IGRSM CONFERENCE 2026

13TH IGRSM
INTERNATIONAL CONFERENCE & EXHIBITION ON GEOSPATIAL & REMOTE SENSING
2026


Geospatial Intelligence for a Sustainable Future

05-06 AUGUST 2026

Berjaya Time Square, Kuala Lumpur, Malaysia

# 13TH IGRSM
# INTERNATIONAL CONFERENCE & EXHIBITION
## ON
# GEOSPATIAL & REMOTE SENSING

# BOOK OF ABSTRACTS

FRONTIER SENSING TECHNOLOGIES | GIS & GEOSPATIAL APPLICATIONS | INNOVATION & RESEARCH | SUSTAINABLE SOLUTIONS | GLOBAL COLLABORATION FOR IMPACT

The International Conference and Exhibition on Geospatial & Remote Sensing (IGRSM) is a prominent platform that brings together experts, researchers, practitioners, industry professionals, government agencies, and stakeholders from various sectors to exchange knowledge, share experiences, and showcase advancements in geospatial technologies and remote sensing applications.

The 13th IGRSM International Conference and Exhibition on Geospatial & Remote Sensing (IGRSM 2026) serves as a multidisciplinary forum for discussing current developments, emerging technologies, and future directions in remote sensing, Geographic Information Systems (GIS), Global Navigation Satellite Systems (GNSS), and related fields. The conference provides opportunities for researchers, policymakers, industry players, and practitioners to present their latest findings, explore innovative solutions, and foster collaborations towards addressing global challenges through the application of geospatial approaches.

IGRSM 2026 holds special significance as it continues the legacy of IGRSM following the celebration of its 30th Anniversary (1995–2025). Over three decades, IGRSM has grown through the dedication, commitment, and continuous support of its members and partners. Throughout this journey, IGRSM has contributed to the advancement of geospatial and remote sensing knowledge, promoted professional excellence, strengthened national and international collaborations, and supported the growth and recognition of the geospatial profession.

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This Abstract Book contains abstracts accepted and presented during the 13th International Conference on Geoinformation Science and Remote Sensing (IGRSM 2026).

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**13th IGRSM Technical Program and Scientific Committee:**

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# IGRSM 2026 SCHEDULE

Geospatial Intelligence for a Sustainable Future

**DAY 1**: 5 AUGUST 2026/WEDNESDAY

| Time | Agenda | Details | Venue |
|---|---|---|---|
| **08:00** | **Registration** | | |
| 09:00 | Opening Ceremony | • National Anthem (Negaraku)<br>• Do'a Recital<br>• Welcome Address by Conference Chairman<br>• Welcome Address by Vice Chancellor, Universiti Putra Malaysia<br>• Officiating Ceremony by YB Dato' Haji Mohammad Yusof Apdal, Deputy Minister of Science, Technology and Innovation (MOSTI) (To Be Confirmed)<br>• VIP Group Photograph<br>• Exhibition Opening | Manhattan II |
| **10:00** | **Networking Break & Exhibition Visit** | | |
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| | | **Session 4C** – Environmental Monitoring & Disaster Management | Manhattan II |
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| 16:15 | Closing Ceremony | • Conference Summary<br>• Best Presentation Award<br>• Appreciation to Sponsors & Partners<br>• Closing Remarks | Manhattan II |
| **17:00** | **End of Conference** | | |

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# PARALLEL SESSION SCHEDULE

Geospatial Intelligence for a Sustainable Future

**SPECIAL SESSION: MANHATTAN II**

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**MANHATTAN II**: 5 AUGUST 2026/WEDNESDAY

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**PARALLEL SESSION A** – Remote Sensing & Earth Observation

**BRONX V**: 6 AUGUST 2026/ THURSDAY

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**PARALLEL SESSION B** – GIS & Geospatial Technologies

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**PARALLEL SESSION B** – GIS & Geospatial Technologies

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**PARALLEL SESSION C** – Environmental Monitoring & Disaster Management

**MANHATTAN II**: 6 AUGUST 2026/WEDNESDAY

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# KEYNOTE SPEAKERS

Geospatial Intelligence for a Sustainable Future

*Keynote Speaker 1*

**Dato' Gs. Haji Azlikamil bin Napiah, Director General, Malaysian Space Agency (MYSA)**

**Vital Role of Geospatial in The Implementation of National Space Policy 2030: In Malaysia Perspective**

**Abstract:**

Malaysia has established the National Space Policy 2030 in 2017 to strengthen the implementation of the agenda of developing, expanding, and popularizing all areas of space technology including remote sensing, Geographic Information Systems (GIS), Global Positioning Systems (GPS), and spatial data analytics to ensure the continuity of prosperity and progress of the country. The policy objectives are; to state the country's stand and objectives on mastering the space sector; to coordinate the country's space activities in an organised manner; to recognise the need for access to space capability; and to determine the direction of development of space sector in Malaysia. Space exploration has produced the space technology and applications which cover various aspect of people's live. Space technology is widely used and utilized by society in all aspects of life including communication networks, broadcasting, internet, mapping, navigation for transportation and weather forecasting. In line with strategic thrusts of the National Space Policy, Malaysia has developed the action plan known as Malaysia Space Exploration 2030 (MSE 2030) to create a comprehensive national space ecosystem. In line with the aspiration for the country to become a scientific nation for socio-economic transformation and inclusive growth, activities in space technology especially in relation with research, development, commercialisation and innovation continues to be carried out and will enable it to contribute to economy and wellbeing of the country towards Sustainable Development Goals (SDGs).

*Keynote Speaker 2*

**Professor, Dr. Wataru Takeuchi, University of Tokyo, Japan**

**Satellite-Based Ground Motion Monitoring for Infrastructure Management: Experience from Japan and Perspectives for Malaysia.**

**Abstract:**

Climate change and increasingly frequent extreme weather events are increasing the risk to critical infrastructure. In Malaysia, highway networks such as the North-South Expressway (PLUS) are particularly vulnerable to ground instability associated with heavy rainfall and complex geological conditions. Satellite-based ground motion monitoring can complement conventional inspection methods by providing wide-area observations of surface deformation. This presentation reviews the application of Interferometric Synthetic Aperture Radar (InSAR), particularly Multi-temporal InSAR (MT-InSAR), for infrastructure monitoring. Operational examples from Japan are presented to illustrate how satellite-derived ground motion information has been used to support infrastructure asset management. The Japan Ground Motion Service (J-GMS) at the University of Tokyo is introduced as an example of an operational platform for large-scale satellite data processing and ground motion monitoring. Based on these existing technologies and operational experiences, the presentation discusses the potential application of satellite-based ground motion monitoring to infrastructure management in Malaysia. The presentation focuses on established methodologies and publicly available operational practices and does not present new algorithms, processing methods, or proprietary technologies.

*Keynote Speaker 3*

**Professor Masahiko Nagai,**
**Graduate School of Sciences and Technology for Innovation, Yamaguchi University**

**Integrating Satellite and UAV data with Calibration and AI Technologies**

**Abstract:**

The utilization of constellation satellite, multi-sensor and UAV data is very important for various monitoring tasks, such as disaster and environment. In order to use multiple remote sensing data, it is necessary to conduct with appropriate geometric and radiometric calibration and validation which is required for effective remote sensing data applications.
I would like to introduce our latest research and development for remote sensing data calibration. We have developed optical calibration sites using both natural surface and ground point-source-mirror target. Those calibration site has been constructed by Yamaguchi University and New Space Intelligence Inc. which is the start-up company of Yamaguchi University.
Our calibration sites experimented with several satellite images for the verification of radiometric and geometric performance following the harmonized reflectance product. The top of atmosphere (TOA) radiance and reflectance of optical micro-satellite imageries are simulated by ground surface and atmospheric measurements. The mirror target is used to verify geometric accuracy and better band co-registration. The TOA reflectance derived from the ground measurements and acquired by satellite instruments is correlated to derive harmonization coefficients. The results show an improvement in image accuracy and harmonization of the different sensor data for the multi-temporal application. Furthermore, it can be used for improving radiometric performance and image quality using deblurring from a point spread function (PSF) created from the mirror target.
These calibration technologies will be API-based, implemented as cloud-based systems. Furthermore, these calibration technologies are applicable not only to satellite data but also to images observed from aircraft and HAPS (High Altitude Platform Systems), enabling integrated use with satellite data.

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# LIST OF ABSTRACTS

Geospatial Intelligence for a Sustainable Future

## ABSTRACT

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# PRESENTATION ABSTRACTS

Geospatial Intelligence for a Sustainable Future

**Abstract ID: SS1**

## PETRONAS CASE STUDY: REMOTE SENSING APPLICATION IN OIL & GAS - CHALLENGES & OPPORTUNITIES

Siti Zaleha binti Misnan[1], Noraini binti Zulkipli[1]

[1]*Geomatics Department, Exploration Geoscience Solutions, Upstream Exploration, PETRONAS Carigali Sdn. Bhd., PETRONAS Twin Towers, 50088 Kuala Lumpur, Malaysia*

### Abstract

Geomatics is an integrated discipline encompassing survey, positioning and geo-information supports providing accurate positioning, mapping solutions throughout the entire oil and gas cycle. Within PETRONAS, the Geomatics Department serves as the custodian of survey, positioning, and mapping activities, ensuring geospatial data integrity and quality assurance to support informed decision-making and enable optimal hydrocarbon recovery.

This paper highlights the collaborative efforts between PETRONAS Geomatics Department and other internal stakeholders in governing, safeguarding, and advancing remote sensing and aerial mapping applications across the organization. It showcases how cross-functional collaboration ensures geospatial data integrity, positioning accuracy, technology adoption, and the effective utilization of remote sensing solutions to support operational excellence. Apart from that, this paper also will present the deployment of remote sensing technologies (satellite-based and airborne-based) encompassing satellite imagery, helicopter-based mapping and Unmanned Aerial Vehicle (UAV) surveying for data capturing throughout exploration, development, production and abandonment phases in the oil and gas life cycle. Through selected case studies, it demonstrates how these technologies support mapping, monitoring, surveillance, and decision-making while discussing implementation challenges, lessons learned, and potential opportunities for future innovation and value creation.

