricultural activity might modify soil attributes and patterns of biodiversity in the region.

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BC-017 Leaf Traits Variability of a Halophyte Influenced by Heavy Metals

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Abstract. Plants are necessary for life as living organisms eat and live in them. Their leaves harness the sun's energy enabling life on earth, making them nature's food factory. Leaf size indices are vital to enumerable information such as health, transpiration, growth, temperature, and light capture. This study investigated the effects of Molybdenum, Manganese, Lead, Chromium, Nickel, and Cadmium on the morphometric leaf traits of *Lumnitzera racemosa* Willd. in ultramafic mining site. A control representative of the species was also tested for comparison. All six heavy metals exceeded the maximum permissible limits in the mining site, while Ni and Cr exceeded permissible limits in control site. Results show differential effects as leaf length and leaf area of *L. racemosa* in mining site were shorter and smaller as the widespread contamination of all six heavy metals may have led to synergistic or antagonistic toxic effects but was broader, which might be a compensatory mechanism as a plastic response to stress due to contaminants. Leaves of *L. racemosa* in both sites were deficient in N, had an optimum level of P and had an excess level of K suggesting differences in leaf size indices were not influenced by macronutrients.

BC-018 Observations on Avifauna at Selected Forest Eco-Parks in Perak

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Abstract. Observations on avifauna were conducted across 10 forest eco-parks (FEPs) in Perak from 19 to 26 April 2024 to document and update avifaunal composition. A team of six observers used direct observation methods with cameras and binoculars for a total of 48 hours of efforts. Overall, a total of 132 bird species from 44 families were recorded. The family Pycnonotidae showed the highest species richness. Resident birds dominated the observations (87.9%), while insectivorous species were the most common feeding guild, making up 47.7% of the total species recorded. The most widespread and frequently encountered species were the Oriental Magpie-robin (*Copsychus saularis*), Black-headed Bulbul (*Brachypodius atriceps*), and Red-eyed Bulbul (*Pycnonotus brunneus*). According to the Wildlife Conservation Act 2010, 112 species are classified as Totally Protected (TP), and 10 species as Protected (P). Based on the IUCN Red List of Threatened Species, two species are listed as Endangered (EN), and three as Vulnerable (VU). Among all sites, Kaki Bukit Larut FEP recorded the highest species richness, representing 38.6% of the total species. Bird species composition varied between sites, with low to moderate Jaccard similarity values ($J = 0.05-0.33$), suggesting diverse avian communities. The highest similarity was between Kledang Saiong and Papan FEPs ($J = 0.33$), while Sungai Salu FEP exhibited the most distinct species composition ($J = 0.05$). Bird species composition in forest eco-parks may vary depending on habitat structure, elevation, location, food availability, and disturbances. These findings demonstrate the ecological uniqueness of each forest eco-park and emphasize the importance of conserving multiple sites to preserve regional bird diversity. This study also provides valuable baseline data to support future conservation planning and biodiversity monitoring efforts within Perak's forested landscapes.

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BC-019 Avian species of Sungai Sedim Forest Eco Park: Boost for ecotourism activities

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Abstract. Sungai Sedim Forest Eco Park is an amenity forest situated within the Gunung Inas Forest Reserve in Peninsular Malaysia, known for its abundant biodiversity and ecotourism activities. The ongoing documenting of fauna richness in the amenity forest could be a crucial element in promoting tourist growth. Hence, this study aimed to document avian species richness to highlight its role for supporting ecotourism activities of Sungai Sedim Forest Eco Park. Bird surveys were conducted for five sessions totalling in 25 days of sampling efforts started from July 2022 until Oktober 2022. The study was conducted by using mist-netting, direct observation and bird vocalization. A total of 63 species belong to 32 families were identified. The diversity indices ranged between from 0.4000 to 0.7222 for Simpsons Index, 0.7324 to 1.7918 for Shannon Index and the Pielou Evenness index ranged between 0 to 0.059 for the overall sampling period. The findings underscore that the diverse avian species in Sungai Sedim Forest Eco Park are not merely ecological indicators but powerful attractions capable of providing a substantial boost to the park's ecotourism profile, aligning with sustainable tourism practices that emphasize conservation alongside experiential learning.

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BC-020 Assessment of Non-Volant Small Mammals at Lenggor Forest Reserve and Mersing Forest Reserve in Johor, Malaysia.

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Abstract. Surveys of non-volant small mammals were conducted in two fragmented forest reserves within Johor, namely Mersing Forest Reserve (MFR) and Lenggor Forest Reserve (LFR), which are part of the J-PL1 ecological corridor under the Central Forest Spine (CFS) initiative. The surveys were carried out in June until October 2024, with the objective of documenting the diversity of non-volant small mammals at the MFR and LFR. In each forest reserve, six transect lines measuring 100m in length were established respectively at distances of 300m, 500m, and 1000m from the forest edge. Ten collapsible cage traps were set along each transect line and operated for five consecutive nights per session. A total of four sampling sessions were conducted at each site. Apart from this, observation was made to document arboreal species. Overall, 17 species are recorded from both forest reserves. MFR recorded 17 species (seven families), while LFR recorded 13 species (five families). Species diversity (Shannon-Wiener Index) is comparable between MFR ($H' = 1.746$) and LFR ($H' = 1.752$). Notably, two Vulnerable species, namely *Maxomys whiteheadi* and *Maxomys rajah* were also documented at both forest reserves. These findings portray the ecological significance of LFR and MFR as vital habitats that support a diverse community of non-volant small mammals. Hence, maintaining and enhancing habitat connectivity within the J-PL1 corridor is crucial to preserve ecological integrity and ensuring the long-term survival of non-volant small mammal populations in this ecological corridor and its adjacent areas.

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BC-021 Reptile Species Composition at Three Forest Reserves in Central Forest Spine Ecological Corridor B-SL1, Selangor, Malaysia

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Abstract. Central Forest Spine (CFS) is an important initiative to reconnect fragmented forest areas in Peninsular Malaysia. According to the master plan (PIRECFS 2022), 39 ecological corridors have been identified, including CFS B-SL1, which connects Raja Musa Forest Reserve, Bukit Tarek Forest Reserve, and Gading Forest Reserve in Selangor. A review of existing research on reptilian diversity in these reserves revealed a lack of studies, with some focusing on the Bukit Tarek Forest Reserve. This study aims to document the reptile species present in CFS B-SL1. Fieldwork was conducted in May, June, August, September, and October 2022, with two sampling sessions in each forest reserve. A total of 25 pitfall traps were used for five consecutive nights, and active searches were done for two nights per session. The study identified 18 species from nine families, with *Calotes emma* being the most frequently captured species (n=31). Gading Forest Reserve constitute the highest number of species (12 sp). Jaccard's similarity dendrogram indicated Gading Forest Reserve and Raja Musa Forest Reserve clustered together, although the similarity was below 0.4. The study suggests more time and effort are needed to uncover additional reptilian species in these forest reserves.

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BC-022 Species Richness and Composition of Mammal Assemblage in Sedim River Eco Park: Supporting Evidence for Ecotourism Potential

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Abstract. Mammals are essential components of tropical rainforest ecosystem and can augment ecotourism by providing captivating wildlife encounters. This study investigated species richness and composition of small mammals in Sedim River Eco Park, Peninsular Malaysia to assess their potential as ecotourism resources. Systematic sampling was performed within 400 meters by 200 meters main plot using 100 collapsible cage traps, three harp traps, and 10 mist nets during four sample sessions, each comprising five consecutive trapping nights. Additionally, direct observations were conducted along adjacent trails and riverbanks of Sedim River including available canopy walk during early morning and late evening. A total of 26 species from 10 families were documented. Live trapping resulted in 113 individuals comprised of 18 species, with *Hipposideros larvatus* being the most frequently captured. Direct observation recorded nine individuals over eight distinct species, all exclusive to this approach, encompassing squirrels, tree shrews, and primates. No species overlap was observed between techniques, highlighting their complementary significance in applied methodologies. Diversity indices ranged from 0 to 2.53 (Shannon-Wiener), 0 to 0.9021 (Simpson), and 0.628 to 1 (evenness), signifying a reasonably diversified and balanced population. The presence of cryptic and visible mammal species supports biodiversity-based ecotourism, promoting guided wildlife tours and educational programs that encourage low-impact nature appreciation.

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BC-023 Herpetofaunal Richness in Sungai Sedim Eco Park: Strengthening the Park's Ecotourism Value

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Abstract. Sungai Sedim Eco Park, located within compartment 16 of the Gunung Inas Forest Reserve in Kedah, was surveyed to document the diversity of herpetofauna and update existing species records. The survey was conducted over five sessions from July 2022 until October 2022, employing pitfall trapping and active search techniques. A total of 45 species comprising 169 individuals were recorded. Among the recorded species, the *Chalcorana labialis* was the most abundant, with 17 individuals followed by *Leptobrachium hendricksoni* with 16 individuals, *Amolops larutensis* with 15 individuals, *Limnonectes blythii* and *Odorrana hosii* with 14 individuals, *Gonocephalus grandis* and *Phrynoidis asper* with 10 individuals. Furthermore, the survey highlighting the ecological richness of the area, with the remaining individuals representing a variety of species, each with less than 10 individuals recorded. Diversity indices revealed a consistently high level of species diversity, with Simpson's index (1-D) ranging from 0.8166 to 0.9282, and Shannon's Index (H) ranging from 1.851 to 2.81. Evenness values (e^H/S), which ranged from 0.7549 to 0.917, indicate moderate to highly uniformity in species distribution across sessions. These findings reflect a well-structured herpetofauna community, suggesting minimal ecological disturbance and remained as a stable habitat within Sungai Sedim Eco Park. The high diversity and even species distribution support the ecological integrity of Sungai Sedim Eco Park and emphasize its potential as a conservation oriented ecotourism.

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BC-024 Limbodium Variation in Selected *Fissidens* Species from Peninsular Malaysia: Taxonomic Implications

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Abstract. The genus *Fissidens* (Fissidentaceae, Bryophyta) shows considerable morphological diversity that often makes species identification difficult due to small differences in key identifying features. Among these features, the presence and structure of the limbodium, which is a specialized border of different cells along the leaf edge, is critically important for classification, yet its application varies inconsistently across different regional studies. This study examines limbodium variation in five limbate *Fissidens* species from Peninsular Malaysia that display significant diagnostic patterns: *F. benitotanii* Z. Iwats., K.T. Yong & Tad. Suzuki, *F. bogoriensis* M. Fleisch., *F. bryoides* var. *ramosissimus* Thér., *F. ceylonensis* Dozy & Molk., and *F. zollingeri* Mont. These species were selected because they represent distinct limbodium development patterns crucial for taxonomic identification, ranging from extensive coverage to highly variable presence. Detailed examination of herbarium specimens and fresh collections was conducted using compound microscopy, focusing specifically on limbodium presence, location, thickness, cell types, and developmental patterns across different laminae. Results revealed that *F. zollingeri* Mont. exhibited the most extensive and consistent limbodium development across all laminae, *F. ceylonensis* Dozy & Molk. showed limbodium restricted to the vaginant lamina only, while *F. bogoriensis* M. Fleisch. displayed remarkable variability ranging from absent to present on various laminae. *F. benitotanii* Z. Iwats., K.T. Yong & Tad. Suzuki demonstrated a distinctive pattern with limbodium absent at the apex, and *F. bryoides* var. *ramosissimus* Thér. exhibited weak and variable limbodium development on the apical lamina. These findings confirm the critical taxonomic importance of limbodium characteristics for species identification and demonstrate the need for careful consideration of intraspecific variation patterns. This study contributes to improved species identification accuracy and enhanced understanding of limbodium stability within the genus, while highlighting the necessity for taxonomic review of certain species classifications and supporting the development of more reliable identification keys for Peninsular Malaysian *Fissidens* species.