### Keywords

Oil and gas, application, geospatial data integrity, remote sensing, aerial mapping.

### Presenter's Email

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**Abstract ID: 3**

## ASSESSING POTENTIAL LANDSLIDE AREAS IN TROPICAL REGIONS USING SENTINEL-1 SYNTHETIC APERTURE RADAR

M. Z. S. Mohd Norsiman[1], A. D. Razali[1], M. F. S. Md Aripin[1], M. R. Md Razli[1], N. M. R. Nik Ruhadi[1], A. R. Jaapar[1]

[1]*Geomapping Technology Sdn Bhd, 43000 Kajang, Selangor*

**Abstract**

Landslides are among the most frequent geohazards in tropical regions that pose significant risks to infrastructure and communities. Conventional monitoring methods including ground-based instruments as well as optical satellite imagery are often limited by persistent cloud cover and restricted field access. These constraints highlight the need for an all-weather and scalable method for regional slope instability assessment. Fundamentally, ground deformation and surface disturbance are key physical precursors of slope failure which makes remote sensing a valuable tool for regional-scale assessment. This study aims to evaluate potential landslide-prone locations using the all-weather imaging capability of Sentinel-1 Synthetic Aperture Radar (SAR). In densely vegetated environments, C-band backscatter variations can reflect canopy disturbance and surface roughness changes associated with ground deformation. Multi-temporal Sentinel-1 Ground Range Detected (GRD) data were processed within the Google Earth Engine cloud platform to measure pre- and post-event SAR backscatter intensity differences. Backscatter change rates were classified into four threshold categories (−1.5 to −2.0 dB, −2.0 to −2.5 dB, −2.5 to −3.0 dB and < −3.0 dB) to delineate varying levels of ground deformation. The results demonstrate consistent radar backscatter changes at identified slope locations that spatially align with Sentinel-2 imagery and documented landslide events. The < −3.0 dB threshold demonstrates the strongest alignment with failure zones which indicates its suitability for monitoring slope disturbances in tropical environments. These findings demonstrate that SAR intensity analysis provides a scalable and cost-effective framework for regional landslide assessment in cloud-prone tropical environments. The approach lays the groundwork for guiding future slope instability monitoring.

**Presenter's Email**

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**Abstract ID: 4**

# INTEGRATING UAV–LIDAR AND SLAM FOR ACCURATE ABOVEGROUND BIOMASS ESTIMATION

S.H.M. Nawi[1], H.Z.M. Shafri[1]*, A. Aitin[2], K. Veerasamy[2], F.A.A. Marzuki[1]

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## Abstract

Accurate estimation of aboveground biomass (AGB) and carbon stock is essential for climate change mitigation and sustainable forest management. This study investigates the integration of UAV-based LiDAR and SLAM-derived point cloud data to estimate AGB and carbon stock within a 3.16-hectare study area at Universiti Putra Malaysia. Airborne LiDAR data were acquired using the CHCNAV AlphaAir 10 sensor, while trunk-level measurements were enhanced using the CHCNAV RS10 handheld SLAM system. Diameter at Breast Height (DBH) was extracted through tree segmentation and cross-sectional slicing in CloudCompare, while tree height was derived from a Canopy Height Model (CHM) generated from Unmanned Laser Scanning data. Field measurements using a total station and manual DBH methods were conducted for validation. AGB was calculated using the allometric equation proposed by Chave et al. (2014). Results show minimal differences between LiDAR-derived and field-based measurements, with total AGB estimates of 103.11 Mg $ha^{-1}$ and 103.14 Mg $ha^{-1}$, respectively. The high agreement demonstrates the reliability of integrated UAV–LiDAR and SLAM approaches for precise forest inventory and carbon assessment, offering a rapid and non-destructive alternative to traditional methods.

## Keywords

UAV–LiDAR; SLAM; Aboveground Biomass (AGB); Carbon Stock Estimation; Canopy Height Model (CHM)

## Presenter's Email

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**Abstract ID: 5**

# ENHANCING PIPELINE INTEGRITY MANAGEMENT USING BVLOS DRONES AND ARTIFICIAL INTELLIGENCE

Afifa Al Mawali
*Petroleum Development Oman (PDO)*

## Abstract

This study presents an integrated approach to pipeline integrity management using Beyond Visual Line of Sight (BVLOS) drone inspections combined with artificial intelligence and GIS technologies. The purpose of the study was to enhance inspection efficiency, strengthen safety, and improve decision making across extended pipeline corridors.

BVLOS drone surveys captured high-resolution imagery along operational pipelines. Seven AI/ML models were developed using over 6,000 annotated training samples to detect anomalies including foreign objects near the pipeline, sand coverage, vegetation encroachment, corrosion, leaks, and exposed buried sections. Geospatial outputs were stored, managed, and analyzed within ArcGIS Pro to support spatial analysis and dashboard visualization.

After three years of operational deployment, the system achieved Technology Readiness Level 9 (TRL9). Model performance showed recall rates from 83% to 98.62%, with precision between 85% and 97.5%. The workflow enhanced safety by reducing manual patrols and personnel exposure to high-risk areas, while BVLOS operations minimized driving and associated greenhouse gas emissions. The GIS dashboard enabled proactive maintenance by visually prioritizing critical pipeline sections.

The study demonstrates that combining BVLOS drone inspections, AI-driven analytics, and GIS-based management strengthens pipeline integrity programs while supporting safety and sustainability objectives. Future developments will focus on Drone-in-a-Box systems for automated, continuous monitoring and near real-time anomaly detection

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**Abstract ID: 6**

# TRANSITIONING FROM STATIC GEOLOGY TO DYNAMIC URBAN RISK: A REVIEW AND EMERGING DIRECTIONS IN SINKHOLE SUSCEPTIBILITY RESEARCH

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## Abstract

Sinkhole research has traditionally focused on static, geology-centred approaches that emphasise lithological predisposition and long-term karst processes. However, accelerated urbanisation has increasingly linked sinkhole occurrence to anthropogenic stressors such as infrastructure degradation, groundwater abstraction, excavation, and cumulative surface loading. Despite this shift, many existing susceptibility models remain limited in capturing temporal evolution, progressive failure, and changing urban risk conditions. This review synthesises global conceptual and methodological trends in sinkhole susceptibility research, with attention to integrating temporal processes and anthropogenic indicators. Drawing on a curated synthesis of international literature published between 2002 and 2025, supported by bibliometric and thematic meta-analyses, this review traces the transition from natural-dominant frameworks toward more integrated, semi-dynamic perspectives. Results highlight the widespread reliance on static proxy indicators, with limited incorporation of temporal dynamics despite advances in remote sensing and cloud-based technologies. The review concludes that future research should prioritise time-aware, operationally relevant frameworks that better represent anthropogenic influences and dynamic processes, particularly in data-limited urban environments.

## Keywords

Sinkhole susceptibility; Anthropogenic stressors; Temporal evolution; Urban risk

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**Abstract ID: 9**

# ASSESSING VARIABILITY IN NDVI CLASSIFICATION THRESHOLDS DERIVED FROM SPOT, SENTINEL-2 AND LANDSAT 8 IMAGERY IN MALAYSIAN URBAN PARK

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## Abstract

Urban parks play an essential role in mitigating climate change impacts by regulating the urban microclimate and enhancing ecological resilience in rapidly urbanising tropical cities. The Normalized Difference Vegetation Index (NDVI) is widely used to monitor vegetation conditions in urban environments; however, its accuracy depends on the spatial resolution and characteristics of satellite imagery. In tropical regions such as Malaysia, cost-effective and accessible satellite data are crucial for sustainable vegetation monitoring. While high-resolution imagery might enhance NDVI classification accuracy, it remains unclear whether finer spatial resolution is necessary for reliable NDVI-based assessment, particularly in heterogeneous urban park environments. The study aims to determine how spatial resolution influences vegetation estimation performance across different urban park sizes in the Klang Valley, Malaysia. Nine urban parks of varying sizes (small (<8 ha), medium (<40 ha), and large (>40 ha)) were analysed using SPOT 7 (1.5 m), Sentinel-2 (10 m), and Landsat (30 m) imagery. NDVI maps were generated and compared to assess variability in classification thresholds and consistency in vegetation representation. Results indicate that spatial resolution significantly affects the stability of algorithm-derived thresholds, particularly in small, structurally complex parks. Higher-resolution imagery reduced mixed-pixel effects and produced more consistent vegetation-class boundaries, whereas coarser imagery shifted the threshold distributions. These findings support evidence-based satellite selection for urban ecological assessment in tropical regions.

## Keywords

NDVI Classification; Satellite Imagery Comparison; Spatial resolution; Tropical Remote Sensing; Urban Park Vegetation

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**Abstract ID: 10**

# EVAPOTRANSPIRATION CHANGES UNDER SOLAR RADIATION MODIFICATION USING SWAT AND GEOMIP6 IN THE MUDA RIVER BASIN, MALAYSIA

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**Abstract**

Introduction - Evapotranspiration (ET) is a key component controlling water balance in river basins. In tropical regions such as Malaysia, changes in temperature and rainfall directly influence evaporative demand. While future warming is expected to intensify ET, its response under solar radiation modification (SRM) scenarios remains uncertain. This study evaluates projected ET changes in the Muda River Basin (MRB) under emission-driven and SRM pathways.

Methods - A calibrated SWAT+ model was forced with bias-corrected CMIP6 and GeoMIP6 projections. Simulations were conducted for the historical period and future scenarios under SSP2-4.5, SSP5-8.5, G6solar, and G6sulfur. Changes in ET were analysed at both basin and spatial scale to understand variations across the watershed and between monsoon seasons.