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BC-027 Diversity of Stingless Bee in Hutan Adat Imbo Putui, Kabupaten Kampar, Riau

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Abstract. Hutan Adat Imbo Putui is located in Desa Petapahan, Kecamatan Tapung, Kabupaten Kampar, Provinsi Riau. This customary forest is an area that is still natural and supports various for fauna habitats, one of which is stingless bees. Changes in land use around the customary forest can affect the habitat and existence of stingless bees. The research purpose was to identify stingless bees found in the Hutan Adat Imbo Putui. The research method used is an exploratory survey. The search for stingless bee nests was carried out using the exploration method in three observation areas. Data was obtained by directly observing the nests and collecting stingless bee samples and identifying them. The identification of stingless bees is done through morphological analysis (morphospecies). The data obtained were analyzed in descriptively, morphological characteristics of stingless bees accompanied by image and related references. The result show that 12 species of stingless bees were found, namely *Tetragonilla collina*, *Tetragonula cf sarawakensis*, *T. laeviceps*, *T. drescheri*, *T. testaceitarsis*, *T. minangkabau*, *T. fuscobalteata*, *Tetrigona binghami*, *Heterotrigona itama*, *Homotrigona fimbriata*, *Lepitrigona terminata* and *L. cf ventralis*. The most common species found was *Tetragonilla collina*

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BC-028 Unveiling the Potential of Weeds in Peat Soils of Oil Palm Plantations

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Abstract. Weeds are generally considered disruptive vegetation in plantations. Their presence can reduce crop yields. This study was conducted to explore the potential value of weeds in peat soil areas within oil palm plantations. The research methods used included surveys and in-depth interviews with key informants. The survey aimed to collect primary data related to weed species. The sampling was carried out at two stations, each with one transect. Each transect consisted of three plots measuring 2 m × 2 m within the oil palm plantation. The distance between plots was 10 m, arranged in a straight line from the edge inward and laid out in a zigzag pattern. In-depth interviews were conducted with five respondents: one village official, one village health worker, one village intellectual, and two community members with knowledge of weeds. This study identified 18 weed species with a total of 37 individual plants. These weeds have potential uses as medicinal plants, ornamental plants, livestock feed, and botanical pesticides. The 18 species identified can be grouped according to their morphology: 7 broad-leaf, 3 small-leaf, 5 fern, 2 sedge, and 1 grass. The most dominant weed found was the fern *Nephrolepis biserrata*, which thrives in moist soil conditions

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BC-029 Evaluation of *Peperomia pellucida* L. Kunth Extract as an Antifungal Agent by In-Vitro and In-Silico Analysis

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Abstract. *Peperomia pellucida* (L) Kunth is gulma grows in moist areas. The Rokan Hulu Riau people use it traditionally for rheumatism, fever, boils, itchy skin, kidney issues, abdominal pain, inflammation, and headaches. The aim of this study is to identify what The bioactive compounds contain in *P. pellucida* (L) Kunth's n-hexane extract (PPHE) and study its antifungal activity via in vitro and in silico. The extract obtained by maceration with n-hexane solvent, following phytochemical screening and characterization through LC-MS spectroscopy. The extract was evaluated for antifungal activity in vitro using the disc diffusion method and in silico through molecular docking. PPHE gave a yield of 9.71%. The phytochemical screening on the n-hexane extract showed the presence of steroids, saponins, and flavonoids. Characterisation by LC-MS spectroscopy identified 19 compounds, three which have showed potential as antifungals: 3,5-Diacetoxy acetophenone, 3,4-Dimethoxy hydrocinnamic acid, and 1-Aminotetralin. The in vitro study of the antifungal activity of extracts showed significant inhibition zones: 26.97 ± 2.48 mm (50%), 21.57 ± 2.92 mm (40%), and 9.97 ± 9.94 mm (30%) and ketoconazole's inhibition zone of 14.97 ± 2.5 mm. The molecular docking antifungal activity testing indicates that the cDOCKER values of the bioactive compounds on PPHE are in the following order: 3,5-Diacetoxy acetophenone at -57.0011 kcal/mol, 3,4-Dimethoxy hydrocinnamic acid at -5.7307 kcal/mol, and 1-Aminotetralin at -53.308 kcal/mol, showing greater potential than ketoconazole at -50.99 kcal/mol.

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BC-030 Relationships among Seawater Quality, Sediment Total Organic Carbon, Phytoplankton Abundance, and Macrozoobenthos Distribution in the Coastal Waters of the Dumai River Estuary, Indonesia

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Abstract. This study investigates the relationships among Water Quality Index (WQI), chlorophyll-a concentration, total organic compounds (TOC) in water and sediment, phytoplankton abundance, and macrozoobenthos distribution in the estuarine waters of the Dumai River, Indonesia. Eight purposively selected sampling stations were surveyed. Physicochemical parameters—including total suspended solids, dissolved oxygen, oil and grease, ammonia, and phosphate—were measured to calculate WQI in accordance with Indonesian Ministry of Environment and Forestry guidelines. Phytoplankton abundance was determined by microscopic enumeration, and chlorophyll-a concentration was quantified using the trichromatic spectrophotometric method. TOC levels in water and sediment samples ranged from 27.84 to 30.68 mg L⁻¹ and 8.21 % to 10.02 %, respectively. Six macrozoobenthos species were identified, with abundances of 155–1,267 ind m⁻² and Shannon–Wiener diversity indices between 0.48 and 1.27; no bioindicator species were observed. Simple linear regression revealed strong positive correlations between phytoplankton abundance and WQI ($R^2 > 0.80$) and between chlorophyll-a concentration and WQI ($R^2 > 0.75$). Correlation analysis indicated a moderate relationship between water TOC and macrozoobenthos abundance ($R^2 = 0.4546$) and a weak relationship for sediment TOC ($R^2 = 0.061$). These findings provide essential baseline data to inform water quality management and conservation strategies for the Dumai estuary.

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BC-031 Unveiling Moss Diversity in Peninsular Malaysia

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Abstract. Mosses are small green plants without vascular tissue that reproduce through spores. They can capture up to four times more carbon dioxide per square meter compared to forests. The exploration of the moss flora in the Malay Peninsula began in the mid-19th century, when Sir Stamford Raffles. Comprehensive moss checklists were published in 1988 by Mohamed and Tan, and in 2013 by Yong et al. The objective of this study is to update the moss species reported in Peninsular Malaysia, incorporating the numerous recent changes in taxonomy and nomenclature that have resulted from revisions and molecular studies. The methodology involved analysing data from all publications since 1840, including the author's moss collections (ca. 7000), which were kept in the Herbarium of Universiti Kebangsaan Malaysia (UKM). This ensured accurate recent nomenclature and classification. Results show a total of 561 moss taxa, belonging to 159 genera and 45 families. Most of these species were found in the state of Pahang and live as corticolous. Many moss species are threatened with extinction, mainly due to habitat loss. To date, 283 moss species have had their extinction risk evaluated globally for the IUCN Red List. Therefore, this study can support future conservation efforts and serve as a reference for researchers, conservationists, and policymakers.

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Sustainability and Technology

Environmental aspects such as atmospheric sciences, land and water management, climate change, biotechnology and green technology



ST-002 Exploring the Features of Plants Threatening Malaysia's Heritage Buildings

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Abstract. Plants contributes to various functions in landscape design such as shade, ornamentation, food sources, and etc. For heritage buildings, the functions of plants are identified as elements that can enhance the heritage value of a building. The presence of plants also harms the stability of heritage buildings. Certain plants are identified to cause damage such as roof damage, wall cracks, plaster layer damage, stains on the paint layer, paint peeling, gutter and drain blockage, and wooden component damage. Therefore, the objective of this study is to identify the features of plants that threaten heritage buildings. This study uses a qualitative approach through observation and interviews. Observation methods were carried out on 112 masonry heritage buildings listed by the National Heritage Department (JWN). In-depth interviews were conducted with eight (8) registered conservators who are experienced and actively involved in heritage building conservation. The collected data were analysed using thematic methods to produce a list of characteristics of plants that damage heritage buildings. The study found a total of eight (8) plant characteristics, namely dense foliage, heavy leaf shedding, bearing fruit, dense flowering, creeping roots, adventitious roots, easy decay, and shading. This study will assist conservators, building occupants, maintenance contractors, and landscape architects in selecting suitable plants for landscaping and environmental design surrounding heritage buildings in Malaysia.

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ST-003 Ultrasound-assisted Extraction of Antioxidants from Watermelon Rind using Green Solvent for Food and Cosmetic Applications

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Abstract. Watermelon (*Citrullus lanatus*) rind often discarded as agricultural waste, contains valuable bioactive compounds such as citrulline, phenolics and flavonoids. This study investigates the impact of solvent polarity on the efficiency and phytochemical profile of watermelon rind extracts using ultrasound-assisted extraction (UAE). Extractions were performed with ethanol, ethyl acetate, and hexane under fixed conditions (30°C, 70 minutes, 1:10 solid-to-liquid ratio). Extracts were analysed for total phenolic content (TPC), total flavonoid content (TFC), and antioxidant activity using the DPPH radical scavenging assay. Ethanol yielded the highest TPC (4.47 ± 0.03 mg GAE/g) and antioxidant activity (IC₅₀: 4.56 µg/mL), while ethyl acetate exhibited the highest TFC (1.292 ± 0.02 mg QE/g) with comparable antioxidant potential. The results demonstrate that solvent polarity significantly affects the recovery of bioactive compounds. Both ethanol and ethyl acetate effectively extracted hydrophilic and moderately lipophilic constituents. Due to its food-grade status and environmental safety, ethanol is particularly suited for applications in food, nutraceutical and cosmetic industries. This study underscores the potential of UAE as an eco-friendly and efficient method for valorising watermelon rind by-products into functional natural ingredients.

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ST-005 Cluster Analysis of Ground-level Ozone and Nitrogen Dioxide Concentrations Diurnal Variability in Klang

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Abstract. Ground-level ozone (O_3), formed through photochemical reactions between nitrogen oxides and volatile organic compounds, is a key component of photochemical smog. This study analysed the diurnal variability and clustering of O_3 and NO_2 concentrations at the Klang monitoring station, based on anthropogenic and meteorological factors. Secondary data from the Department of Environment (DoE) covering 1 January 2018 to 31 December 2020 were used. Descriptive analysis showed annual mean O_3 concentrations ranged from 88.30 to 92.40 ppb, below the Malaysia Ambient Air Quality Standard (MAAQS) limit of 100 ppb. NO_2 levels ranged from 60.90 to 78.80 ppb, also within the 140 ppb MAAQS limit. The highest O_3 concentrations occurred in the first quarter of 2019 due to intensified photochemical activity linked to human activities. Diurnal analysis revealed O_3 peaked between 1 p.m. and 3 p.m., while NO_2 showed bimodal peaks at 9 a.m. and 11 p.m. Cluster analysis using OriginPro 9.1 confirmed these patterns. O_3 concentrations clustered between 12 p.m. and 3 p.m., while NO_2 clustered between 9 a.m. and 10 a.m. Findings indicate pollutant levels remained within permissible limits and highlight the relevance of understanding O_3 formation for informing policy makers and stakeholders.

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ST-006 Bioconcentration of Metals in *Oreochromis niloticus* and *Pangasius* sp. from a Commercial Pond

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Abstract. The accumulation of metals in aquatic organisms is a growing environmental and public health concern, often linked to contamination from industrial and agricultural sources. This study investigated the concentrations of iron (Fe), zinc (Zn), and copper (Cu) in *Oreochromis niloticus* and *Pangasius* sp., collected from a commercial fish pond in Marang, Terengganu. Metal concentrations in fish tissues were determined using acid digestion followed by flame atomic absorption spectrophotometry (FAAS). Results showed that *Pangasius* sp., a bottom-dwelling species, accumulated significantly higher levels of Fe (271 mg/kg), Zn (50.6 mg/kg), and Cu (16.2 mg/kg) compared to *O. niloticus*, a column feeder. These differences are likely due to species-specific habitat preferences and feeding behaviors, with *Pangasius* sp. being more exposed to sediment-associated metals. To evaluate potential human health risks, Target Hazard Quotients (THQs) were calculated, indicating possible non-carcinogenic effects. Importantly, the concentrations of all metals exceeded the permissible limits set by the World Health Organization (WHO) and the Malaysian Food Act. These findings highlight the need for ongoing monitoring of aquaculture environments and the implementation of effective management strategies to minimize metal contamination and ensure food safety.

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ST-007 Evaluating the efficacy of plant-based coagulants in reducing water turbidity: a comparative study

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Abstract. Coagulants are essential in water treatment processes particularly in coagulation and flocculation for reducing suspended solids and improve water clarification. The purpose of this study is to investigate the effectiveness of plant-based coagulants from coconut husk and pandan leaves in reducing turbidity of river water. The study used jar test to determine the optimal coagulant dose and solution pH for coconut husk and pandan leaves coagulants in reducing river water turbidity with alum used as a benchmark for comparison. In addition, a comparison between these plant-based coagulants and alum was made to see the potential of the coagulants. Scanning electron microscope (SEM) was employed to observe the morphology of the plant-based coagulants while phytochemical tests confirmed the presence of tannins and flavonoids through colorimetric observation. Results indicated that pandan leaves coagulants achieved up to 90% turbidity removal of river water at an optimal dose of 10 mg/L and pH 9, whereas coconut husk coagulant reached 60% removal at 40 mg/L and pH 4. SEM analysis revealed fibrous structures with rough surface textures, suggesting good potential for particle adsorption. Overall, both plant-based coagulants demonstrated promising performance in turbidity reduction, supporting their potential as sustainable alternatives to conventional chemical coagulants.

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ST-008 Spatiotemporal rainfall analysis in Kuala Krai, Kelantan: interpolation and trend assessment from 2009 to 2020.

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Abstract. Kelantan experiences annual flood events, many of which are triggered by rainfall exceeding historical norms. This study investigates the spatiotemporal patterns of rainfall and water levels in Kuala Krai, Kelantan, Malaysia, using data collected from 2009 to 2020 by the Department of Irrigation and Drainage (DID). Missing data were addressed through arithmetic mean interpolation, and trend analyses were conducted using the Mann-Kendall test. The result revealed that the maximum rainfall occurred during the year 2020 at Dabong station. On the other hand, the year 2009, 2013, 2014, and 2017 also reported a high amount of rainfall compared to the other year. The result of the Mann-Kendall analysis revealed that Dabong and JPS Kuala Krai stations had a positive S value (637,130) which indicates an upward trend. Meanwhile, the other 4 stations show a downward trend. However, the trends of all DID stations were not significant because the p-value > 0.05. The rainfall recorded prior to the flood events. By applying data interpolation and temporal trend analysis, this research contributes valuable insights into flood risk management and climate resilience strategies. The findings underscore the importance of accurate rainfall monitoring and highlight the broader impacts of extreme weather on hydrological systems and community preparedness.

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ST-010 Ultrasound-assisted extraction of antioxidant-rich compounds from watermelon rind (*Citrullus lanatus*) for sustainable natural resource valorization

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Abstract. The growing interest in natural and sustainable resources has driven research into the valorisation of agricultural by-products such as watermelon (*Citrullus lanatus*) rind. This study focuses on the optimisation of extraction conditions for watermelon rind, an underutilised yet nutrient-rich fruit waste, to enhance the recovery of its bioactive antioxidant compounds. Ultrasound-assisted extraction (UAE) combined with Response Surface Methodology (RSM) was employed to maximise extraction yield and antioxidant content through systematic tuning of key parameters. Optimal conditions were identified at 59.99 °C, 43.78 min, 0.0999 g/mL solid-to-solvent ratio, and 30.15% ethanol concentration, resulting in a high extract yield of 23.97%. The extract demonstrated potent antioxidant properties, as indicated by strong DPPH radical scavenging activity (105.131 µmol TE/g), total phenolic content (424.49 mg GAE/g), and total flavonoid content (0.372 mg QE/g). These findings underscore the potential of watermelon rind as a valuable natural source of antioxidants. By employing a green extraction approach to valorise fruit waste, this study contributes to sustainable development and supports the circular bioeconomy through the generation of high-value compounds from agricultural residues.

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ST-011 Evaluation of heavy metal contamination and pollution indices in soil from selected dumpsites in Kelantan, Malaysia

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Abstract. Heavy metal contamination was one of the most important environmental issues and the dumping of municipal waste at the dumpsites led to the contamination. Hence, this study concentrated on 3 dumpsites in Kelantan, which were Beris Lalang Dumpsite, Kok Bedollah Dumpsite, and Bukit Che Ros Dumpsite. This study aimed to determine the concentration of selected heavy metals and to examine the soil quality using pollution indices. The soil samples were analysed using Atomic Absorption Spectroscopy (AAS). This study revealed the mean concentration of heavy metals in soil at Beris Lalang Dumpsite as following order, Cu (16.00 mgkg⁻¹) > Cr (11.87 mgkg⁻¹) > Zn (10.54 mgkg⁻¹) > Mn (6.69 mgkg⁻¹) > Pb (5.72 mgkg⁻¹), while Kok Bedollah Dumpsite were Mn (64.86 mgkg⁻¹) > Zn (31.28 mgkg⁻¹) > Cu (18.92 mgkg⁻¹) > Pb (18.59 mgkg⁻¹) > Cr (3.52 mgkg⁻¹) and Bukit Che Ros Dumpsite, were Zn (17.46 mgkg⁻¹) > Cu (13.24 mgkg⁻¹) > Cr (8.60 mgkg⁻¹) > Mn (5.74 mgkg⁻¹) > Pb (4.89 mgkg⁻¹). Meanwhile for the pollution indices, the Igeo result showed that all stations were in class 0 except one sampling point at Kok Bedollah Dumpsite. This is also supported by the Pollution Load Index (PLI) result for each dumpsite, which was also below 1, which showed that the areas were not polluted. If the dumpsite management remains not properly managed, this contamination may continue to have an impact on soil quality in the future. As a result, the data gained from this study was valuable in assisting authorities in managing dumpsites systematically to maintain the soil quality.

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ST-013 Sustainable Consumption in Practice : Exploring Green Product Purchase Intentions Among Malaysian Adults

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Abstract. As environmental challenges intensify, understanding the factors that drive consumers' intention to purchase green products has become increasingly vital. This study investigates the determinants influencing Malaysian adults' intention to buy green products, grounded in the Theory of Planned Behavior (TPB). The framework is extended by incorporating two critical constructs: environmental concern and green awareness. Using a quantitative approach, data were collected from 300 respondents through a structured online survey. The results, analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM), reveal that attitude, subjective norms, perceived behavioral control, environmental concern, and green awareness all have a significant positive relationship with purchase intention. These findings affirm the relevance of TPB in predicting sustainable consumer behavior in emerging economies and highlight the growing environmental consciousness among Malaysian adults. This research offers valuable insights for marketers, policymakers, and educators seeking to foster sustainable consumption habits. Strategic awareness campaigns, clearer eco-labelling, and accessibility of green products are essential to further enhance green purchase intentions across demographic segments.

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ST-014 Sustainable eating begins with youth: exploring organic food consumption intentions among young adults in Malaysia

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Abstract. As Malaysia moves towards more sustainable food practices, organic food consumption has gained traction, especially among young adults. This study examines the key factors influencing young adults' intentions to consume organic food. Grounded in the Theory of Planned Behavior (TPB), the model extends the framework by incorporating two additional constructs—health consciousness and environmental concern—to provide deeper behavioral insights. Data were collected through an online survey (n = 324) using a purposive sampling method and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). Results indicate that attitude, subjective norms, perceived behavioral control, health consciousness, and environmental concern significantly influence purchase intention. The findings confirm the applicability of the TPB framework for predicting sustainable food choices and highlight the importance of health and environmental values in shaping young consumers' decisions. This research provides practical implications for organic food producers and marketers to design targeted strategies that resonate with the values of health-aware and environmentally conscious youth.

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ST-019 A Study on Food Waste Utilizing for Fertilizer Production: Analysis of Physical and Chemical Properties

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Abstract. Food waste is generated daily in every household, posing significant challenges for waste management. Disposal in landfills consumes substantial land, water, and fertilizer resources while releasing methane gas that contributes to global warming. This study investigated the nutrient content and physicochemical properties of biofertilizer produced via the Bokashi composting system. Physical characterization focused on liquid fertilizer concentration and moisture content. Results showed that liquid fertilizer from the Bokashi bin had a higher concentration at outdoor temperature, although the yield was lower (0.0073 ratio) than at room temperature. Moisture content in samples at room temperature was 99.27% higher than those stored outdoors. However, degraded film samples at outdoor temperature had a greater average weight (9 g) compared to room temperature (5 g). The fertilizer was analyzed for nitrogen (N), phosphorus (P) and potassium (K) concentrations. For chemical characterization, total nitrogen content was measured using the Kjeldahl method according to Malaysian Standard MS 417: Part 3: 1994. The results showed that the thin film fertilizer contained 0.3% nitrogen, which is higher than that of the liquid fertilizer. Phosphorus content was determined using UV-Visible Spectroscopy at 740 nm, with the liquid fertilizer at room temperature showing a higher phosphorus concentration of 4.117 mg/L. Potassium concentration in the film fertilizer was found to be 156.1 mg/L, as analyzed using Atomic Absorption Spectroscopy (AAS). These findings highlight the potential of Bokashi-based and films bio-fertilizers as a sustainable solution for nutrient recovery and food waste reduction.

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ST-022 Abundance of Microplastics in Coastal Area Surface Water at Tok Bali, Kelantan.

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Abstract. Plastic is a man-made material made up of polymers, which are long molecules structured around carbon chains. Microplastic pollution affects the environment by altering habitats and natural processes. Human activities produce plastic waste, which causes pollution to the environment. Tourism areas are one of the highly exposed areas for microplastic pollutants since a lot of activity is held. Tok Bali Beach is a tourist attraction and a resort area for residents around Tok Bali Beach. Therefore, this study is needed to assess the abundance, distribution, and characteristics of microplastics in the surface waters of Tok Bali beach, Pasir Puteh, Kelantan. In this study, 10 sampling points were selected in the beach area to determine the presence of microplastics in the surface water. Photomicroscopic examination, Fourier Transform Infrared Spectroscopy (FTIR), and Scanning Electron Microscopy (SEM) were used to identify the presence of microplastics in surface seawater samples. Five types of microplastics in the surface seawater such as pellets, fibers, fragments, filaments, and films were identified in this study. Photographic microscopy revealed that flakes were the most dominant form, followed by pellets and fibers. These findings highlight the significant presence of microplastics in the surface waters of Tok Bali Beach, emphasizing the need for pollution mitigation and sustainable coastal management.

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ST-024 Thorium Retention Rate using Different Functionalized Resins

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Abstract. Thorium (Th^{4+}), a naturally occurring radioactive element, is often found alongside rare earth elements (REEs), posing both environmental risks and recovery potential. This study evaluates the thorium retention efficiency of three distinct resins: WA21j (a weak base anion exchange resin), PE-F (a chelating resin with fluoride-based functional groups), and PM401 (a chelating resin functionalized with iminodiacetate groups). Batch adsorption experiments were conducted using 10 ppm thorium solution and 0.5 M ammonium sulphate at room temperature and 150 rpm shaking speed, over contact times from 5 to 360 minutes. The residual thorium concentrations were analysed using inductively coupled plasma optical emission spectroscopy (ICP-OES). Adsorption data were fitted to non-linear pseudo-first-order and pseudo-second-order kinetic models. PE-F demonstrated the highest thorium uptake and strongest correlation with the pseudo-second-order model (coefficient of determination, $R^2 = 0.9921$), indicating chemisorption as the dominant mechanism. PM401 followed closely ($R^2 = 0.9896$), while WA21j showed lower retention and model fit. These findings emphasize the influence of functional group chemistry on thorium binding efficiency and support the potential of fluoride- and iminodiacetate-based chelating resins in radioactive waste treatment and REE purification systems.

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ST-027 Utilization of *Citrus hystrix* Peels as Natural Coagulant for the Reduction of Turbidity

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Abstract. Chemical coagulants are commonly applied in wastewater treatment due to high efficiency in removing contaminants. However, their usage often generates toxic sludge and poses risks to human health and the environment. In response, plant-based alternatives derived from agricultural waste, such as *Citrus hystrix* (Kaffir lime) peels, have gained attention as sustainable coagulants. This study investigates the potential of *Citrus hystrix* peels as natural coagulants, focusing on the ability to reduce turbidity in water. The peels were air-dried and oven-dried, ground, sieved and treated with 2 M NaOH to extract active compounds. Jar test were conducted to evaluate the effects of pH, coagulant dosage, mixing speed and time, and settling duration on turbidity removal. Three sets (A, B and C) with varying mixing conditions were tested at different dosage. Optimal turbidity removal (94.05%) was achieved at pH 6 with a 10 mg/L dosage using mixing Set C. In contrast, the lowest removal efficiency (79.90%) was observed under Set A at the same dosage. Higher dosages (50–150 mg/L) led to increase turbidity and discoloration. SEM analysis revealed a porous surface structure, while FTIR confirmed the presence of functional groups associated with coagulation activity. These findings highlight the effectiveness and environmental advantages of using *Citrus hystrix* peels as a green alternative to conventional chemical coagulants.

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ST-029 Assessing Water Reservoir Potential in Tanah Merah, Kelantan using Advanced GIS and Remote Sensing Techniques

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Abstract. Natural water resources in Malaysia are abundant, allowing many catchment areas to serve as storage or reservoirs. Environmental factors have increased the demand for water users and supply. Establishing reservoirs ensures a dependable and sustainable water supply for future generations. This study aims to identify potential water reservoirs in Tanah Merah, Kelantan using GIS and remote sensing techniques. The objectives are to determine the environmental factors for identifying water reservoirs in Tanah Merah, Kelantan and to assess their potential. Landsat-9 data were processed and analyzed in four locations: Bukit Bunga, Bukit Panau, Kemahang and Gual Lipor. The main criteria selected for this research are slope, land use, river proximity and elevation extracted from the Digital Elevation Model. The Weighted Overlay (WO) method was used to scale parameters for decision-making. The analysis identified three locations with high potential for new water reservoirs which were area close to Kampung Chandan & Chas, area in Kampung Bukit Mas Tanah Merah and area near to Jedok River. These areas were selected based on comprehensive criteria, ensuring adequate water storage capacity and efficient distribution for all water uses. Additionally, the water flow in these locations facilitates easy connection between the reservoirs and the river. Therefore, it can be concluded that the Weighted Overlay (WO) method is a useful tool for analyzing water reservoir site selection in the studied area.

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ST-030 Biodegradable Film from Kombucha SCOBY Culture Using Different Types of Tea Extracts With/Out Glycerol

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Abstract. The use of single-usage plastic goods causes serious pollutants in many countries. Kombucha tea is a beverage made using fermented symbiotic culture of bacteria and yeast (SCOBY). A new SCOBY layer (film form) usually discarded by manufacturers. Hence, this study explores the use of SCOBY as biodegradable films in the direction of address plastic waste issues. Black tea, green tea and a combination of both were used to develop SCOBY films *via* fermentation process. SCOBY films (coated with/without glycerol) were tested to determine its physical properties and antioxidants capacities. In general, fermented green tea produced the thickest SCOBY film. SCOBY films coated with glycerol enhanced its redness and yellowness colour, water solubility, degradation rate, and percentage of elongation at break; however, it significantly reduced the melting point, and the tensile strength compared to SCOBY films without glycerol. SCOBY films fermented with green tea exhibited the highest DPPH activity, while SCOBY films coated with glycerol significantly increased the DPPH values. This may due to the ability of glycerol to solubilize and stabilize antioxidants present in the films. In conclusion, green tea-based films with the presence of glycerol demonstrated good physical properties and high antioxidant content, making it a potential material to be used as biodegradable films to reduce single-used plastic waste.

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ST-035 Toward Sustainable Tea (*Camellia sinensis*) Production: The Role of Seaweed Extract and Biochar on the Growth, Physiology and Soil Fertility

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Abstract. The tea industry faces growing sustainability challenges due to limited land and rising input costs. Reducing agrochemical dependence while maintaining productivity and improving soil health is essential. This study evaluated the effects of seaweed extract (SWE), alone and in combination with biochar, on tea growth, physiology, quality and soil fertility under reduced fertilizer input. Results indicated that halving fertilizer application adversely affected tea growth. While individual application of SWE or biochar did not fully compensate for reduced fertilizer, their combined use produced a synergistic effect. The combined impact of both amendments improved soil pH, OM, and CE by 10%, 268%, and 2.5%, respectively. This increased the availability of key nutrients, N, P, and K, by 46%, 15%, and 23%. As a result, nutrient absorption also increased, with N, P, and K uptake rising by 11%, 26% and 20%, respectively. Further, the enhanced nutrient availability boosted photosynthetic rates, total chlorophyll and RGR by up to 21%, 28% and 19%, respectively. Therefore, synergistic strategy offers a sustainable, cost-effective alternative, allowing for up to 50% reduction in fertilizer use without compromising productivity.