Results - Results show that ET increases across most parts of the basin under future warming, with the strongest intensification consistently observed under SSP5-8.5, especially in the long-term period. Spatial analysis indicates that higher percentage increase occurs in southern and central part of MRB. Under SRM scenarios, ET increases are moderated but do not return to historical levels.

Conclusion - Overall, SRM partially reduces warming-driven ET amplification, yet land use characteristics and climate variability continue to shape spatial water balance responses.

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**Abstract ID: 12**

# RADIOMETRIC CALIBRATION OF UAV MULTISPECTRAL SENSORS: INFLUENCE OF REFLECTANCE PANELS AND SITE-SPECIFIC VARIABILITY

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## Abstract

The use of unmanned aerial vehicles (UAVs) equipped with multispectral sensors has revolutionised agricultural monitoring through high-resolution reflectance analysis. However, radiometric consistency remains a key limitation, particularly when utilising different manufacturer-provided reflectance panels. This study evaluates the radiometric consistency of DJI Phantom 4 Multispectral imagery calibrated using MicaSense and Sequoia reflectance panels across two oil palm plantations in Malaysia. Data were acquired at multiple flight times between 09:00 and 11:00 a.m. to capture varying solar geometries. Radiometric agreement was assessed through pixel-wise differences and two-way analysis of variance (ANOVA). Results indicate a continual systematic bias, with MicaSense-calibrated orthomosaics consistently yielding higher reflectance values. A two-way ANOVA revealed a strong interaction effect of site and time across all bands ($p < 0.001$), with the near-infrared (NIR) band showing the highest sensitivity ($F = 1323.12$). While root mean square error (RMSE) was lowest in the visible regions, it increased significantly in the red-edge and NIR regions. Conversely, the relative RMSE (rRMSE) increased in the blue, green, and NIR bands, where maximum values exceeded 20%. These findings suggest that calibration differences are non-linearly influenced by acquisition timing and site location, emphasising the need for radiometric harmonisation in longitudinal UAV studies.

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**Abstract ID: 13**

# BEYOND PROXIMITY: INNOVATING URBAN FOODSCAPE SURVEILLANCE THROUGH GIS-BASED SATURATION ANALYSIS

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## Abstract

Rapid urbanization in Malaysia has fundamentally reshaped the food environment, fostering an "obesogenic" landscape. This study utilizes Geographic Information Systems (GIS) to analyze the spatial distribution of 1,367 Mamak restaurants across Selangor, Wilayah Persekutuan Kuala Lumpur, and Wilayah Persekutuan Putrajaya. Results from the Average Nearest Neighbor (ANN) analysis reveal a highly significant clustered pattern (z-score = -44.72, $p < 0.001$). Getis-Ord Gi* Hot Spot Analysis identifies statistically significant hotspots (99% confidence) that were concentrated within the urban core of Kuala Lumpur and central-eastern Selangor. Furthermore, service area analysis via Thiessen polygons demonstrates that 51.9% of establishments operate within influence zones smaller than 1 km2, indicating extreme saturation in high-density areas. This research provides an empirical framework for urban foodscapes, offering municipal authorities actionable insights for targeted zoning and public health strategies. It supports national health agendas and aligns with Sustainable Development Goals (SDG) 3 and 11.

## Keywords

geospatial analysis, urban food environment, health planning, urban planning, spatial clustering, SDG

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**Abstract ID: 15**

# COMPARATIVE ANALYSIS OF YOLO OBJECT DETECTION AND MANUAL COUNTING FOR BEACH TOURIST DETECTION

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## Abstract

This study evaluates the performance of a YOLO-based object detection approach for automated identification of tourists in beach environments. Image data were collected from Ao Leuk Beach, Thailand and the YOLO algorithm was applied to detect individual tourists, with manual counting used as a benchmark for comparison. Accuracy and detection performance metrics were employed to examine differences between automated and manual approaches. The results indicate that the proposed method achieves approximately 80% precision and around 90% recall, while the overall counting error, expressed as RMSE, is on the order of 30% when compared with manual counts. A workflow diagram is presented to illustrate the process from image acquisition to result evaluation. These preliminary findings suggest that YOLO-based detection provides a promising and efficient tool for rapid tourist counting, with potential applications in geospatial monitoring of beach tourism. The study demonstrates the feasibility of integrating machine learning-based object detection into geospatial research and management practices.

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**Abstract ID: 16**

# PREDICTIVE MODELLING OF ASIAN ELEPHANT MOVEMENT IN ENDAU-ROMPIN (PETA) NATIONAL PARK USING MAXENT AND REMOTE SENSING APPROACH

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## Abstract

Habitat loss and fragmentation have become major hazards to wide-ranging species such as Asian elephants. In Peninsular Malaysia, the population of Asian elephants is gradually declining due to the degradation of their habitat. Studying the potential movement area of an endangered species within a protected rainforest is important, as they are highly significant for ecology. However, spatial data on elephant movement remains limited across Asian elephant range countries, including Peninsular Malaysia. Therefore, in the present study, we estimate the potential Asian elephant movement area in Endau-Rompin (Peta) National Park while analysing the influence of natural and anthropogenic factors on movement patterns within the landscape. This study used Maximum Entropy Modelling (Maxent) with remote sensing derived environmental factors and elephant occurrence to estimate the potential Asian elephant movement area. The results of this study predicted that 43% of the study area is suitable habitat for Asian elephant movement, with 19% classified as highly suitable and 38% as less suitable. The model training and test data showed satisfactory AUC scores of 0.85 and 0.90, respectively. In conclusion, Maxent is considered an insightful method for estimating the movement area patterns of endangered species within a protected rainforest.

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**Abstract ID: 17**

# RULE-BASED EXTRACTION OF WATER COLUMN FEATURES FROM MULTIBEAM ECHOSOUNDER DATA FOR CORAL MAPPING

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## Abstract

The coral reef is an important ecosystem to marine biodiversity and coastal sustainability. The presence of water column data generates new opportunities for marine habitat exploration. This study proposes a water column extraction method from multibeam echosounder (MBES) data for coral mapping in the Redang archipelago, Malaysia. Kongsberg EM2040C is used to acquire the MBES data operating at 300 kHz. The longitudinal slicing was applied to generate vertical water column echograms, followed by manual visual extraction using a rule-based approach. The rule followed three criteria: attachment to the seafloor, discernible morphology, and minimum height ≥0.1 m above the seafloor. Two descriptors derived were peak height and acoustic intensity (dB). Ground truth data were collected using drop-down camera and scuba surveys. A spatial join method classified the extracted features, and the statistical analysis of both descriptors established the characteristic differences between coral and non-coral classes. Euclidean allocation was applied to generate the coral distribution map, and accuracy was assessed using an error matrix. The classification achieved an overall accuracy of 87.5%. The findings demonstrate the importance of peak height and intensity in distinguishing coral from non-coral features for acoustic-based mapping.

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**Abstract ID: 18**

# STREAMFLOW RESPONSES TO VOLCANIC ERUPTIONS IN MAJOR RIVER BASINS OF PENINSULAR MALAYSIA

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## Abstract

This study evaluates the spatial variability of streamflow response in tropical river basins of Peninsular Malaysia to volcanic-induced climate perturbations, using major eruptions as natural analogs for climate change impact assessment. A geospatial analysis was conducted across six minimally regulated river basins in Kedah, Perak, Kelantan, Pahang, Selangor, and Johor. Monthly streamflow data were aggregated into water-year series to preserve monsoonal characteristics. The influence of the El Niño–Southern Oscillation (ENSO) was removed using statistical detrending to isolate external radiative forcing. A Superposed Epoch Analysis (SEA) was applied over a ±24-month window relative to eruption onset for Mount Pinatubo (1991), Mount Sinabung (2010), and Mount Taal (2020). Composite anomalies were normalized using standard deviation to enable spatial comparison across basins. The results reveal a consistent reduction in streamflow following major eruptions, with peak negative anomalies occurring within 6–12 months. Spatial analysis indicates heterogeneous responses across basins, with stronger negative anomalies observed in selected regions, reflecting differences in hydroclimatic sensitivity. The 1991 Pinatubo eruption exhibits the most pronounced and widespread signal. The findings highlight the importance of geospatial analysis in understanding basin-scale climate sensitivity and provide new insights into hydrological variability under external climate forcing, supporting climate change impact assessment and water resource management in tropical regions.

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**Abstract ID: 19**

# VALIDATION OF THE SENTINEL-3 OLCI SLSTR SYNERGY AOD PRODUCT OVER MALAYSIA

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## Abstract

Aerosol optical depth (AOD) is an important atmospheric parameter for air quality monitoring, climate studies, and environmental management. Satellite-derived AOD products provide extensive spatial coverage and continuous observations, making them valuable for monitoring aerosol distributions over large regions. However, their accuracy must be evaluated before they can be reliably applied, particularly in tropical regions such as Malaysia, where persistent cloud cover, high humidity, and diverse aerosol sources present challenges for aerosol retrieval. The Sentinel-3 OLCI–SLSTR SYNERGY aerosol optical depth (SY_2_AOD) product is a relatively new dataset that integrates observations from the Ocean and Land Colour Instrument (OLCI) and the Sea and Land Surface Temperature Radiometer (SLSTR) to improve aerosol retrieval performance. Nevertheless, comprehensive validation of this product over Malaysia remains limited. Therefore, this study aimed to evaluate the performance of the Sentinel-3 SYNERGY AOD product by (i) validating Sentinel-3A and Sentinel-3B AOD retrievals against ground-based Aerosol Robotic Network (AERONET) observations and (ii) examining the seasonal spatial distribution of AOD over Malaysia and the surrounding region. The validation results indicated moderate agreement between the Sentinel-3 SYNERGY product and AERONET observations. Sentinel-3A achieved an R2 =0.572, RMSE = 0.156, while Sentinel-3B yielded an R2 = 0.419, an RMSE = 0.162. Overall, the Sentinel-3 SYNERGY AOD product demonstrates potential for regional aerosol monitoring and provides a useful data source for air quality and atmospheric studies in tropical environments.