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ST-036 Finite Element Analysis of U-Shaped Biodegradable Polyvinyl Alcohol Thin Film for Sustainable MEMS Applications

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Abstract. The advancement and sustainability of micro-electro-mechanical systems (MEMS) increasingly depend on the integration of environmentally friendly and biodegradable materials that maintain high mechanical performance. This study presents a Finite Element Analysis (FEA) of U-shaped biodegradable Polyvinyl Alcohol (PVA) thin films, using SolidWorks® software, to assess their mechanical behaviour in comparison with conventional MEMS materials such as Silicon, Copper, and Gold. The analysis focused on stress distribution and displacement under gradually increasing loads. Results revealed that PVA exhibits superior flexibility, with a peak displacement of 18.39 μm at a load of 0.01 N—substantially higher than traditional materials. While PVA showed a slightly lower maximum stress tolerance (4.88 MPa) compared to Gold (4.93 MPa), the difference was minimal (1.09%). These findings highlight the potential of biodegradable PVA as a sustainable alternative for MEMS applications, especially in environmentally conscious and biocompatible device design, aligning with the goals of green technology and sustainable engineering.

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ST-038 Agronomic Performance and Resistance Traits of Abaca Hybrid (*Musa textilis* Nee) in the Field

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Abstract. The abaca (*Musa textilis* Nee) industry is a vital contributor to employment and foreign exchange in the Philippines, but its productivity is increasingly threatened by viral diseases, particularly abaca bunchy top virus (ABTV). This study aimed to evaluate the agronomic performance and disease resistance of newly developed ABTV-resistant abaca hybrids under greenhouse and field conditions. Tissue-cultured plantlets were assessed for key agronomic traits including pseudostem weight, length, and girth; dry fiber weight; percent fiber recovery; and sucker production. Disease resistance was evaluated through symptom observation and confirmed using ELISA and PCR diagnostics. Results indicated that the hybrids matured earlier (10–14 months) after planting. Notably, abaca hybrid Bandala (H7) outperformed Inosa with longer pseudostem (250–300 cm), heavier weight (25–30 kg), more suckers (8–10), and higher fiber dry weight (750–850 g) with similar fiber recovery (2.5–3.0%). Additionally, hybrids exhibited complete resistance to ABTV, showing no symptoms and testing negative via PCR, unlike the highly susceptible control varieties 'Inosa' and 'Tinawagang Pula.' Hybrids also showed partial resistance to abaca mosaic and bract mosaic viruses under high disease pressure. These findings highlight the potential of virus-resistant abaca hybrids to improve yield, reduce disease losses, and support the long-term sustainability of the abaca industry.

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ST-039 Loop-Mediated Isothermal Amplification Assay For Rapid Detection Of Banana Bunchy Top Virus (BBTV) In Abaca (*Musa textilis* Nee)

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Abstract. The Banana Bunchy Top Virus (BBTV) poses a severe threat to abaca production, leading to significant yield losses and economic hardship. This study highlights the effectiveness of the Loop-Mediated Isothermal Amplification (LAMP) assay for detecting BBTV in abaca plants from Agusan del Norte and Agusan del Sur. The primary objective was to evaluate LAMP's performance in identifying BBTV, compare infection rates across provinces, and assess its advantages over traditional PCR. We collected 140 leaf samples from seven municipalities, encompassing both symptomatic and asymptomatic plants. The results revealed a high prevalence of BBTV, with 51 out of 80 samples in Agusan del Norte and all 60 samples in Agusan del Sur testing positive. The LAMP assay, employing specific primers and visualized with SYBR Green, proved to be exceptionally sensitive and rapid, offering a significant improvement over conventional PCR methods. This innovative assay demonstrated remarkable accuracy and cost-effectiveness, making it an invaluable tool for early and precise BBTV detection. The findings emphasize the urgent need for advanced detection methods like LAMP to implement effective disease management strategies. By enhancing early detection capabilities, LAMP enables timely intervention, thereby safeguarding abaca crops and promoting the long-term sustainability of the industry in these regions.

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ST-040 Digitising the Herbal Industry and Its Role in Sustainable Forest-Based Bioeconomy in Malaysia

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Abstract. Malaysia is well known as one of the twelve mega biodiversity, with the herbal industry having significant economic and ecological value. However, the information about the landscape of the herbal industry is fragmented, with weak traceability and limited digital integration. The Forest Research Institute Malaysia (FRIM) developed HerbaXpress to address these challenges. This national digital platform connects stakeholders across the herbal value chain using verified data on species, products, and geographic locations. This study presents the first analysis of HerbaXpress data, comprising 7000 herbal players from planting material suppliers, cultivators, producers, wholesalers, retailers and service providers. It maps value chain roles, dominant plant species, and spatial patterns. The results highlight that Tongkat Ali and Kacip Fatimah are the most commonly used species by the industries. However, only a few herbal players include scientifically verified species names, which raising concerns about quality and sustainability. By integrating species authentication and geospatial tools, HerbaXpress supports biodiversity conservation, traceability, and market access, especially for small producers. It also aligns with national policy goals and contributes to SDG 8, SDG 12, and SDG 15. The platform offers a scalable model for digitalising traditional bio-resource sectors.

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ST-042 Domestic Tourist Perceptions of Social Carrying Capacity: Implications for Sustainable Tourism Management in Pangkor Island, Perak

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Abstract. Although economically advantageous, tourism growth can present considerable challenges to local communities and natural environments if not properly managed. This study examines domestic tourists' perceptions of Social Carrying Capacity (SCC) on Pangkor Island, Perak, a well-known tourism destination in Malaysia. A quantitative approach was used to collect data from 92 domestic tourists through structured questionnaires and the People at One Time (PAOT) visual assessment method to assess perceived crowding during peak periods. Most respondents (84.8%) indicated that their visit was for holidays and leisure. Results demonstrate a moderate level of satisfaction with infrastructure, especially in transport services (mean = 3.27). However, concerns were identified regarding cleanliness (mean = 3.01), crowding (mean = 2.25), and interaction with local communities (mean = 2.29). Findings from the PAOT showed that moderate crowding levels were deemed acceptable, with 39.1% of the respondents selecting Image C and 37.0% selecting Image D. The study emphasises the necessity of ongoing monitoring and increased community engagement, despite current SCC indicators being within acceptable thresholds, to ensure a balance between tourism development and the quality of life for residents. The findings provide valuable insights for policymakers and tourism planners focused on sustainable destination management in coastal and island contexts.

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ST-043 Microalgal CO₂ Concentration Mechanisms and Their Role in Sustainable Green CO₂ Sequestration Potential

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Abstract. The CO₂ concentration mechanism (CCM) in *Chlamydomonas* (a microalga) is an adaptation to changing CO₂ availability and constraints imposed due to the less efficient CO₂-fixing enzyme, RuBisCo. It depends upon rapid scavenging of CO₂ and active uptake and transport of both HCO₃⁻ and CO₂ to the site of RuBisCo. The induction of CCM takes place under low or very low CO₂ conditions and accumulates 100-fold more CO₂ than environmental CO₂, representing the most efficient CO₂ pumping system discovered so far. The use of CCM for sustainable CO₂ sequestration is limited due to its induction under low CO₂ but not at high CO₂ and high light conditions. The exposure of cells to gamma irradiation may develop high CO₂-requiring mutants. The studied objectives were to screen the effect of gamma irradiation on *C. reinhardtii* and to analyze the physiological and biochemical alterations induced by gamma irradiation across various CO₂ concentrations and light conditions. The cells were exposed to the gamma irradiation (G-5000) at Baba Atomic Research Centre, Mumbai. The results revealed that both colony and cell numbers decreased with increasing gamma radiation. Cells exposed to gamma radiation exhibited more chlorophyll and carotenoid content, notably at 200 Gy. Interestingly, irradiated cells exhibited twofold increased biomass under high CO₂ and high light conditions. The gamma radiation-based random mutagenesis and screening led to the identification four putative high carbon requiring mutants.

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ST-044 Comparative Analysis of ResNet-18 and EfficientNet-B0 for Lightweight Deep Learning in Smart Waste Classification

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Abstract. Waste mismanagement poses a growing challenge to urban environments, where effective recycling systems are critical to minimizing environmental impact. Recent advances in computer vision and deep learning have enabled the automation of waste classification processes, yet lightweight models suitable for deployment in resource-constrained settings remain underexplored. Although prior studies have applied deep convolutional networks for waste recognition, many rely on computationally intensive models that limit real-world scalability. In this paper we show that lightweight architectures, specifically EfficientNet-B0 and ResNet-18, can effectively classify waste images into six common categories: cardboard, glass, metal, paper, plastic, and trash. We trained and evaluated both models using TrashNet dataset of 2,527 images with size 224×224 pixels. EfficientNet-B0 achieved a test accuracy of 92% and a weighted F1-score of 0.92, outperforming ResNet-18, which reached 90% accuracy and an F1-score of 0.90. Notably, EfficientNet-B0 performed better across most classes, while ResNet-18 exhibited higher recall for the minority trash class. These results demonstrate that lightweight models can balance efficiency and accuracy in waste classification tasks.

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ST-045 Hydroxyapatite Synthesized from Defunct Coral Reefs for Bioceramic Applications

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Abstract. Hydroxyapatite (HA) is a bioceramic material widely recognized for its excellent biocompatibility and similarity to the mineral component of natural bone. In this study, defunct coral reefs were utilized as a natural calcium source for the synthesis of hydroxyapatite. The coral was first calcined at varying temperatures of 800°C, 900°C, and 1000°C to produce calcium oxide (CaO) powder. The results indicated that calcination at 900°C yielded the highest CaO content, reaching 84.09%. Subsequently, the obtained CaO was employed in the synthesis of hydroxyapatite, with sintering temperatures set at 800°C, 900°C, and 1000°C. X-ray diffraction (XRD) analysis revealed that all synthesized samples exhibited similar diffraction patterns, with dominant peaks corresponding to hydroxyapatite, indicating successful phase formation. Fourier Transform Infrared Spectroscopy (FTIR) further confirmed the presence of characteristic functional groups, including strong phosphate (PO_4^{3-}) bands, hydroxyl (OH^-), and carbonate (CO_3^{2-}) groups, consistent with standard hydroxyapatite spectra. Scanning Electron Microscopy (SEM) analysis supported these findings by demonstrating the typical morphology of hydroxyapatite. The results demonstrate that defunct coral reefs can be effectively converted into high-purity hydroxyapatite highlighting their potential as a sustainable raw material for bioceramic applications.

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ST-046 Phytochemical Characterization and Wound Healing Potential of *Alocasia longiloba* Miq. Extracts in Excision Wound Rat Model

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Abstract. *Alocasia longiloba* is a medicinal aroid known for its traditional wound healing by local forks.. However, the specific mechanisms and active compounds responsible for its therapeutic effects remain underexplored. This study aimed to evaluate the wound healing potential of the ethanol extract (EE) and chloroform fraction (CF) of *A. longiloba* petiole using in vivo, biochemical, histological, and phytochemical approaches. Wound healing activity was assessed in Sprague-Dawley rats through histological analysis, and measurement of biochemical markers of oxidative stress, total antioxidant status (TAS) and malondialdehyde (MDA) as well as inflammatory cytokines (IL-6, IL-10). CF-treated wounds exhibited accelerated wound closure and significantly improved tissue regeneration, as evidenced by enhanced fibroblast proliferation, angiogenesis, collagen deposition, and epithelialization. Biochemically, CF significantly elevated TAS and IL-10 while reducing MDA and IL-6 levels, indicating strong antioxidant and anti-inflammatory activity. Phytochemical characterization using GC-MS, LC-MS, and FTIR revealed the presence of bioactive compounds including isoferulic acid, 6-paradol, β -sitosterol, and various phenolics and fatty acids, which are known to modulate inflammation and oxidative stress. These findings support the therapeutic potential of *A. longiloba*, particularly its chloroform fraction, as a natural agent for promoting wound healing via multiple synergistic mechanisms.

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ST-047 Identification of the Influence of Meteorological Factors on NO_x Emissions at Palm Oil Mill Generators Using Multiple Linear Regression Models

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Abstract. The palm oil processing industry potentially emits nitrogen oxide (NO_x) gases, which may harm the environment and public health. This study aims to model NO_x emission dispersion from the generator stack of a planned palm oil mill by PT. XYZ in the Tenayan Raya Industrial Area, Pekanbaru, and analyze the influence of meteorological factors on emission concentrations. The AERMOD model was used with input data including 2023 meteorological data from the Copernicus Climate Data Store, topographic data, and stack specifications. Emission concentrations refer to the air quality standard set by the Indonesian Ministry of Environment and Forestry Regulation No. 11 of 2021 (3400 mg/Nm³). The modeling showed the highest NO_x concentration in January (0.082 µg/m³) and the lowest in March (0.033 µg/m³). Windrose analysis revealed dominant wind directions toward the southeast and south in the dry season, and toward the north and northwest in the rainy season. Pearson correlation indicated positive relationships between NO_x and rainfall and air pressure, and negative relationships with temperature, wind speed, relative humidity, and cloud cover. Multiple linear regression identified temperature as the most influential factor ($R^2 = 0.98$), while all meteorological variables collectively explained 71.2% of NO_x concentration variation.

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ST-048 A Forward-Scattering Laser Speckle Imaging System for Rapid, Real-Time, and Non-Destructive Detection of CPO Adulteration

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Abstract: Ensuring the purity of crude palm oil (CPO) is crucial for maintaining product quality, consumer safety, and economic value. However, conventional detection methods, such as Fourier Transform Infrared (FTIR) spectroscopy, Raman spectroscopy, and chemical analysis, are often time-consuming, reagent-dependent, and unsuitable for real-time industrial applications. This study proposes a forward-scattering Laser Speckle Imaging (LSI) system combined with real-time speckle monitoring as a rapid, non-destructive, and reagent-free method for detecting CPO adulteration. A custom-designed Graphical User Interface (GUI) was developed to enable continuous monitoring and instant classification. A total of 23 sample variations were tested under four different optical distance configurations to determine the optimal setup. The results indicate that the best performance is achieved with a 30 cm distance between both the laser source and the cuvette, and the camera and the cuvette, yielding the highest sensitivity to optical property differences. The developed system achieved an accuracy of 94.74% in distinguishing between pure and adulterated CPO. This method offers a promising alternative to conventional techniques, providing a fast, reliable, and eco-friendly solution for industrial-scale palm oil quality control.

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ST-049 Optimization of Electrophotographic Toner Properties by Addition of Reduced Graphene Oxide and Palm Oil Shell Carbon Aerogel using Emulsion Aggregation Method

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Abstract. This study aims to make an environmentally friendly electrophotographic toner using carbon aerogel made from activated carbon from palm kernel shells mixed with reduced graphene oxide (rGO). The main objective is to assess the feasibility of this biowaste-based material as a sustainable alternative to commercial toner in terms of print performance and material characteristics. The palm kernel shell carbon aerogel was made using a chemical process to activate it and then heating it to turn it into carbon, while the toner formulation was prepared by the emulsion aggregation (EA) method. This method enables improved particle homogeneity and allows performance comparison with commercial toner. Toner characterization included print quality evaluation, color image analysis, and toner density measurement. The SEM analysis results showed that the carbon aerogel has a long shape, is light, has holes in its surface, and can withstand high temperatures above 151.99°C. The B1 toner formulation exhibited print quality and RGB color values comparable to commercial toner, with a notably low toner density of 0.480 g/cm³. These findings suggest the potential of palm kernel shell-based carbon aerogel as a sustainable material for eco-friendly toner applications.

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ST-050 Analysis Of Heavy Metal Content In Emissions From Shell, Fiber, And Empty Fruit Bunch Biomass Fuels

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Abstract. Riau Province is one of the largest palm oil producers in Indonesia, where palm oil mills use boilers as a primary component to generate steam energy for processing activities. At PT TH Indo Plantation, particularly at Pulai Palm Oil Mill, biomass fuels such as palm kernel shells, fibers, and empty fruit bunches are commonly used. Boiler operations are often associated with emissions that may pose environmental and health risks. This study aims to analyze the heavy metal content in emissions from these biomass fuels. The research employed quantitative methods, including proximate and ultimate analyses, as well as spatial modeling using AERMOD to observe emission dispersion. The results showed relatively low heavy metal content: 0.01% in palm kernel shells and empty fruit bunches, and 0.02% in fibers. AERMOD simulation indicated that the concentration of PM_{2.5}-type particulate matter reached 3.31311 $\mu\text{g}/\text{m}^3$, with dispersion extending up to 3 km from the source. Based on these findings, the use of shell, fiber, and empty fruit bunch fuels at Pulai Palm Oil Mill does not result in significant environmental impact related to heavy metal dispersion and may be considered relatively safe.

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ST-051 Resonant Frequency Shift Analysis of a Rectangular Metamaterial Sensor for Salinity Measurement

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Abstract. Salinity intrusion in coastal and estuarine environments poses a serious threat to freshwater availability, agriculture, and ecosystem health. Accurate monitoring of salinity levels in both water and soil is essential for environmental management and early warning systems. Conventional salinity measurement techniques often require bulky equipment or complicated sampling procedures, limiting their practicality for real-time monitoring. To overcome these limitations, metamaterial-based sensors offer a novel solution due to their ability to manipulate electromagnetic waves with high sensitivity and specificity. This study investigates a rectangular metamaterial sensor through electromagnetic simulations to evaluate its performance in detecting salinity. The sensor is designed to exhibit resonant frequency shifts in response to variations in the dielectric properties of the surrounding medium, which are influenced by salinity levels. Analysis of the S-parameters reveals a consistent and measurable shift in the resonant frequency as salinity increases. The simulation results show a strong linear correlation between salinity concentration and frequency shift, with a correlation coefficient greater than 0.95. These findings demonstrate that the proposed metamaterial sensor provides reliable, accurate, and real-time detection of salinity. Its compact and non-invasive nature makes it a promising candidate for future applications in environmental and agricultural salinity monitoring systems.

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ST-052 Portable Laser Speckle Imaging System with Neural Networks for Adulterated Fertilizer Detection

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Abstract. The high demand for fertilizers in Indonesia's agricultural sector has triggered the widespread circulation of adulterated (mixed) fertilizers, which are difficult to identify visually and may cause significant losses for farmers as well as environmental damage. This study aims to design a fertilizer identification system for pure and adulterated fertilizers based on Laser Speckle Imaging (LSI) combined with an Artificial Neural Network (ANN) using the backpropagation method. The LSI system applies a forward scattering configuration with a 650 nm diode laser source and a CMOS camera to capture speckle patterns, which are then processed into RGB data. The RGB data are analyzed using an ANN with a multi-layer network architecture (500, 300) to classify six types of samples: pure non-subsidized urea fertilizer, subsidized urea fertilizer, and adulterated fertilizer with various mixing ratios of 3 g, 5 g, 7 g, and 9 g. The speckle image processing results show that the RGB patterns differ significantly between pure and adulterated fertilizers. The ANN model achieved a training accuracy of 97.49% and a testing accuracy of 99.59%, with a Mean Squared Error value approaching 0.00001. The implementation of this system through a MATLAB-based GUI enables rapid, non-destructive, and real-time fertilizer identification. This research demonstrates that the integration of LSI and ANN has great potential as a practical and cost-effective alternative method for fertilizer quality testing compared to conventional laboratory analyses.

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ST-053 Bioactivity of *Mikania micrantha* Extract in Controlling *Erwinia chrysanthemi*: A Natural Antibacterial Approach

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Abstract. Crop losses resulting from soft rot disease caused by *Erwinia chrysanthemi* present a persistent threat to agricultural productivity. The extensive use of chemical pesticides has raised environmental and health concerns due to their residual toxicity and ecological impact. As a sustainable alternative, plant-derived biopesticides have received increasing focus for their eco-friendly properties. This study aims to evaluate the potential of sembung rambat (*Mikania micrantha*) as a biological controller in inhibiting the growth of *Erwinia chrysanthemi* bacteria. The antibacterial activity test of the extract of the sembung rambat (*Mikania micrantha*) plant against *Erwinia chrysanthemi* was carried out using the Kirby- Bauer smear method. Activity test was conducted on 2 control groups; negative control and positive control (chloramphenicol 1%) and the treatment group; concentration of *Mikania micrantha* leaf extract; 25%, 50% and 80%. Data were statistically analyzed using analysis of variance (ANOVA), followed by Duncan's multiple range test at a 95% confidence interval. The 80% extract demonstrated the highest antibacterial activity, with an inhibition zone averaging 8.40 mm. These results suggest that *M. micrantha* leaf extract holds potential as a biocontrol agent in managing *E. chrysanthemi*, thereby contributing to more sustainable and eco-friendly agricultural practices.

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ST-054 Synthesis of Mannich Eugenol Oxirane Morpholine Compound as Antifungal In Vitro And in Silico

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Abstract. The use of antifungal drugs increases along with the increase in fungal infections. This causes the fungus to be resistant to antifungal drugs, one of which is the azole class of drugs. This increase resistance poses a major threat to global health services. This research aims to synthesize eugenol-morpholine compound reacted with epichlorohydrin as antifungal drug in vitro and in silico. In silico testing uses the molecular docking method with the discovery studio application. Synthesis of eugenol-morpholine and synthesis of eugenol oxirane morpholine using the reflux method. Characterization of synthetic compounds using NMR. The synthesized compound was applied for in vitro testing on the *Candida albicans* fungus using the disc diffusion method. The results of in vitro and in silico research show that the compound eugenol oxirane morpholine has better antifungal activity compared to the compounds eugenol-morpholine and eugenol. The results of in silico research showed a cDOCKER value of -38.5537 kcal/mol and the in vitro results had an inhibition zone of 28.55 mm. The best compound as an antifungal drug candidate is the compound eugenol oxirane morpholine with the lowest cDOCKER value in in silico testing and a wide zone of inhibition in in vitro testing showing very strong activity.

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ST-055 Implementation of Visible Light Communication (Vlc) For A Water Monitoring System Based on an Android Application and Cloud Database

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Abstract. Water quality is crucial for the environment, industry, and public health. To maintain water quality, a monitoring system capable of accurately and efficiently measuring key parameters is essential. This study develops an application based on Visible Light Communication (VLC) technology for real-time water quality monitoring, offering advantages in speed, security, and minimal electromagnetic interference compared to other wireless technologies. The application connects to a sensor system that measures various water parameters of a lake i.e. temperature, pH, TDS and water height level. It enables data transmission through visible light (red laser) and radio frequency based on microcontroller Arduino R3 and NODEMCU ESP8266. The received data is stored in a cloud database, allowing efficient access and further analysis. The mobile application itself was designed by using Integrated development environment (IDE) in Visual Studio Code. Testing results indicate that the application can display monitoring data accurately and responsively. In communication testing, the delay from the database to the application was around 2 to 4 seconds, which proves that the system has low latency, making it suitable for real-time data monitoring. This research serves as a foundation for the development of more advanced and efficient water monitoring systems.

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ST-056 Electrochemical and Thermal Studies of Polymer Electrolyte Membrane Based on Cellulose-Chitosan-Alginate as Lithium Ion Battery Separator

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Abstract. The commercial Polymer Electrolyte Membrane (PEM) products typically consist of synthetic and non-biodegradable materials, which requires toxic reagents and complex synthesis processes. The aim of this research is to synthesize PEM using biodegradable materials based on cellulose-chitosan-alginate as an environmentally friendly PEM in lithium-ion battery applications. The synthesis of PEM was conducted using Hydroxy Ethyl Cellulose (HEC), Carboxymethyl Chitosan (CMCs), and Sodium Alginate (SA) in nine (9) variations of compositions. The methods start from the synthesis of each variation in aquadest, then LiOH was added as an electrolyte source and glutaraldehyde as a crosslinking agent using the solution casting technique. The electrochemical analysis (EIS-CV), thermal analysis (TGA-DSC), swelling and porosity testing were carried out for membrane variations. Based on electrochemical test, the highest ionic conductivity value was obtained from the HEC:CMCs:SA (0:50:50) variation of 1.06×10^{-1} S/cm and highest specific capacitance was obtained from HEC 100% of 75.5 F/g. The best TGA-DSC test results were obtained from the HEC:CMCs:SA (0:50:50) variation with a weight loss of 30.49%, Tg (Glass Transition) of 197.26°C, and Tm (Melting Point) of 270.04°C. The best swelling and porosity results were obtained from the HEC:CMCs:SA (50:0:50) variation, which were 48.39% and 9.9456%.

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ST-057 Exploring plant-based antiviral agents from Malaysian medicinal plant biodiversity

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Abstract. Plant-derived compounds offer promising alternatives for antiviral drug development due to their structural diversity and bioactivity. This study explores the potential of three medicinal plants namely *Asplenium nidus*, *Phaleria macrocarpa*, and *Goniothalamus umbrosus* as sources of antiviral agents. The paper discusses the various extracts from the above mentioned plants for the in vitro antiviral activity in particular against herpes simplex virus type-1. The variability in phytochemical profiles will be addressed and related to the molecular mechanisms of antiviral action and possible activity towards the host cells. *Asplenium nidus* root aqueous extract that contains flavonoids showed several mode of action including preventing virus attachment and penetration into cells, virucidal activity by damaging virus particles and reduces viral progeny to halt reinfectivity. *Phaleria macrocarpa* fruit protein aqueous extract can affects viral entry, virucidal activity and progeny release. Goniothalamine from *G. umbrosus* has the ability to induce intrinsic pathway apoptosis in infected cells, causes cell cycle arrest, reduces progeny release, effective during early virus replication cycle and has a strong affinity with the thymidine kinase. These findings underscore the potential of tropical medicinal plants in contributing to novel antiviral therapeutics.

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Geosciences

Minerals and geology related to
geo-scientific issues and
technology



GS-001 Evaluation of Groundwater Sources Using Electrical Resistivity Imaging (ERI) Method in Felda Tersang 02, Raub, Pahang

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Abstract. This study employs Electrical Resistivity Imaging (ERI) method in the Felda Tersang 02 area of Raub, Pahang, to address the region's water supply disruptions. The study area is primarily composed of sandstone, slate and dacite. Groundwater is an essential resource for agricultural, residential, and industrial uses. However, exploring and evaluating groundwater sources can be challenging due to the complexity of subsurface geology and hydrogeology. Electrical Resistivity Imaging (ERI) is a geophysical method used to map and assess groundwater sources by measuring the electrical resistivity of subsurface materials. Each of the survey lines extends over a length of 200 meters, incorporating 41 takeouts positioned at 5m spacing, and adopts the Schlumberger array and pole-dipole electrode configuration. The study's outcomes will aid in groundwater resource management and provide a better understanding of the area's subsurface geology and hydrogeology. The 2D pseudosection results for all three survey lines emphasize a substantial accumulation of groundwater in a spatially expansive zone. This exhibits low resistivity values between 0 Ωm and 100 Ωm , indicating water-saturated materials with high groundwater potential.