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# EVALUATING THE EFFICACY OF PLANETSCOPE IMAGERY FOR HIGH-RESOLUTION BENTHIC HABITAT MAPPING: A CASE STUDY OF MANTANANI ISLAND, MALAYSIA

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## Abstract

This study aims to utilize high-resolution PlanetScope satellite imagery (3 m/pixel) to analyze marine habitats around Mantanani Island, Malaysia. Using Support Vector Machine (SVM) classification and in-situ geotagging for validation, the study categorized benthic types into two levels: Level 1 (L1), distinguishing live coral and non-coral, and Level 2 (L2), identifying seven distinct classes including branching, patch, and massive corals, sand, coral rubble, submerged rock, and deep water. Results indicate that live coral covers approximately 42.25% (525.17 ha) of the area, while non-coral communities occupy 57.75% (717.80 ha). Within the L2 classification, deep-water habitats cover the largest area (464.542 ha), followed by patch coral (295.275 ha) and branching coral (190.239 ha). The classification achieved an overall accuracy of 85.86% with a kappa coefficient of 0.8326, demonstrating a high level of agreement with ground truth data. The prevalence of live coral suggests favorable water conditions, yet the findings underscore a critical need for focused conservation strategies, such as managing sediment discharge and enforcing tourism regulations, to safeguard the island's biodiversity. This research provides essential insights for sustainable ecosystem management and highlights the role of coral reefs as vital nature-based coastal protection features.

## Keywords

PlanetScope Imagery; Benthic Habitat Mapping; Borneo, Pulau Mantanani

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**Abstract ID: 21**

# A GEOMATICS-BASED APPROACH TO HERITAGE TRAIL DOCUMENTATION AS VISIBILITY INFRASTRUCTURE: A CASE STUDY OF THE SANDAKAN HERITAGE TRAIL, SABAH

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## Abstract

Heritage signages and inscriptions are commonly documented as isolated textual or photographic records rather than as spatially anchored datasets, revealing the need for GIS-based approaches that integrate spatial, textual, and visual information within a single framework. This paper presents a geomatics-based project that establishes a baseline spatial dataset of the Sandakan Heritage Trail, documenting heritage sites as they are currently presented and accessed. Field data collection was undertaken to record the locations of all trail sites and to photograph on-site signboards, plaques, and interpretive panels. All textual materials were manually digitised and managed as spatially anchored information within a GIS environment. The project integrates multiple forms of geospatial media, including site photographs, digitised textual records, and 360° imagery captured to document site context and physical accessibility conditions. These datasets were organised and visualised using ArcGIS StoryMaps, enabling access for both on-site and remote users. The workflow emphasises consistency, transparency, and completeness in spatial documentation, supporting the creation of a reliable reference dataset. The project supports accessibility, data reuse, and long-term sustainability, enabling the spatial datasets and digital archive to inform future research and monitoring. The workflow is replicable for managing heterogeneous spatial data in urban heritage contexts.

## Keywords

Geographic Information Systems (GIS); Spatial data management; Field data collection; Spatial visualisation; Digital archiving

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**Abstract ID: 22**

# TOWARD ACCESSIBLE GROUND TRUTHING METHOD: EVALUATING A LOW-COST UNDERWATER CAMERA APPROACH AT SEPANGGAR ISLAND, SABAH

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## Abstract

Advancements in ground-truthing systems have improved the efficiency of benthic habitat mapping, enabling a shift from traditional diver-based surveys to optical observation methods. This study evaluates the effectiveness of a drop-down camera mechanism as a cost-efficient and low-labour approach for shallow-water benthic habitat assessment at Sepanggar Island, Sabah. The system consisted of a custom-made PVC cage (50 × 50 × 60 cm) equipped with a GoPro camera, providing a bird's-eye view of the seafloor and capturing continuous video recordings at depths between 5 and 30 meters. Video frames were extracted using FFmpeg and geotagged to create a spatially referenced dataset for ground-truthing validation. A total of 17 video series were collected, yielding 164 still images, of which 160 were successfully geotagged in Garmin BaseCamp. The georeferenced images supported site validation by delivering detailed benthic feature information, leading to the classification of six distinct habitat classes. The drop-down camera mechanism demonstrated high reliability for shallow-water habitat assessment. This approach offers a practical alternative for large-scale benthic mapping in remote or resource-limited areas, though very fine-scale benthic details may be less observable.

## Keywords

Benthic habitat mapping; drop-down camera; ground-truthing; shallow water

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**Abstract ID: 23**

# A COMPARATIVE ANALYSIS OF ARTIFICIAL LIGHT AT NIGHT (ALAN) EMISSION PATTERNS ACROSS LAND USE ACTIVITIES USING SDGSAT-1 GLIMMER IMAGER (GIU) FOR URBANISATION

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## Abstract

Light pollution has become a serious global concern driven by rapid urbanisation, raising alarming implications for ecological, environmental, and human health. Artificial light at Night (ALAN) remains one of the most widespread yet understudied consequences of urban sprawl and understanding its spatial distribution relative to land-use activity is crucial for addressing this pressing issue. Variations in nighttime light brightness across land use activities reflect the intensity and nature of human activities, providing a quantitative basis for assessing lighting demand and identifying areas of over-illumination. This study focuses on the Klang Valley as a case study, integrating land use data with SDGSAT-1 nighttime imagery to examine ALAN emission patterns across different land uses through a comparative analytical framework. The findings reveal significant differences in nighttime light brightness across land use activities, driven by the diversity of human activities and their corresponding lighting needs. Commercial areas consistently emerge as the hotspots of excessive nighttime lighting, while residential, industrial, and green space areas exhibit distinctly different ALAN emission profiles. This study offers a comprehensive understanding of how different land use activities contribute to ALAN emissions and provides quantitative support for developing differentiated and sustainable lighting management policies in the Klang Valley.

## Keywords

SDGSAT-1, Night-time Light Data, Remote Sensing, Urban Development

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**Abstract ID: 24**

# ESTIMATING SEAGRASS UNDERWATER NET PRIMARY PRODUCTIVITY (uNPP) USING OPTICAL REMOTE SENSING: A CASE STUDY OF MERAMBONG SHOAL, JOHOR, MALAYSIA

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## Abstract

Subtidal seagrass meadows are vital blue carbon ecosystems, yet quantifying their underwater net primary productivity (uNPP) remains difficult in turbid tropical waters. This study advances an optical remote sensing framework to estimate subtidal seagrass uNPP at Merambong Shoal, located in Johor, Malaysia. Satellite-derived spectral and pigment information is analyzed to identify robust indicators of seagrass productivity under optically complex coastal conditions. Bio-optical signals associated with chlorophyll content and photosynthetic capacity are examined to establish quantitative relationships with uNPP. Reflectance-based spectral indices and productivity models are developed to generate spatially explicit uNPP estimates across the turbid coastal environment of the study area. Model outputs are validated using independent in-situ measurements of seagrass physiological and biochemical parameters to assess accuracy and reliability. By strengthening the linkage between spectral response and ecological function, this research provides a scalable, non-destructive approach for monitoring subtidal seagrass productivity. The outcomes support improved blue carbon assessment and evidence-based coastal ecosystem management in tropical regions.

## Keywords

Underwater net primary productivity (uNPP), subtidal seagrass, optical remote sensing, spectral indices, Merambong Shoal.

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**Abstract ID: 25**

# DESIGN AND SPACE RADIATION ENVIRONMENTAL VALIDATION OF THE MYCU-X1 DUAL-CAMERA IMAGING PAYLOAD FOR CUBESAT EARTH OBSERVATION

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**Abstract**

The increasing use of CubeSats for national Earth observation missions requires imaging payloads that are compact, cost effective, and reliable in the space environment. This study presents the design and validation of MYCu-X1, a dual-camera imaging payload developed using a system-oriented approach to mitigate technical risk before full satellite integration. Payload- and mission-level requirements were first defined, followed by a rigorous trade-off analysis to select the microcontroller, flash memory, image sensors, and optical lenses based on performance, power consumption, data handling, and environmental resilience. The payload was initially implemented as a breadboard and then as an engineering model through a dedicated Camera Controller Board (CCB). Unit-level environmental validation included a 200 Gy Total Ionizing Dose (TID) test using a Co-60 gamma source, with functionality continuously monitored before, during, and after irradiation testing. Results showed that all key components remained operational under both test conditions, with no critical functional degradation observed. These findings confirm the feasibility of the selected payload architecture for CubeSat Earth observation missions and provide a practical reference for early-stage payload development, validation, and risk reduction in national CubeSat programs.

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# EVALUATING THE INFLUENCE OF PHOTOGRAMMETRIC PROCESSING PARAMETERS AND OBIA CLASSIFIERS ON UAV-BASED SEAGRASS HABITAT MAPPING

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## Abstract

Despite the expanding use of Unmanned Aerial Vehicles (UAVs) in aquatic remote sensing, varying image classification techniques often yield inconsistent results. While research has focused on Object-Based Image Analysis (OBIA) for seagrass mapping, the influence of specific photogrammetric workflows on classification performance remains under-explored. This study compares the efficacy of two OBIA classifiers, Random Trees (RT) and Decision Trees (DT) across UAV orthomosaics generated from three photogrammetric workflows (Workflow-1, 2, and 3) with varying processing settings. Results indicate that Workflow-1 (sharp smoothing, high-resolution blending) achieved the highest performance, yielding an overall accuracy (OA) of 96% (Kappa: 0.939) with RT and 91% (Kappa: 0.861) with DT. Notably, Workflow-2 required the longest processing time (29 hours) yet yielded significantly lower accuracy than Workflow-1 (10 hours), suggesting that "smooth" settings may degrade the spectral clarity required for aquatic features. Across all workflows, RT consistently outperformed DT. RT's superiority is attributed to its ensemble approach, which effectively mitigated spectral noise inherent in aquatic imagery. In contrast, DT exhibited limitations in Workflow-3, misclassifying dense seagrass as mud/silt. This suggests that DT's single-path logic is susceptible to bias, leading to a "missing class" phenomenon where transitional zones are absorbed into dominant categories. These findings highlight that optimizing initial photogrammetric parameters specifically sharp smoothing, paired with ensemble classifiers is essential for producing reliable, high-resolution seagrass habitat maps.