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GS-004 Petrography and Mineralogy of Plutonic Rocks in Dabong, Kelantan, Malaysia

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Abstract. The textures and minerals in the granitic rocks are contributing to the magma evolution using the combination of petrography and mineralogy study in Dabong, Malaysia. Here, the results are presented for the northern part of the Central Belt in Peninsular Malaysia that is linked with the overall Central Belt. The intrusion of the Stong Migmatite Complex into the metamorphic rocks in the surrounding area is shown by the large bodies of batholith in the Stong Mountainous area. Based on the textures, granites can be divided into biotite granite porphyry and biotite granite with medium to coarse grain size. Some parts of the granite show alteration of biotite into chlorite and sericite. Results from X-ray Diffraction show the varieties of minerals, including quartz low, alkali feldspar (orthoclase and microcline), and plagioclase (labradorite and oligoclase), which indicate the forming of the mineral might be lower than 3 GPa and the temperature range up to 1500 degrees Celsius. Based on the results suggesting magma differentiation undergoes the Strong Migmatite Complex with some alteration during the crystallisation process.

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GS-005 Geoheritage Potential of Limestone Caves at Felda Chiku 7, Gua Musang, Kelantan, Malaysia

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Abstract. The aim of this study is to assess the geoheritage potential at Felda Chiku 7, Gua Musang, Kelantan. There are 2 caves in the study area. Both caves basically have unique geological features that can be observed in nature. The geology of the study area is mainly covered by 3 types of lithology, which are limestone, phyllite and slate. The geoheritage values of the area were observed by using qualitative and quantitative assessments, where the qualitative assessment was based on researchers' observations, whilst the quantitative assessment was based on the geoheritage potential (GP) equation. The study indicates a high scenic/aesthetic value for the assessed sites, Chiku 7 caves.

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GS-006 Geology and Petrographic Analysis of Schist, Quartzite, and Granite from Kampung Kelaik, Lojing, Kelantan.

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Abstract. This study presents the geology and petrographic analysis of Kampung Kelaik, Lojing, located within the Bentong–Raub Suture Zone (BRSZ) in the Central Belt of Peninsular Malaysia. Despite its tectonic significance, detailed petrographic documentation of specific rock units in this area remains limited. Field mapping and thin section analysis were conducted on samples from three major rock units: schist, quartzite, and granite. Schist, interpreted as the oldest unit based on field relationships and cross-cutting granite contacts, comprises ~50% aligned micas (biotite and muscovite), ~35% quartz, ~12% feldspar, and ~3% opaque minerals, exhibiting strong foliation consistent with medium-grade regional metamorphism. Quartzite, interpreted as a metamorphosed arkosic sandstone, is dominated by >90% quartz with polygonal interlocking textures and granoblastic fabric, lacking sedimentary features and feldspar twinning. Granite, the youngest unit, displays a phaneritic, holocrystalline texture with interlocking quartz (~30%), alkali feldspar (~40%), and plagioclase (~30%), with features such as perthitic intergrowths and polysynthetic twinning confirming its classification as monzogranite. The lithological succession and microtextural features indicate a tectonic sequence involving sediment deposition, metamorphism under directed stress, and post-tectonic granitic intrusion. These findings clarify stratigraphic relationships and contribute to understanding the petrogenesis and structural evolution of the BRSZ.

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GS-008 Geochemical Assessment of Sediments in Kampung Belanga, Kuala Krai, Kelantan: Implication for Mineralization and REE Distribution

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Abstract. This study presents a geochemical analysis of sediment samples from Kampung Belanga, Kuala Krai, Kelantan, aimed at assessing elemental composition and identifying potential mineralization. While Kelantan is known for its mineral wealth, limited geochemical data exists for smaller areas like Kampung Belanga, with previous research primarily focused on larger mineral belts and lacking integration of spatial and mineralization data. Selected six sediment samples were analyzed using Inductively Coupled Plasma Mass Spectrometry (ICPMS), X-Ray Fluorescence (XRF), and Atomic Absorption Spectrometry (AAS). The analysis focused on major, trace, and rare earth elements (REE), particularly elements indicative of mineralization, such as iron, copper, zinc, and lead. ICPMS analysis of REEs indicated the highest total REE concentration in sample SA8H (166.69 ppm), with a predominance of light rare earth elements (LREEs) such as Lanthanum and Cerium. The concentrations of heavy rare earth elements (HREEs) were generally lower, with Yttrium contributing significantly to the total HREE content. Chondrite-normalized REE patterns exhibited a distinct Europium anomaly, typical of felsic, crustal sources, likely originating from the weathering of granitic rocks in the region, particularly the Stong and Noring Granites. The study highlights the potential for future mineral exploration and REE distribution in Kampung Belanga, Kuala Krai, particularly in relation to REE-bearing sediments, and underscores the significance of integrating multiple geochemical techniques for comprehensive geological assessments.

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GS-010 Geophysical Investigation of Subsurface Structure Using Electrical Resistivity Imaging (ERI) and Induced Polarization (IP) Methods in Metagneous Terrains of UMK Jeli, Kelantan

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Abstract. This study presents a geophysical investigation of subsurface structures within the metagneous terrains of selected area located in Jeli, Kelanta using integrated Electrical Resistivity Imaging (ERI) and Induced Polarization (IP) methods. The study area lies within the Central Belt of Peninsular Malaysia. Geological mapping at this area revealed the presence of metagneous rocks, offering critical insights into the lithological distribution and structural deformation history of the region. Geophysical surveys along selected profiles delineated variations in resistivity and chargeability, identifying key features such as fractured zones, weathered layers, and compact bedrock. High resistivity and moderate-to-high chargeability values correspond to intact metagneous rock bodies, while lower values indicate weathered or altered zones. The integration of ERI and IP data with surface geological observations provides a comprehensive model of the subsurface, offering insights valuable for REE mineral exploration.

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GS-011 Deciphering Seawater Intrusion in Multilayered Aquifers: Insights from Ionic Ratios and Isotopic Signatures in Northern parts of Kelantan Coastal Aquifer, Malaysia

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Abstract. This study investigates seawater intrusion in a multilayered coastal aquifer system in northern Kelantan, comprising shallow (<15 m), intermediate (15–35 m), and deep (>40 m) zones. Forty-two groundwater samples were analysed for major ions and stable isotopes to identify the source and extent of salinisation. Electrical conductivity ranged from 34 to 3188 $\mu\text{S}/\text{cm}$, with the highest values recorded in the intermediate aquifer. Relationships between chloride (Cl^-) and major ions (Na^+ , Mg^{2+} , Ca^{2+} , K^+ , SO_4^{2-} , Br^-) reveal distinct geochemical patterns. The intermediate aquifer shows a strong Na^+/Cl^- correlation and elevated Br^- and Mg^{2+} , indicating active seawater mixing and ion exchange. Ionic ratios (Na^+/Cl^- , Cl^-/Br^-) further reflect marine influence in this zone. In contrast, the shallow aquifer exhibits low Cl^-/Br^- and high Na^+/Cl^- ratios, typical of freshwater systems. Stable isotope data support these findings: the intermediate aquifer displays depleted $\delta^{18}\text{O}$ (-6.2‰) and d-excess $<8\text{‰}$, pointing to seawater mixing and evaporation. The shallow aquifer shows $\delta^{18}\text{O}$ near -5.0‰ and d-excess $>10\text{‰}$, indicating meteoric recharge. Overall, seawater intrusion is most evident in the intermediate aquifer, moderate in the deep, and minimal in the shallow aquifer. These integrated findings highlight aquifer-specific vulnerability and offer a scientific basis for sustainable groundwater management in coastal areas.

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GS-012 Heavy Metal Concentration in River Sediments of Sungai Lebir, Sungai Galas, and Sungai Kelantan

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Abstract. This study investigates the distribution of heavy metals in stream sediments from three major rivers in Kelantan, Malaysia: Sungai Lebir, Sungai Galas, and Sungai Kelantan. A total of 29 sediment samples were collected from upstream, midstream, and downstream sections of each river, comprising 10 samples from Sungai Kelantan, 9 from Sungai Galas, and 10 from Sungai Lebir, using hand augers at a standard depth of 50 cm. The sediments were processed to determine the concentrations of five environmentally significant heavy metals: Iron (Fe), Manganese (Mn), Zinc (Zn), Cadmium (Cd), and Nickel (Ni), using Atomic Absorption Spectroscopy (AAS). The findings show that Fe (127.7–978 ppm), Mn (24.09–509.1 ppm), and Zn (0.087–2.587 ppm) exceeded the sediment quality guidelines set by the World Health Organization (WHO) at several sites, particularly those influenced by anthropogenic activity. Although Cd (0.007–0.043 ppm) and Ni (0.007–1.072 ppm) were generally within safe limits, localised enrichment was observed in some areas. Notable concentrations were recorded at LS7 (Sungai Lebir), GS6 (Sungai Galas), and AS6/AS9 (Sungai Kelantan), which may reflect the combined effects of land use, underlying geology, and potential point-source pollution. The limited number of samples in relation to the size of the river systems is acknowledged as a key limitation. Thus, this study serves as a preliminary baseline assessment and provides a foundation for more comprehensive future research.

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GS-013 Assessing Landslide Susceptibility in Bukit Kwong Dam, Kelantan, Malaysia Using Geospatial Technique and Frequency Ratio Model

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Abstract. Landslides occurring at or near dam structures are critical geological hazards that can compromise dam stability, damage infrastructure, and pose a significant risk to downstream communities and ecosystems. To understand the risk, this study aims to assess the landslide susceptibility in an ageing embankment, Bukit Kwong Dam, Kelantan, Malaysia, with an integrated approach of Unmanned Aerial Vehicles (UAV), Geographic Information System (GIS) and frequency ratio model. The proposed methodology involves the preparation of a landslide inventory, generation of multiple thematic maps representing factors influencing slope instability, including aspect, slope, profile curvature, plan curvature, elevation, land use, distance from river, Normalised Difference Vegetation Index (NDVI), rainfall and distance from road. These thematic layers were subsequently integrated within a GIS environment using the frequency ratio technique to produce a Landslide Susceptibility Map (LSM). The delineated LSM of the study area was classified into five categories as very low (48%), low (34%), moderate (12%), high (5%) and very high (1%). According to their high frequency values, slope, land use, plan and profile curvatures and distance from river were identified as the most influential predisposing factors contributing to landslide occurrence. The performance and accuracy of evaluated and verified using Area Under Curve (AUC) with an accuracy of 0.70. The results of this study identify landslide-prone areas and can serve as a valuable tool for decision making related to preventing potential hazards to the structure and local communities.

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GS-014 Utilization of Riau Peat-Derived Humic Acid Modified with Urea-Formaldehyde for Ni(II) Adsorption: A Geochemical Approach

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Abstract. This study presents a geochemical approach to developing a humic acid-based adsorbent modified with urea-formaldehyde (HA-UF) for Ni(II) removal. Humic acid was extracted using an alkaline method and crosslinked with urea-formaldehyde via a one-step reflux. The novelty lies in utilizing UF as a stabilizer and assessing the effect of ionic strength on Ni(II) adsorption. The formation of HA-UF was confirmed by characteristic peaks of C–O–C and C–N groups at 1035, 1136, and 1248 cm⁻¹ (ATR-IR), semi-crystalline features at 2 θ = 22° and 25° (XRD), and an increase in nitrogen content from 6.85% to 23.46% (EDX). HA-UF showed enhanced stability (up to pH 12) and active functional groups (–COOH, –OH, –NH) for binding Ni(II). The adsorption followed Langmuir isotherm behavior, with capacity increasing from 1.899 $\times 10^{-4}$ mol/g (HA) to 3.682 $\times 10^{-4}$ mol/g (HA-UF). Kinetic analysis revealed a pseudo-second-order model with a rate constant of 2.328 $\times 10^{-2}$ g/mol·min. However, NaCl presence reduced both adsorption capacity and rate, indicating ionic competition in solution. These findings support the potential of chemically modified humic substances from peat soil as effective materials for heavy metal remediation.

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Environmental Sociology

Socio-cultural sustainability, social impacts on the environment, institutions and policies, ecotourism, environmental laws and governance, including ESG (Environmental, Social, and Governance)



ES-001 Site Suitability Assessment of Recreational Forests in Jeli, Kelantan for *Shinrin-yoku* Practice

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Abstract. In an era of increasing urban stress and mental fatigue, the restorative power of nature has gained global attention particularly through the practice of *Shinrin-yoku*, or forest bathing. Originating in Japan, this nature-based therapy emphasizes mindful immersion in forest environments to enhance physical and psychological well-being. This study explores the potential of four forest recreational sites in Jeli, Kelantan namely Lata Janggut, Lata Keding, Lata Renyok, and Bukit Salor as suitable locations for forest bathing experiences. A total of 154 respondents, largely familiar with these sites, provided feedback through structured questionnaires focused assessing awareness, biodiversity, serenity, and overall environmental quality. Findings reveal that 95.5% of participants deemed the selected sites suitable for *Shinrin-yoku*, with biodiversity and tranquillity emerging as the most valued attributes. The results highlight the therapeutic potential of forest landscapes in Jeli, offering a framework for integrating nature therapy into local ecotourism and wellness strategies. This study provides practical insights for policymakers and planners to promote sustainable forest use while enhancing community health and fostering deeper human-nature connections.

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ES-002 Critical success factors (CSF) in implementing smart solid waste management in Banda Hilir, Melaka

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Abstract. Smart Solid Waste Management (SSWM) employs advanced technologies to enhance the efficiency, environmental sustainability, and regulatory compliance of waste management systems. However, its adoption in Malaysia remains limited, largely due to inadequate stakeholder awareness and insufficient community engagement. This study investigates the core features, implementation barriers, and critical success factors (CSFs) of SSWM in Banda Hilir, Melaka, offering empirical insights to address existing adoption challenges. A quantitative approach was employed, using convenience sampling of 293 respondents from key institutional stakeholders, including the Melaka Solid Waste Corporation (SWCorp), Melaka Historic City Council, and SWM Environment Sdn Bhd. Descriptive statistical analysis identified low-carbon technologies (mean=4.42), multi-stakeholder collaboration (mean=4.35), and intelligent routing systems (mean=4.26) as the most critical features. Key barriers to implementation included financial constraints (mean=3.93), high initial investment costs (mean=3.82), and technological limitations within current waste systems (mean=3.42). These barriers align with four critical success factors (CSF): financial support (mean=4.48), public acceptance (mean=4.12), public awareness (mean=4.11), and the availability of adequate facilities and technology (mean=4.06). The findings offer evidence-based policy recommendations to support the wider adoption of SSWM, contributing to sustainable urban development and aligning with Malaysia's environmental sustainability objectives.