## Keywords

Seagrass mapping; Unmanned Aerial Vehicle (UAV); Pix4Dmapper; Sabah; Coastal research.

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**Abstract ID: 27**

# A BIBLIOMETRIC ANALYSIS OF DIGITAL INNOVATION AS A CATALYST FOR ESG ACHIEVEMENTS

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## Abstract

Environment, Social and Governance (ESG) aims to mitigate risks in climate change, resource usage, occupational health and safety, and business ethics. Digital technologies are able to expedite the achievement of ESG goals as digital tools encourage green innovation as part of corporate strategy. This study uses bibliometric analysis to analyse the publications in digitalization and ESG from the Scopus database using Harzing's Publish or Perish and VOSviewer. There is an upward trend in the publications with research mainly in Business, Management and Accounting, Computer Science, and Economics, Econometrics and Finance. China, the United States, and India were the most productive countries while the United Kingdom had the greatest citation impacts. The areas of research based on keywords include the application of digitalization for corporate performance, ESG reporting, greenwashing, environmental innovation, decision making, and risk management. From bibliographic coupling, research areas are also focused on enhancing transparency, corporate 2 engagement, and financial and investment implications. This study is significant to industry practitioners to identify linkages between ESG and digital technologies to enhance the process of integration digital tools in ESG adoption. Besides, this study also guides policy making in digitalization for ESG transformations.

## Keywords

Digital innovation; digital transformation; digitization; ESG; bibliometric analysis

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**Abstract ID: 30**

# CONSTRUCTING THE SMART CAMPUS: FROM TLS POINT CLOUDS TO GEOSPATIAL INSIGHTS

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## Abstract

Smart campuses embody the integration of digital innovation with urban resilience, utilizing geospatial data and sophisticated modelling to connect physical infrastructure with informed decision-making. Dense datasets obtained by Terrestrial Laser Scanning (TLS) provide accurate 3D modelling, supporting simulations for stormwater management, pedestrian analysis, and risk mitigation which is crucial for higher education institutions in Southeast Asia during growing urbanization. This research implements this paradigm in Tunku Abdul Rahman University of Management and Technology (TARUMT)'s Student Arena, acquiring extensive point clouds utilizing Riegl VZ-600i TLS equipment. The study captures intricate architectural geometries and topographical features with high-resolution scanning (6-10mm spacing), mitigating the limitations of conventional surveying methods. The technical workflow transitions from raw, massive datasets to actionable geospatial intelligence. Data processing, conducted via RiSCAN PRO, focuses on multi-station registration, atmospheric noise filtration, and precise geo-referencing. Results show densified point clouds are integrated with advanced geospatial analytical tools to facilitate automated feature extraction of structural dimensions and terrain profiles within the TARUMT Student Arena. This research bridges the gap between raw LiDAR acquisition and GIS-ready insights, establishing a robust framework for Smart Campus infrastructure. Ultimately, the study demonstrates how digitized spatial assets serve as a critical foundation for predictive facility management, optimized crowd dynamics, and data-driven urban administration within an educational ecosystem.

## Keywords

Terrestrial Laser Scanning (TLS); Smart Campus; RIEGL VZ-600i; RiSCAN PRO; Geospatial Intelligence; 3D Modelling; TARUMT

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**Abstract ID: 31**

# MAXENT-BASED SEAGRASS HABITAT SUITABILITY MODELLING OF GAYA ISLAND, SABAH

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## Abstract

This study aims to create a seagrass habitat suitability model for Gaya Island and identify the most suitable habitat for seagrass spatial distribution. Field survey presence data were combined with environmental water parameter variables, such as water temperature, salinity, tidal current speed, dissolved oxygen, and water depth. Seagrass habitat suitability was modelled using the Maximum Entropy (MaxEnt) which is effective in predicting species distributions based on presence-only data. Model effectiveness was evaluated using the Area Under the Curve (AUC), with values above 0.8 indicating high predictive accuracy. The results demonstrate that seagrass growth is not uniform; it is concentrated in specific hotspot areas and in certain small, shallow areas that are just right for it, rather than being spread out everywhere along the coast. These findings highlight the spatial variability of seagrass habitats and illustrate the effectiveness of MaxEnt in identifying suitable areas for seagrass growth. These maps are helpful for protecting seagrass in Gaya Island. This study support planning conservation efforts, managing coastal resources, and tracking seagrass health over time.

## Keywords

MaxEnt, Seagrass, Habitat suitability

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**Abstract ID: 33**

# OFFENCE LOCATION CHOICES AND MODUS OPERANDI FOR MOTOR CAR THEFT IN KUCHING, SARAWAK, MALAYSIA

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## Abstract

Car thefts issues rising concerns among individuals particularly in urban areas during to lack of security. There are three technique that were used in this study to identify the offence location choices, namely Kernel Density Estimation, Standard Deviational Ellipse, Mean Center and Optimized Hot Spot. Attribute data comprising motor car theft in 2018, a total loss of car theft, types of car model, name of car reported missing, date, time, address of crime location, and modus operandi, while spatial data consists of nine police station boundaries with 57 police station sectors. Car theft hotspots in Kuching's urban areas is driven by opportunities created by a lack of security measures and a high concentration of cars. Offenders target cars parked outside of homes for longer periods, especially when there are no CCTV cameras or security guards present. Additionally, the time of day plays a significant role, with daytime being a prime target due to people being at work and a larger number of cars parked in urban areas. In residential areas, car left unattended without CCTV or witnesses are also vulnerable. Kernel Density shows Sekama police station sectors are being targeted for car theft as this area tend to be concentrated by people as it located in centre of urban area. Mostly the cars are locked when taken away. Car thieves often use altered keys or sophisticated electronic tools to bypass car security systems and steal vehicles in Kuching. The older model cars are the most common targets for car thieves in Kuching, Sarawak. Offenders select their targets based on the vehicles model. The report also highlights that foreign-made cars are the most common targets for car thieves in Kuching. SDE analysis shows that the distribution of car thefts in Kuching at night covers an area of 0.001969 square meters. Conversely, during the daytime the distribution of car thefts in Kuching covers a slightly larger area of 0.002465 square meters. This indicates the car thefts higher chance to occur during the daytime in Kuching. The car theft incidents are more spread out to occur in wider range of locations during the daytlight occur, while at nighttime the spatial distribution of car thefts is more limited during nighttime.

## Keywords

Spatial analysis, location, choices, motor car theft, Kuching, SDE, KDE.

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**Abstract ID: 37**

# TAKING THE TEMPERATURE OF THE OCEAN FROM PRESSURE: USING OCEAN BOTTOM PRESSURE MEASUREMENTS OF INTERNAL WAVES IN THE SOUTH CHINA SEA TO TRACK THE ANNUAL CYCLE OF STRATIFICATION

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## Abstract

Oceans are stratified by vertical variations in temperature and salinity, creating a medium for climate-modulated nonlinear internal gravity waves. This phenomena plays a critical role in numerous oceanic processes, including thermal mixing, nutrient supply, sediment transport, and acoustic transmission. Additionally, their properties offer a potential means of observing how stratification varies across both space and time. Despite their importance, nonlinear internal waves remain difficult to continuously detect over large spatial and temporal scales. In this study, we combine a decade of geostationary satellite imagery with a year-long ocean-bottom pressure record to evaluate whether nonlinear internal wave parameters can serve as proxies for stratification. From the satellite imagery, we generate a dataset of propagation speeds and arrival directions for nonlinear internal waves generated in the eastern Luzon Strait of the South China Sea — home to some of the world's largest-amplitude internal waves. From a pressure sensor deployed offshore of Dongsha Atoll, we measure the temporal changes in wave periods and amplitudes. The pressure data reveal a seasonal cycle in wave period that anti-correlates with amplitude and locally varying stratification. These results indicate that ocean-bottom pressure measurements can track temporal changes in near-surface stratification, while satellite imagery supplies the spatial context needed to interpret these variations across the basin as indicators of seasonal and climate-driven variability.

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**Abstract ID: 38**

## UAV BASED LIDAR AND PHOTOGRAMMETRY: A COMPARATIVE STUDY FOR ENGINEERING TERRAIN MODELLING

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**Abstract**
Introduction - This study aims to evaluate and compare the accuracy, suitability, and performance of UAV-based photogrammetry and LiDAR survey technologies for supporting engineering design and planning of a proposed road infrastructure project in Ajau, Pakan, Sarikei, Sarawak. The comparison focuses on their effectiveness in road alignment planning, terrain modelling, and earthwork assessment under challenging terrain and vegetation conditions.

Methods - Data acquisition was conducted using two UAV platforms: a DJI Matrice 300 for LiDAR data collection and a DJI Mavic 2 Pro for high-resolution photogrammetric imagery. Static RTK GNSS surveying was employed to establish accurate ground control points (GCPs) and independent check points for georeferencing and validation. Photogrammetric processing produced orthophotos, dense point clouds, digital surface models (DSM), and contour data, while LiDAR data were processed to generate classified point clouds and digital terrain models (DTM). Quantitative accuracy assessment was performed by comparing both datasets against RTK GNSS check points.

Results - The comparative analysis demonstrates that LiDAR-derived terrain models provide superior bare-earth representation and data completeness in vegetated and complex terrain. Photogrammetry-derived models offer higher surface detail and resolution in open areas but are more affected by vegetation cover. Accuracy assessment indicates that both methods achieve acceptable horizontal and vertical accuracy for road design purposes, with LiDAR exhibiting more consistent elevation accuracy across varying terrain conditions.

Conclusion - The findings confirm that both UAV-based photogrammetry and LiDAR are effective tools for road infrastructure surveying, with each offering distinct advantages depending on terrain and project requirements. LiDAR is more suitable for accurate terrain modelling in vegetated areas, while photogrammetry provides high-resolution surface information for detailed mapping. This study supports informed selection of UAV survey technologies for proposed road projects in similar environmental and topographic settings.

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**Abstract ID: 39**

## UAV-BASED PHOTOGRAMMETRIC ASSESSMENT OF SLOPE FAILURE FOR ROAD CONSTRUCTION PROJECT IN PAKAN, SARIKEI, SARAWAK

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**Abstract**

This paper presents the application of UAV-based photogrammetry for detailed slope assessment and failure analysis along an existing proposed road project affected by slope instability in Pakan, Sarikei, Sarawak. The primary objective of this study is to utilise high-resolution photogrammetric data to generate accurate three-dimensional (3D) terrain and surface models for the purpose of evaluating as-built slope geometry, identifying failure mechanisms, and assessing conformity with the original construction design.

Data acquisition was conducted using a DJI Mavic 2 Pro unmanned aerial vehicle (UAV) in conjunction with Static Real-Time Kinematic (RTK) Global Navigation Satellite System (GNSS) survey instrumentation to establish precise ground control and validation points. The UAV imagery was processed using photogrammetric techniques to generate dense 3D point clouds, high-resolution orthophotos, and digital surface models (DSM), enabling detailed representation of the failed slope surface and surrounding terrain.

The derived 3D point cloud and surface models were spatially overlaid with the approved construction drawings and design slope profiles to facilitate direct geometric comparison between the as-built slope conditions and the intended design geometry. This integration allowed for quantitative assessment of slope angles, bench configurations, crest and toe positions, and deviations from design specifications. In addition, the spatial distribution and morphological characteristics of the failure features, including scarp formation, tension cracks, and displaced material, were analysed to identify potential failure patterns and contributing factors.

The results demonstrate the effectiveness of UAV-based photogrammetry as a rapid, safe, and cost-efficient tool for post-failure slope assessment and forensic engineering analysis. The methodology provides valuable support for remedial design, risk assessment, and decision-making for slope stabilisation measures in road infrastructure projects.

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**Abstract ID: 43**

# GEOSPATIAL ANALYSIS OF SHORELINE CHANGE HOTSPOTS ALONG THE TERENGGANU COASTLINE USING DSAS AND SPATIAL STATISTICAL TECHNIQUES

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## Abstract

Shoreline change is a dynamic process influenced by both natural coastal processes and anthropogenic activities, requiring systematic monitoring to support sustainable coastal management. This study investigates spatio-temporal shoreline morphological changes and identifies erosion–accretion hotspots along the Terengganu coastline using the Digital Shoreline Analysis System (DSAS) integrated with spatial statistical techniques. Multi-temporal shoreline datasets representing 2000, 2017, and 2024 were extracted from Landsat and Sentinel-2 satellite imagery. Shoreline changes were quantified using Net Shoreline Movement (NSM) and End Point Rate (EPR), while Global Moran's I, Incremental Spatial Autocorrelation, and Getis–Ord Gi* statistics were applied to evaluate spatial clustering and identify statistically significant hotspots. The results reveal considerable spatial variability in shoreline dynamics across the six coastal districts. Besut and Setiu generally exhibited accretion, Kuala Nerus exhibited mixed shoreline behaviour with localized erosion clusters., Marang and Dungun showed mixed erosion and accretion patterns, whereas Kemaman was characterised by persistent shoreline erosion. Spatial statistical analysis confirmed significant clustering of shoreline changes and highlighted priority erosion hotspots requiring immediate management attention. The integration of DSAS and spatial statistical techniques provides a robust geospatial framework for identifying critical shoreline change patterns and supports evidence-based coastal monitoring and management along the Terengganu coastline.

## Keywords

Shoreline Change; DSAS; Spatial Statistics; Hotspot Analysis; GIS; Terengganu Coastline.

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**Abstract ID: 44**

## AI-DRIVEN GEOSPATIAL FRAMEWORK FOR SATELLITE BASED CROP DAMAGE ASSESSMENT AND FAIR COMPENSATION

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**Abstract**

Crop production in India is commonly interfered with by farm disasters like floods and droughts that are often accompanied with unfair payment to farmers. Current evaluation techniques are based on land ownership activities or physical surveys which can hardly reflect the real crop health or phenological stage. The paper suggests a system of geospatial intelligence that combines satellite remote sensing with artificial intelligence to facilitate objective and parcel-level extent of crop damage assessment and facilitate a system of fair compensation. The framework illustrates how AI and geospatial intelligence may be applied to monitor the fields and estimate compensations on a field scale. Crop classification was targeted at rice fields and it was conducted with a Random Forest classifier that was trained on features of temporal vegetation index. For flood damage estimation, a weighted multi-index scoring model was employed based on the comparison of the pre- and post-disaster spectral conditions. In addition, the analytical process of flood damage estimation was achieved through a Flask server and a React-based web application, which enables efficient spatial analysis. In field boundary detection, the experimental results showed that the accuracy of the U-Net model for segmentation is 91.8%, and the Dice coefficient is 0.89. Random Forest classifier was able to identify the rice field with an accuracy of 88.6 with a precision of 0.91. The damage scoring mechanism has proved to be a reliable disaster impact mapping method as it was able to classify the flood-affected parcels with low vegetation indicators and high water indicators. Altogether, the framework demonstrates the effectiveness of the application of AI and geospatial intelligence to assist field-level agricultural surveillance and equitable reimbursement estimation to aid in transparent disaster management and long-term agricultural decision-making. Future research will achieve the framework in multi-crop classification and SAR-optical image fusion to enhance the disaster monitoring process.

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# EVALUATION OF PRECISION BIO-ENHANCED NITROGEN APPLICATION USING A DJI T50 UAV ON SORGHUM PLANT HEIGHT AND SPAD CHLOROPHYLL CONTENT

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## Abstract

Sorghum (Sorghum bicolor (L.) Moench) is increasingly acknowledged as a climate-resilient crop with significant potential to support food and feed security within Malaysia's evolving agro-ecological conditions. Nevertheless, achieving its optimum yield remains limited by the inefficiencies associated with conventional fertilization practices. Granular fertilizer applications to the soil often experience substantial nutrient losses through volatilization and leaching, while traditional ground-based spraying can lead to crop damage due to trampling and soil compaction.

This study examines the effectiveness of Unmanned Aerial Vehicle (UAV) technology as a precision agriculture approach for foliar nutrient application. Specifically, the research evaluates the effects of a bio-enhanced fertilizer, YaraVita Croplift, applied using a DJI T50 agrarian drone, on the growth performance, physiological condition, and nutrient uptake of sorghum cultivated in Gemas, Negeri Sembilan. The study also addresses nutrient absorption challenges commonly observed in waxy-leaf crops by utilizing the aerodynamic rotor downwash produced by UAVs along with the physicochemical characteristics of surfactant-based formulations.

The experiment compared UAV-based foliar fertilizer application with a control treatment. Crop performance was assessed using two primary indicators: plant height, which represents vegetative growth vigor, and leaf chlorophyll content measured using SPAD readings to indicate photosynthetic activity and nitrogen status. The experiment consisted of four treatments with three replications, applying different fertilizer rates (0, 1, 3, and 5 L ha−1). Foliar applications were conducted at critical vegetative growth stages, and data on plant height and SPAD chlorophyll values were collected weekly from week 1 to week 9.

The results demonstrated that UAV-assisted foliar fertilization significantly improved crop growth and physiological performance ($p < 0.05$), leading to the rejection of the null hypothesis. Among the treatments, Treatment 3 (3 L ha−1) exhibited the best performance, recording the highest average plant height and SPAD values compared with the control and the higher application rate in Treatment 4. These findings suggest that an application rate of 3 L ha−1 represents the optimal physiological level for sorghum, whereas the higher rate (5 L ha−1) did not produce additional significant benefits, indicating a potential plateau in nutrient use efficiency.

Moreover, the precise aerial delivery system enabled a uniform and non-contact fertilizer application, which contributed to consistent crop establishment and steady increases in plant height throughout the growth period. Overall, the findings indicate that the integration of UAV

technology with bio-formulated foliar fertilization represents a promising strategy to enhance sorghum productivity. This approach offers an effective pathway to improve physiological performance and vegetative growth, particularly in tropical marginal soil environments.

**Keywords**

*Sorghum bicolor*, UAV, SPAD, Plant Height, Foliar Fertilization, Precision Agriculture, Ascophyllum nodosum.

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**Abstract ID: 47**

# A GIS-BASED FRAMEWORK FOR SPATIAL SCREENING OF PERENNIAL CROP TREE VITALITY

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## Abstract

Monitoring the condition of perennial crop trees is often constrained by fragmented field observations and the absence of spatially integrated tools for landscape-level management. While urban forestry has developed structured tree condition assessment systems, comparable spatial monitoring frameworks for perennial crop trees remain limited. This study proposes a GIS-based framework integrating spatial tree tagging with a Perennial Crop Vitality Index (PCVI) to support early screening of perennial crop tree condition. The framework consists of two components: (1) a spatial tree inventory capturing tree identity, crop type, and geographic location, and (2) a structured PCVI derived from standardised visual indicators of tree vitality and structural condition. Integration within a GIS environment enables spatial visualisation, clustering analysis, and comparative evaluation of tree condition across management zones. The framework was demonstrated using field data collected from perennial crop plots including coconut, mango, and coffee trees. Spatial analysis identified distinct clusters of trees exhibiting reduced vitality within specific plantation zones. These patterns enable the delineation of priority management zones and support targeted early intervention strategies. The study demonstrates how integrating structured field-based vitality indicators with spatial inventories can enhance landscape-level monitoring of perennial crops and strengthen geospatial decision support for agricultural tree management.