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ES-003 Landscape Design Guidelines for Eco-Tourism-Oriented Rural Homestays Based on ESG Performance

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Abstract. Eco-oriented homestays are a significant driving force for rural revitalization. Landscape plays a critical role in the attraction and differentiation of homestays, contributing to cultural heritage and sustainable economic development. However, the current development of homestays faces issues such as landscape homogenization, disconnection from local culture, overdevelopment, imbalance in ecological protection, lack of interactive experiences, and unregulated services. This study using six representative cases in Zhejiang Province, China. It integrates publicly available government environmental performance data, tourist review text data from online travel platforms and insights from semi-structured expert interviews. A multi-dimensional evaluation framework is constructed based on the Environmental, Social, and Governance (ESG) principles. Quantitative text semantic analysis techniques were applied to parse the review texts. Statistical methods were then used to determine the relative importance of dimensions and indicators and investigate relationships. A significant correlation was observed between the frequency of ecologically positive language in user reviews and official environmental assessment scores. The frequency of location-specific cultural references in guest reviews showed a statistically significant positive association with tourist ratings. Drawing upon the preceding analysis, the study proposes a landscape design guideline centered on green technology, cultural empowerment, and social identity.

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ES-006 Roadside Trees Species Selection Model for Environmental Health and Public Safety in Malaysia

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Abstract. Selecting right tree species for roadside planting is crucial to balance environmental health with public safety concerns. Roadside trees as a part of urban green infrastructure have the potential to cope with some of these problems in urban environment and provide an array of services such as shade provision and aesthetic creation. Unfortunately, roadside trees are also acknowledged to render disservices. Damaged road surface, pedestrian walkway and underground utilities are few instances of this. The wrong tree species planted at the wrong place can lead to significant environmental, social and economic consequences. Aim of this study is to develop roadside tree species selection model for reference to the local authorities. Two objectives are to determine additional attributes in urban roadside tree species selection and to examine the relationship between additional and similar attributes in landscape practices. This research employs mixed methods approaches consisting of both qualitative and quantitative approaches. An in-depth interview was conducted in four selected local authorities, namely Kuala Lumpur City Hall, Petaling Jaya City Council, Selayang Municipal Council, and Subang Jaya Municipal Council. The findings are validated by five registered landscape architects, revealing eleven (11) additional attributes of trend, landscape policies, personal preference, knowledge, skill, experience, expertise, location, space, framework, plan, and themes that influence the selection of roadside tree species in urban areas. These attributes were integrated into the roadside tree species selection model.

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ES-008 A study on the collaborative governance constructs towards sustainable farming in Kelantan, Malaysia

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Abstract. Sustainable farming has become imperative to harmonize economic growth, environmental conservation, and social equity. Kelantan farming sector faces critical challenges, including land degradation, water scarcity, climate vulnerabilities, and technological gaps. While collaborative governance (CG) is touted as a transformative approach to multi-stakeholder alignment, empirical evidence on its drivers and operational constructs in developing agrarian economies remains limited. This study bridges this gap by identifying the critical CG constructs and their drivers for sustainable farming in Kelantan. Through stratified sampling of 117 farmers across ten districts. Results show joint action (3.65) as the most vital CG component, followed by shared motivation (3.55) and principled engagement (3.53). Consequential incentives (3.73) and leadership (3.69) emerged as primary drivers, outperforming interdependence (3.46) and uncertainty (3.37). These findings demonstrating how incentivized participation and strong leadership can enhance agricultural resilience against climate threats and providing a governance framework to improve stakeholder engagement in sustainable practices. The study offers policy-relevant insights for strengthening Kelantan's agricultural productivity and its contribution to Malaysia's food security.

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ES-011 Fashion Recycling: The Insight of Younger Generation in Kelantan

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Abstract. Fashion recycling is also known as fashion sustainability has emerged as a significant practice in promoting environmental sustainability and reducing textile waste, particularly among the younger generation. However, studies on fashion recycling in Kelantan still lack and need more attention. Therefore, this study aims to understand the extent to which youths in Kelantan engage in recycling fashion items, their motivations, and the barriers they face. To perform this study, a qualitative method was chosen by conducting semi-structured interviews with 18 young consumers who involve in fashion. To analyse the data, template analysis was employed with the use of Microsoft Word. Findings have shown a growing awareness of environmental issues related to the fashion industry among the youth in Kelantan. Many respondents expressed concern about textile waste and its harmful effects on the environment. However, while awareness is relatively high, actual engagement in fashion recycling activities—such as donating used clothes, upcycling garments, or purchasing second-hand clothing—remains moderate. Findings also demonstrate that cultural factors, peer influence, and social media play a significant role in shaping young people's attitudes toward fashion recycling. Platforms like Instagram, TikTok, and Facebook contribute to the popularity of thrift shopping and DIY fashion projects, encouraging a shift in perception where second-hand fashion is no longer viewed as inferior.

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ES-012 Assessment of Pesticide Handling Practices and PPE Use Among Rice Farmers in Pasir Mas, Kelantan

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Abstract. The extent to which rice farmers are exposed to pesticides is significantly influenced by their handling practices and their use of personal protective equipment (PPE). This study collected contextual information from 20 rice farmers affiliated with the Kemubu Agricultural Development Authority (KADA) in Pasir Mas, Kelantan. The farmers were surveyed between July 2024 and April 2025. Data were collected through personal interviews and questionnaire surveys, and analysed using descriptive statistical methods. The farmers were aged between 21 and 87 years, had between four and 50 years of experience, and cultivated paddy fields ranging in size from 0.8 to 12.1 hectares. All of the farmers applied pesticides using manual and/or motorised backpack sprayers, with twelve of them had received KADA training between 2022 and 2024. However, none of them reported using alternative pest management methods. The most commonly used pesticides were liquid formulations (4-12 products per farmer), with insecticides being the most frequently used (2-7 products per farmer). All farmers reported using at least one product classified as WHO classes II and III, and some used unregistered and expired products. The most common method of disposing of empty pesticide containers was burying them in the ground (13 farmers). While all farmers wore basic protective clothing (long sleeves and long pants), only 14 wore non-absorbent gloves and boots. These findings suggest gaps in safe pesticide handling practices and PPE use, indicating the need for targeted training and behavioural change interventions, as well as improved access to appropriate protective equipment and waste disposal facilities for the rice farmers in the region.

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ES-015 Site-Specific Planting Design: Linking Soil Texture Analysis to Ecological Landscape Design Strategies

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Abstract. Despite growing emphasis on sustainable campus landscapes, planting decisions often rely on generic species palettes without consideration of micro-site soil variability, leading to poor plant performance and higher maintenance demands. Addressing this gap, the study explores the use of basic and cost-effective soil texture analysis as tool to inform more site-responsive planting strategies. Two accessible soil analysis techniques namely the soil jar test and the ribbon method were used to assess soil texture across selected zones within Universiti Malaysia Kelantan, specifically the Bachok and Jeli campuses. By combining visual sedimentation and tactile assessment, the study translated the findings into site-based planting recommendations embedded within landscape planting layout proposals. The comparison of results reveals distinct differences in soil texture. Bachok's campus soils tend toward sandy loam, which supports drought-tolerant and fast-draining species such as *Casuarina equisetifolia*. On the other hand, Jeli campus soils exhibit higher clay content, favoring moisture-retentive species like *Syzygium myrtifolium*. The outcome of this study provides a practical, site-specific plant recommendation list tailored to each campus's soil conditions. By aligning planting design strategies with local soil conditions, this study implied the contribution to ecologically grounded planting practices and promote greater awareness of soil-responsive design strategies in campus environments.

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ES-016 Assessing the Role of Knowledge in Shaping Household Solid Waste Management Practices: A Study in Kota Bharu District.

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Abstract. Solid Waste Management (SWM) is a crucial aspect of environmental sustainability, requiring active participation from households to ensure effective implementation. This study aims to assess the level of knowledge and practices related to Household Solid Waste Management (HSWM) and examine the association between knowledge and practices, as well as the influence of demographic factors. Data were collected using structured questionnaires distributed to selected households and analysed using SPSS software. Descriptive and inferential statistical methods, including t-tests, ANOVA, and Chi-square tests, were employed. Results indicated that households demonstrated a high level of knowledge regarding HSWM, particularly in areas of reuse, reduction, and segregation. Practices related to recycling and disposal were found to be moderate. A significant association was observed between knowledge and practices across all components of HSWM ($p < 0.001$). Furthermore, significant differences in knowledge and practices were identified based on gender, household income, age, education level, and occupation. The findings suggest that demographic factors play a meaningful role in shaping household waste management practices. Enhancing awareness and promoting targeted educational strategies can further improve community engagement in sustainable waste practices.

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ES-018 Practices and Challenges in Pijanga (*Glossogobius giuris* H.) Fishing across Lake Mainit, Philippines

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Abstract. Lake Mainit is the fourth largest lake in the Philippines, playing an important role in the lives of local fishermen who rely on Pijanga fishing. This study explores the livelihood practices and challenges of fishermen in Lake Mainit, who depend primarily on fishing for income, using semi-structured questionnaires administered to 90 respondents. Frequency and percentage were used to tabulate the data collected. Point-biserial and Spearman's rho correlation tests were utilized to determine significant relationship between practices and socio-demographic variables using Jamovi- an open-statistical software. The findings showed that their primary way of catching fish is by using Modified Cast Net at 65.56%. Most of the challenges they encountered are natural disasters (83.33%), bad weather conditions (57.78%) and the boat or fishing equipment problems (35.56%). There was no significant correlation between fishing methods (Gillnet, Modified cast net, and spears) and the respondent's age, number of children, and educational level. Similarly, catch per kilo, percentage sold, and percentage consumed showed no significant relationship with these factors. Lastly, respondents were asked about their perception towards banning of Pijanga, 51.11% agreed. In conclusion, Pijanga fishing faces a range of challenges, including adverse weather, pollution and regulatory constraints. Fishermen view Pijanga fishing vital to their livelihood and community. To address challenges, they must work with local authorities and environmental groups to ensure its sustainability and protect the long-term health of the lake.

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ES-019 Gender-Based Assessment of Indigenous People Towards Conservation, Management and Perception in Taguibo Watershed, Butuan City, Philippines

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Abstract: The Taguibo Watershed is a key biodiversity area in Caraga Region, providing source of water to the entire of city of Butuan. A gender-based analysis of Indigenous Peoples (IPs) in Taguibo watershed aims to determine the socioeconomic, conservation, environmental management practices and perception of male and female respondents. Following a mixed method approached, the data were gathered through the use of structured surveys questionnaires, key informant interviews and validation through a focus group discussion. Data were analyzed using Spearman Correlation to determine the relationship. A total of 323 IP respondents, 113 (35%) were male and 210 (65%) were female. Most had low education and family income, high percentage of the occupation were housewives and farmer. Gender had a very highly significant ($p < 0.0001$) relationship on occupation but household member ($p = 0.4460$), educational attainment ($p = 0.0335$) and family income ($p = 0.1299$) have no significant relationship. The study reveals that gender should not be a basis for determining one's ability to participate in the conservation and effective management of the Taguibo Watershed. Respondents expressed confidence that continued direct management and conservation of the watershed by members of the indigenous cultural community can lead to sustainable outcomes.

ES-020 Fostering public awareness and wetland conservation through biodiversity education at Paya Indah Wetlands, Malaysia

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Abstract. Paya Indah Wetlands (PIW) in Dengkil, Selangor, managed by PERHILITAN, is a biodiversity-rich reserve that serves as a sanctuary for wildlife such as the endangered saltwater crocodile (*Crocodylus porosus*) and river hippopotamus (*Hippopotamus amphibius*), while promoting conservation, education, and ecotourism. This study evaluated the effectiveness of Communication, Education, and Public Awareness (CEPA) activities in enhancing visitor awareness and knowledge of wetland and wildlife conservation. Using a mixed-methods approach, data were collected from 18 January to 24 April 2025 through questionnaires, interviews, focus group discussions, and field observations involving 261 visitors aged 18 and above. Results indicate that visitors highly valued PIW's conservation and educational roles, with average ratings ranging from 4.52 to 4.58. They appreciated the site's biodiversity (M = 4.45), strongly supported ecosystem protection (M = 4.53), and felt safe during their visit (M = 4.49). These findings suggest that CEPA efforts at PIW positively influence public perception and understanding, offering a useful baseline for future improvements. The study highlights the importance of environmental education in fostering public engagement and supporting long-term biodiversity conservation.

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ES-021 From scraps to sustainability: a case study on SMEs patchwork innovation in Kelantan's batik and dressmaking industry

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Abstract. The fashion and batik industry in Kelantan plays a vital role in preserving Malaysia's cultural heritage and supporting the local economy. However, it simultaneously contributes to a growing issue of textile waste, primarily in the form of fabric offcuts and remnants from dressmaking and batik production processes. These excess materials are often discarded, leading to environmental concerns and resource inefficiencies. This research explores the potential of patchwork the creative reuse of waste fabric pieces as a sustainable design and production strategy. Focusing on selected Small and Medium Enterprises (SMEs) in Kelantan, this qualitative case study investigates how these businesses adopt patchwork techniques to transform textile waste into new, marketable products such as accessories, bags, home decor, and fashion items. Data were collected through a triangulated approach involving direct observation, in-depth interviews with SME owners and artisans, and structured surveys distributed among local producers and consumers. The early findings reveal that patchwork not only contributes to waste reduction but also opens up new streams of income, encourages local craftsmanship, and supports sustainable entrepreneurship. The study highlights the environmental and socio-economic benefits of integrating patchwork practices into the local creative industry, suggesting that this approach can serve as a viable model for circular economy implementation. The study concludes by recommending policy support, design training, and greater market exposure to empower SMEs in sustaining this eco-innovative practice for the future.