## Keywords

Geographic Information System (GIS), perennial crop management, perennial crop vitality index, spatial screening, decision support.

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**Abstract ID: 49**

## MULTI-SENSOR UAV–LiDAR AND MULTISPECTRAL MAPPING OF TASEK BERA RAMSAR SITE

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**Abstract**

Effective conservation of Tasek Bera requires high-resolution and up-to-date spatial data to capture its complex eco-hydrological processes (Zgórska et al., 2022, p. 2). This study evaluates the combined use of UAV-based LiDAR, RGB photogrammetry, and multispectral imaging for high-precision hydrological and environmental characterization of the wetland system. UAV LiDAR data generated accurate Digital Terrain Models (DTM) and Canopy Height Models (CHM), enabling detailed assessment of vegetation structure, micro-topographic variation, and hydrologically significant features such as peat domes, drainage pathways, depressions, and seasonal flood zones. Ultra-high-resolution RGB orthomosaics enhanced habitat delineation and mapping of surface water extent, floating vegetation mats, and inundation patterns. Multispectral imagery provided critical spectral indicators for evaluating vegetation health and detecting moisture gradients and distinguishing hydrologically driven vegetation communities, including open-water zones, sedge-dominated areas, and peat-swamp forest margin.The fusion of structural and spectral datasets improved the identification of water flow networks, wet–dry transitions, stagnant-water pockets, and water-level fluctuations, particularly beneath dense canopy cover. The results demonstrate that UAV–LiDAR and multispectral systems provide complementary insights for understanding and managing tropical wetland dynamics.

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**Abstract ID: 51**

# SPATIAL TEMPORAL ANALYSIS OF REPEAT PROPERTY CRIME HOTSPOTS IN KOTA KINABALU, SABAH

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## Abstract

Property crime is one of the main issues that records the highest number of index crime cases compared to violent crimes in Malaysia. Kota Kinabalu is the largest district in Sabah and shows a high number of property crime cases every year. Therefore, this study aims to analyse property crime hotspots in Kota Kinabalu from 2018 to 2022 using a Geographic Information System (GIS) approach through Hot Spot Analysis (Getis-Ord Gi*). This study uses spatial data which consists of the coordinates (x,y) of property crime incidents and police station sector boundaries as the unit of analysis. Attribute data include information on the type of property crime, year 2018-2022, month, time of incident, time of period, address of incidents and police station names. The data were obtained from the Police Reporting System (PRS) IPD Kota Kinabalu. The results show that there are repeated property crime hotspot areas over the five-year period within sector boundaries under the supervision of Kota Kinabalu Police Station, with the highest Z-score of 6.501032 and a very low p-value ($p<0.01$) in 2019. The findings of this study can help the authorities, especially the Royal Malaysia Police (PDRM) in monitoring and implementing crime prevention strategies in hotspot areas.

## Keywords

Spatial Analysis, Property Crime, Police station sector boundaries, Hotspot, Getis-Ord Gi*, GIS, Kota Kinabalu

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**Abstract ID: 52**

# DEVELOPING AN OIL PALM GROWTH REFERENCE MAPS THROUGH EMPIRICAL MODELLING: A DATA-DRIVEN APPROACH FOR PLANTATION MANAGEMENT

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## Abstract

Effective management of large oil palm estates is challenged by the need to identify potential problematic areas, such as those with stunted growth or nutrient deficiencies, for targeted management interventions. While satellite and unnamed aerial vehicle (UAV) imagery are commonly used for oil palm health classification, existing methods often lack age-specific information crucial for understanding palm growth dynamics. This study explains a method to generate an age-specific classification for oil palms using UAV imagery. The palm detection and radius estimation were implemented using the YOLOv5s model. The estimated radius was then used to develop a data-driven growth reference model to classify oil palms based on agespecific mean and standard deviations of canopy size. The YOLOv5s achieved a precision, recall, and F1-score of 0.9993, 0.9903, and 0.9929 for palm detection, respectively. Predicted crown radius exhibited a strong correlation with ground-truth measurements especially for palms younger than 7 years old (ranging from 0.34 to 1.00), with a root mean squared error (RMSE) of 1.26 m to 0.16 m. The variability in RMSE and correlation is attributed to the degree of crown overlap. The growth reference achieved high accuracy, with Nash-Sutcliffe Efficiency (NSE) values ranging from 0.9459 to 0.9744 and RMSE ranging from 0.25 m to 0.33 m, when simulating the mean and standard deviations of canopy size in the testing data, demonstrating its efficiency in predicting growth patterns. The final output is an improved canopy size index (CSI) map to indicate potential problematic areas, enabling more informed and efficient plantation management.

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# PERFORMANCE OF CONSUMER-GRADE MULTI-BAND AND SINGLE-BAND GNSS UNDER OPEN-SKY AND CANOPY CONDITIONS IN OIL PALM PLANTATIONS

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## Abstract

Reliable GNSS positioning is essential for palm census mapping, block demarcation, and estate-level operations in oil palm plantations, where dense canopy conditions can attenuate satellite signals and introduce multipath interference, thereby degrading positional accuracy. Multipath effects arising from signal reflections on vegetation and terrain present a significant limitation for single-band receivers, which lack the capability to effectively mitigate such errors. This study evaluates the precision, stability, and accuracy of two consumer-grade GNSS receivers with differing capabilities: the multi-band Garmin GPSMAP 65s and the single-band Garmin eTrex 22x, under both open-sky and oil palm canopy conditions. Ten fixed ground points (five open-sky and five under canopy) were surveyed, with both receivers positioned concurrently and recording at 1-second intervals for 10 minutes (≈600 epochs per point). Under canopy conditions, the GPSMAP 65s exhibited moderate performance degradation, with mean horizontal error increasing from 0.38 m to 0.71 m (+87%) and path length extending from 6.47 m to 17.58 m, indicating controlled positional drift. In contrast, the eTrex 22x experienced substantial deterioration, with mean horizontal error increasing from 0.91 m to 2.26 m (+149%) and path length variability approaching 90 m, reflecting reduced positional stability. Relative to centimeter-level RTK positioning used as the reference standard, the GPSMAP 65s maintained RMSE values between 1.41 m and 1.74 m (+23%), whereas the eTrex 22x showed RMSE rising from 1.7 m to 3.25 m (+92.4%), with maximum errors reaching 6.5 m. These findings confirm that multi-band GNSS significantly enhances positioning reliability in obstructed plantation environments by mitigating multipath interference through multifrequency signal processing and improved satellite geometry. In summary, multi-band GNSS receivers are recommended for agronomists, estate managers and field workers requiring reliable sub-meter positional accuracy under canopy conditions for plantation operations.

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**Abstract ID: 57**

# OBJECT-BASED IMAGE ANALYSIS (OBIA) FOR MANGROVE DEGRADATION ASSESSMENT: A SYSTEMATIC LITERATURE REVIEW

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## Abstract

Mangrove forests are globally significant blue carbon sinks, yet they remain highly vulnerable to both anthropogenic extraction and natural disturbances. In tropical regions, localized lightning strikes frequently cause the synchronized mortality of interconnected tree clusters, creating distinct canopy gaps. A critical challenge in modern geospatial monitoring is "spectral confusion," where in traditional remote sensing analyses misclassify these natural lightning gaps as anthropogenic degradation, such as illegal logging. This misclassification overestimates human impacts and disrupts the sustainable management of silvicultural systems. This systematic literature review, conducted in accordance with PRISMA guidelines, evaluates the methodological limitations of traditional pixel-based classification and assesses the efficacy of transitioning to Object-Based Image Analysis (OBIA) and high-resolution Unmanned Aerial Vehicles (UAVs). A synthesis of current literature demonstrates that standard pixel-based algorithms consistently fail in high-biomass, heterogeneous mangrove canopies due to index saturation, uneven canopy shadows, and the biological time lag of standing dead trees. Conversely, OBIA significantly improves classification accuracy by grouping spectrally similar pixels into meaningful polygons. This paradigm shift allows for the extraction of precise geometric metrics such as the Circularity Index and the application of contextual proximity rules. Ultimately, integrating OBIA with high-resolution imagery and UAV validation is essential for definitively distinguishing the circular patterns of natural mortality from irregular human extraction, thereby refining carbon accounting and guiding proactive coastal conservation.

## Keywords

Mangrove Degradation, Object-Based Image Analysis (OBIA), Remote Sensing, Land Use and Land Cover Change (LULCC), Canopy Gaps, UAV Validation

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**Abstract ID: 59**

# GEOSPATIAL ANALYSIS OF DENTAL ACCESS AND ITS IMPLICATIONS FOR FORENSIC ODONTOLOGY IN MALAYSIA

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## Abstract

Geographic Information System (GIS) technology enables spatial analysis of healthcare accessibility, helping us understand how far people travel for dental care across Malaysian regions. This spatial analysis also has forensic implications, particularly in retrieving antemortem dental records for identification. This study aims to analyse and compare residential-to-clinic travel distances across urban and suburban settings in Malaysia using GIS-based analysis. Following this, the distances and distribution data obtained were evaluated to support decision on dental record retrieval process. A total of 437 patients from three areas: Kuala Lumpur (urban), Kota Bharu and Kota Kinabalu (both suburban), were interviewed. Residential addresses were retrieved from dental records and geocoded via Google Maps to obtain coordinates. These were integrated into QGIS, where distances between each patient's residence and clinic were measured. Statistical comparisons were conducted using the Kruskal-Wallis H test with post-hoc analysis. Findings showed travel distances ranged from 0.18 km to 227.05 km in Kota Kinabalu (median 4.33 km), 0.34 km to 42.02 km in Kuala Lumpur (median 7.83 km), and 0.26 km to 60.19 km in Kota Bharu (median 5.59 km). The test revealed significant differences among groups. Post-hoc analysis showed significant differences between Kuala Lumpur and both Kota Bharu and Kota Kinabalu, but not between the suburban areas. Overall, patients in urban areas travel farther to access dental care than those in suburban areas. Across all sites, the lower median compared to mean suggests a skewed distribution, with most patients residing closer to clinics. From a forensic perspective, retrieving antemortem dental records may be faster in suburban areas, while urban searches may be more challenging due to wider geographic spread.