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ES-022 Sustainable dining revisited: exploring consumer intentions in green restaurants in Malaysia

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Abstract. The global food industry is undergoing a notable shift towards sustainability, primarily driven by heightened consumer awareness of environmental issues. However, there remains a dearth of research focusing on green practices within the food service sector, particularly from the perspective of green consumers in Malaysia. To address this gap, the present study aims to elucidate the factors that influence consumers' intentions to revisit green restaurants. Using a survey method with purposive sampling, data on consumers' intentions to revisit green restaurants were collected. The study adopted a model based on the Value-Belief-Norm theory and analyzed survey data from 249 respondents using SmartPLS version 4. The findings suggest that green consumerism and product price exert a positive influence on consumers' intention to revisit green restaurants. Conversely, perceived value and quality did not demonstrate a significant impact on revisit intention. These insights hold valuable implications for green restaurant managers and policymakers who are seeking to foster sustainability within the food service sector. Furthermore, they contribute to the advancement of theoretical understanding, offering an extension to the Value-Belief-Norm theory.

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ES-023 Urban environment comparisons between street connectivity with driving preferences in Bandar Kota Bharu, Kelantan

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Abstract. The design of urban environment reflects driver's behaviour and preferences when navigating a town during peak hours or other times. While street connectivity forms various numbers of turns or travel distances indicates uncertainty to the traffic parameters indirectly influences negative driving behaviour. Thus, this study explores the street connectivity in relation to the driver's behaviour and preferences in Bandar Kota Bharu, Kelantan. Bandar Kota Bharu was selected due to its rapid urbanization, which enhances connectivity with surrounding districts and reinforces its cultural identity, thereby centralizing local mobility. This study employed integration mapping and site observations for data collection. Space syntax techniques, including axial-line and HH-integration analyses were used to examine the relationship between street connectivity and the urban environment in Kota Bharu in relation to driver's preferences. Findings show that the high connectivity of main street which is Jalan Sultanah Zainab has a significant relation to the driving preferences especially during peak hours. The street is preferred due to the connections with 12 major streets and links to key nodes like heritage sites, cultural and tourism areas, government offices, and institutions. Therefore, this study implies that the street connectivity parameters should be considered as a strategy element in promoting the enjoyable urban mobility experience.

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ES-024 Assessing the relationship between walkability factors and walking behaviours among university students using structural equation model

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Abstract. Walkability in university campuses has attracted more attention in Malaysia due to its influence on student health, mobility, and environmental sustainability. Yet, few studies have examined the determinants of walking behaviour in local higher learning institutions. This study investigates the relationship between determinants of walkability and walking behaviours among students at Universiti Malaysia Kelantan (UMK), Bachok Campus. A qualitative approach was adopted to gain deeper insights into the determinants of pedestrian behaviours. Quantitative data were collected from a purposive sample of 300 students through a structured survey in May and June 2024, and were analysed using SPSS Version 28.0 and AMOS. This study reveals that among three factors of factors encouraging walkability in campus, only Amenities and Environmental Factors significantly influence student walking behaviours, while Pedestrian Safety and Infrastructure factors, despite high ratings, showed no statistical effect. These findings highlight the importance of campus environments enriched with amenities and environmental features in shaping students' walking behaviours. Prioritizing such elements can promote more active, sustainable, and engaging mobility patterns across the campus.

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ES-025 From nature to design: the role of nature connectedness in shaping biophilic design preferences, attitude and behaviour

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Abstract. Nature connectedness is crucial in shaping an individual's environmental awareness, as well as attitude and behaviour towards nature and the environment. Biophilic design has been found to positively contribute to an individual's health and well-being. However, the impact of nature connectedness on biophilic design has yet to be explored. Hence, this study aims to identify the role of nature connectedness in shaping biophilic design preferences, attitude and behaviour. Questionnaires were randomly distributed to 123 respondents. The data were analysed using mean score, standard deviation, and correlation analysis. The results indicate that people have a more positive attitude towards 'nature in space' than 'nature analogues'. The results also indicate that respondents prefer 'nature in space' rather than 'nature analogues', and these features have a greater impact on well-being. Furthermore, the results indicate that as nature connectedness level increases, the attitude, preferences and behaviour towards biophilic design also become more positive. Overall, this study suggests that nature connectedness is vital and needs to be developed, especially since childhood, through both direct and indirect exposure to nature in the built environment, as well as through environmental education. Subsequently, a higher level of nature connectedness will shape a positive attitude and behaviour towards nature, specifically biophilic design, which will further contribute positively to health, well-being, and the sustainability of future generations. Further research directions have also been outlined.

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Environmental Economics

Ecosystem services, natural
resource products, economic
sustainability, agriculture and
aquaculture



EE-002 Trends and Patterns in the Use of the Contingent Valuation Method for Conservation: A Bibliometric Analysis

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Abstract. The Contingent Valuation Method (CVM) has been widely used to estimate the economic value of non-market environmental goods, particularly in conservation efforts. Despite its extensive application, there has been limited bibliometric research analyzing publication trends, influential contributors, and thematic developments in this field. This study aims to fill that gap by conducting a bibliometric analysis of CVM-related literature in conservation from 2000 to 2024. Data were extracted from the Scopus database using relevant keywords, and analytical tools such as VOSviewer were used to map citation patterns, co-authorship networks, and keyword co-occurrence. The results indicate a steady growth in publications over the last two decades, with a notable increase after 2010. The United States, China, and the United Kingdom emerged as the most productive countries, while leading journals included Ecological Economics and Journal of Environmental Management. Thematic analysis revealed evolving interests from basic valuation techniques to broader topics such as ecosystem services and biodiversity conservation. This study provides a comprehensive overview of the CVM research landscape in conservation and highlights emerging trends and gaps, offering useful insights for future research and policy development.

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EE-003 From Farm to Fork: Evaluating the Socio-Economic and Environmental Impact of Consumer Meat Preferences in Support of Local Agriculture

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Abstract. Consumer food choices, particularly regarding meat consumption, significantly influence both environmental sustainability and rural economic development. This study examines how consumer preferences for locally sourced versus industrially produced meat impact local agricultural systems, environmental outcomes, and socio-economic conditions. A total of 320 questionnaires were distributed through online platform. Using a multiple logistic regression, the research explores the drivers behind meat purchasing decisions and evaluates their alignment with Sustainable Development Goals SDG 8 (Decent Work and Economic Growth) and SDG 12 (Responsible Consumption and Production). Results indicate that a shift toward locally sourced meat supports regional economies by strengthening small-scale farming, creating jobs, and enhancing supply chain resilience, while also offering reduced environmental footprints in terms of emissions and resource use. However, barriers such as price sensitivity, consumer awareness, and distribution access limit broader adoption. The study concludes with policy and market recommendations to promote sustainable meat consumption that benefits both local communities and the environment.

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EE-004 Consumer trust in local meat supply chains and its impact on willingness to pay: advancing sustainable food systems in Malaysia

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Abstract. Trust plays a crucial role in shaping consumer behavior within food systems, particularly in the context of local meat supply chains where concerns over food safety, authenticity, and sustainability are growing. This study investigates the relationship between consumer trust and willingness to pay (WTP) for locally produced meat in Malaysia, aiming to assess how trust in producers, retailers, certification systems, and government regulation influences consumer purchasing decisions. Through a combination method of survey data and econometric analysis, the research explores demographic and psychographic determinants of trust and WTP, while also considering cultural and religious factors unique to the Malaysian context. Using a Contingent Valuation method (CVM), a findings reveal that higher levels of trust in the local meat supply chain significantly correlate with greater consumer WTP, suggesting that transparency, traceability, and effective communication strategies are key to fostering sustainable consumption. By advancing understanding of consumer behavior in emerging markets, this study contributes to the development of resilient and sustainable food systems aligned with Malaysia's broader food security and environmental goals.

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EE-006 Dynamic Panel GMM Approach to Economic Growth, Renewable Energy and Carbon Emissions in High-Emission Countries

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Abstract.

This study investigates the dynamic relationships among economic growth, renewable energy consumption, and CO₂ emissions in ten high-emission countries over the period 1991 to 2021. With the urgent global imperative to achieve sustainable development and climate targets, understanding these interactions is crucial for policy formulation. The primary objective is to examine how renewable energy adoption influences carbon emissions while testing the Environmental Kuznets Curve (EKC) hypothesis, which posits a nonlinear relationship between economic growth and environmental degradation. Employing a balanced panel dataset, the study utilizes multiple econometric methods including Pooled Ordinary Least Squares (POLS), Fixed Effects (FE), Random Effects (RE), and two-step System Generalized Method of Moments (GMM) to address unobserved heterogeneity, endogeneity, and the dynamic persistence of emissions. Key variables include per capita CO₂ emissions (dependent), GDP growth rate and its square (to capture EKC), renewable energy consumption as a percentage of total energy, and lagged CO₂ emissions to capture inertia. Results consistently validate the EKC hypothesis, reveal significant persistence in emissions, and demonstrate that increased renewable energy consumption leads to substantial reductions in CO₂ emissions across all models. The findings underscore the importance of scaling renewable energy infrastructure alongside robust institutional frameworks to accelerate decarbonization. Future research is recommended to explore sector-specific impacts of renewable technologies, the role of financial development, and cross-country technology spillovers to deepen understanding and enhance policy effectiveness in diverse economic contexts.

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EE-008 Towards Developing the Circular Economy Framework in Managing Common Agricultural Waste: The Case of Caraga Region, Philippines

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Abstract. Agricultural waste management remains a critical aspect of sustainable agriculture in the Caraga Region, Philippines. This study aims to develop a circular economy (CE) framework reflecting the local realities to guide the management of common agricultural waste in the region. Using a qualitative research design, data were gathered through key informant interviews, focus group discussions, and analysis of documents from various sources. The study revealed that common agricultural wastes come from rice farming, corn farming, coconut plantation, banana plantation and from livestock and poultry. These wastes are predominantly managed through informal and not environment-friendly practices, including open burning and dumping. Key challenges include limited policy support, lack of appropriate technologies, and weak institutional coordination. Despite these issues, stakeholders identified opportunities for waste valorization through composting, bioenergy production, and resource recovery. Based on the findings, a CE framework is proposed covering waste characterization, stakeholder collaboration, policy and institutional support, technology and innovation, and capacity building. The framework provides a strategic approach to transition to sustainable and circular agricultural waste management in Caraga Region, with potential applications in similar agricultural regions across the Philippines.

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EE-009 The Economic Value of Forest Ecosystem Services: Insights from Recreation and Ecotourism

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Abstract. Forests provide a variety of ecosystem services essential for human well-being, with recreation and ecotourism increasingly recognised as valuable non-market benefits. This study assesses the economic value of forest ecosystem services and visitors' perceptions of recreational and conservation roles within selected Eco Parks in Perak, Malaysia. Using the Contingent Valuation Method (CVM), primary data were collected through structured visitor surveys to estimate their willingness to pay (WTP) for continued recreational access and enhanced conservation efforts in these parks. Additionally, the study gauged visitors' perceptions of the ecological, educational, and socio-economic contributions of Eco Parks to local communities. The findings reveal that recreational and ecotourism services contribute significantly to the local economy through notable non-market values and individual WTP estimates. Most visitors expressed strong support for conservation initiatives and recognised the importance of Eco Parks in providing environmental education, biodiversity protection, and community benefits. Positive visitor perceptions further reinforce the role of Eco Parks as essential assets for sustainable tourism and rural economic development. The study highlights the value of incorporating both economic valuation and public perception into forest management strategies to enhance conservation financing, improve visitor experiences, and support community livelihoods.

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EE-010 Isolation, Identification, and Bioefficacy of Indigenous Entomopathogenic Fungi Against *Pentalonia nigronervosa* Coq. in Abaca

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Abstract. Abaca (*Musa textilis* Nee) remains at risk due to Banana bunchy top virus and Abaca bunchy top virus, vectored by *Pentalonia nigronervosa* Coq. Present management practices largely rely on chemical insecticides, raising environmental and sustainability concerns. This study explores the biocontrol potential of indigenous entomopathogenic fungi (EPF) sourced from aphids and rhizospheric soil in abaca-growing areas. From twenty fungal isolates, four fast-growing and sporulating ones were selected for molecular identification via internal transcribed spacer (ITS) region. AEPF5 was 100% similar to *Fusarium* sp., AEPF9 as *Penicillium* sp. (97%), SEPF1 as *Talaromyces funiculosus* (100%), and SEPF5 as *Trichoderma* sp. (99%). SEPF5 and AEPF9 were most aggressive and effective, with highest mortality rate of 70.00% and 64.44% after 12 hrs, respectively. All isolates were comparable to commercial insecticide with 100% mortality after 48 hrs. *Trichoderma* sp. showed rapid infectivity and robust pathogenicity. *Penicillium* sp. exhibited strong bioactivity but marginally slower. Conversely, *Fusarium* sp. displayed limited pathogenicity, and *Talaromyces* sp. was varied. Results affirm the promise of indigenous EPF as effective, reduce reliance on synthetic chemicals, improve ecological balance, and strengthen the resilience of abaca farming communities. This approach contributes to regenerative pest management strategies that align with sustainable fiber-based agroecosystems.

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