## Keywords

GIS, dental record, travel distance, antemortem, forensic odontology

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**Abstract ID: 60**

# GEOSPATIAL DATA ACQUISITION AND PREPROCESSING USING GOOGLE EARTH ENGINE: AN APPLIED WORKFLOW FOR FUTURE ANALYSIS OF URBAN RAIL TRANSIT IMPACTS ON RESIDENTIAL PROPERTY VALUES

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## Abstract

The study of the relationship between urban rail transit (URT) and residential property values requires environmental and built-environment variables that are spatially consistent and temporally comparable. However, the geospatial preprocessing used to construct such variables is often weakly documented, particularly when multiple satellite sensors and global products are combined across time. This study develops a Google Earth Engine (GEE)-based workflow for acquiring and preprocessing multi-temporal station-area indicators in the Greater Kuala Lumpur, Malaysia. The analysis covers 24 selected URT station areas, comprising 12 MRT Kajang Line stations and 12 LRT Shah Alam Line stations, across six benchmark years: 2010, 2013, 2016, 2019, 2022, and 2025. Landsat Collection 2 Level 2 imagery was used to derive the Soil-Adjusted Vegetation Index (SAVI), Modified Normalised Difference Water Index (MNDWI), and Land Surface Temperature (LST). The Global Human Settlement Layer (GHSL) was used for built-up intensity, while DMSP-OLS and VIIRS Nighttime Lights (NTL) were used for relative urban activity intensity. All raster outputs were aggregated to 2-km station-area polygons and merged into a balanced station-year dataset of 144 observations. The results show that station areas are heterogeneous across time, URT system type, and market segment. The final indicators provide complementary measures of greenness, water-surface signal, built-up fraction, nighttime activity, and thermal condition. The study does not estimate property value effects directly; instead, it contributes a reproducible preprocessing workflow and integration-ready geospatial dataset for future hedonic, spatial econometric, Difference-in-Differences or machine learning analysis of URT-residential property value relationship.

## Keywords

Google Earth Engine; Geospatial Preprocessing; Urban Rail Transit; Residential Property Values; SAVI; MNDWI; GHSL; Nighttime Lights; Land Surface Temperature; Greater Kuala Lumpur

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**Abstract ID: 61**

# FIVE DECADES OF ELECTORAL DYNAMICS IN SARAWAK: SPATIAL CONCENTRATION OF ELECTORAL POWER AND HOTSPOT PATTERNS OF WINNING VOTES, 1969–2021

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## Abstract

This study confronts a key limitation in electoral research. The assumption of spatial uniformity in voter behavior. Focusing on five decades of state elections in Sarawak (1969–2021), we aim to map how electoral power concentrates across space. We compile constituency-level results and employ a longitudinal spatial analysis, using the Getis–Ord Gi* statistic to detect statistically significant clusters (hotspots and cold spots) of winning-vote concentrations. The analysis reveals persistent, yet evolving, spatial clusters of electoral strength. High-intensity clusters of winning votes consistently emerge in Sarawak's urban and peri-urban districts (for example, around Kuching and other population centers), indicating entrenched support and intense competition. In contrast, rural and peripheral constituencies are cold-spot areas with comparatively low vote concentration, reflecting dispersed populations and weaker mobilization. Over time, these patterns shift, the decline of uncontested races and the emergence of competition in formerly secure districts signal evolving political alignments. The persistence of particular hotspots implies that local leadership, party organization, and demographic factors sustain these strongholds. These findings show that Sarawak's electoral dynamics are shaped by spatial concentration rather than uniform trends. Methodologically, we demonstrate that hotspot analysis is a powerful tool for revealing clustered voting patterns over time. By focusing on the distribution of winning votes, our study fills a gap in the literature and sheds new light on the geography of political power. In doing so, it resolves the earlier oversight of assumed uniformity and underscores the importance of spatial perspective for understanding long-term electoral change.

## Keywords

Electoral geography; getis–ord gi* statistic; longitudinal geospatial analysis; spatial clustering of electoral behaviour; winning vote distribution

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**Abstract ID: 62**

# EVALUATING LULUCF DYNAMICS IN THE MATANG MANGROVE FOREST RESERVE FOR ABOVEGROUND BIOMASS ESTIMATION POTENTIAL

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## Abstract

Mangrove ecosystems constitute one of the most carbon-rich coastal biomes, yet their aboveground biomass (AGB) is highly dynamic and strongly regulated by land use and land cover change (LULUCF). This research presents a comprehensive and integrative assessment of LULUCF dynamics within the Matang Mangrove Forest Reserve over three consecutive years, with a focus on advancing the potential for reliable AGB estimation. Multi-temporal satellite imagery is rigorously analysed to generate consistent land cover classifications, enabling the precise delineation of mangrove extent and the detection of subtle yet significant spatial transitions over time. Areas of mangrove gain and loss are systematically quantified and subsequently linked to variations in AGB through the application of representative biomass, facilitating the evaluation of biomass redistribution across changing landscapes. The analytical framework incorporates a range of influencing factors, including forest harvesting cycles, land conversion pressures, natural regeneration processes, and environmental variability, which collectively drive observed spatiotemporal patterns. Anticipated outcomes reveal distinct trajectories of mangrove expansion and degradation, with corresponding implications for biomass accumulation and decline, thereby underscoring the sensitivity of AGB to LULUCF dynamics. The study ultimately establishes a robust and transferable approach for linking LULUCF dynamics with AGB estimation, contributing to improved carbon stock assessment, strengthened climate change mitigation strategies, and more informed, evidence-based management of sustainably managed mangrove ecosystems.

## Keywords

Aboveground Biomass (AGB), LULUCF, Mangrove Ecosystem, Forest Management, Geospatial Analysis

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**Abstract ID: 64**

# VALIDATION OF DRONE-BASED LiDAR FOR MEASURING OIL PALM CANOPY HEIGHTS

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## Abstract

Accurate, scalable monitoring of oil palm productivity and biomass is increasingly critical amid land constraints and yield stagnation. This study evaluates the accuracy of drone-borne LiDAR-derived canopy height in oil palm plantations in Malaysia, addressing a key gap in canopy height measurement for subsequent biomass estimation. Palm heights were derived from a Canopy Height Model (CHM), calculated as the difference between LiDAR-generated Digital Surface Model (DSM) and Digital Terrain Model (DTM), while individual crown radii were delineated using a deep learning approach. LiDAR estimates were validated against 213 ground-truth pole measurements obtained via stratified random sampling across seven height classes (4-25 m) and three plantation blocks. LiDAR-derived heights showed strong correlation with ground measurements ($r=0.972$, MAE=0.647 m, RMSE=1.089 m), with 83.6% of palms within ±10% error. Bias was minimal (mean difference= -0.061m), though variability increased with height (95% limits of agreement: -2.07 to +2.20 m). Height-stratified analysis revealed significantly lower errors in palms <15 m (MAE = 0.310-0.726 m; 75-93% within ±10%) compared to taller palms (MAE=1.34-1.53 m; 72-76% within ±10%), supported by ANOVA ($F=8.40$, $p<0.001$). Reduced accuracy in taller palms is likely driven by canopy overlap and LiDAR signal attenuation. Excluding 14 outliers (n=199) improved overall performance ($r=0.982$, MAE=0.566 m, RMSE=0.897 m; 85.9% within ±10%), though height-dependent differences remained significant ($F=4.43$, $p<0.001$). These findings define the operational accuracy envelope of LiDAR-derived height and highlight that palms exceeding 15 m require correction for reliable large-scale biomass and carbon stock estimation.

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**Abstract ID: 67**

# ENHANCING LANDSLIDE RISK MAPPING USING EXPLAINABLE MACHINE LEARNING MODELS

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## Abstract

Landslide susceptibility mapping plays a critical role in disaster risk reduction and land-use planning, particularly in regions prone to rainfall-induced slope failures. While machine learning models such as XGBoost have demonstrated strong predictive capabilities, their black-box nature limits interpretability and practical adoption. This study proposes an Explainable Artificial Intelligence (XAI)-based framework for landslide susceptibility mapping by integrating geospatial conditioning factors, including topographic, environmental, and proximity variables. An XGBoost model is trained to generate susceptibility maps, and SHapley Additive Explanations (SHAP) are employed to interpret both global and local feature contributions. The results reveal that slope gradient and rainfall intensity are the most influential factors, while proximity to roads and land use exhibit varying impacts across different locations. The XAI framework enhances model transparency by providing intuitive explanations for each prediction, thereby supporting more informed decision-making for disaster management authorities. This study demonstrates that integrating explainability into AI models not only improves trust but also offers valuable insights into the underlying mechanisms of landslide occurrence.

## Keywords

Landslide Susceptibility Mapping, Explainable Artificial Intelligence (XAI), Machine Learning, SHAP (SHapley Additive Explanations), Geospatial Analysis

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**Abstract ID: 68**

# DEVELOPMENT OF WEB MAPPING APPLICATION WITH ARTIFICIAL INTELLIGENCE (AI) CHATBOT FOR PERSONALIZED TRAVEL

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## Abstract

The travel sector has undergone significant changes due to technological advancements and digital solutions, yet travellers still face challenges in obtaining personalized, adaptable, and context-sensitive information. Existing travel apps often lack flexible search queries to respond in a natural language format, failing to meet diverse needs. This research aims to bridge this gap by integrating artificial intelligence (AI) chatbots with web mapping applications. The objectives are: (1) to study the current state of AI chatbot integration with tourism and web mapping, and (2) to develop a web mapping application embedded with an AI chatbot for travellers. The methodology includes web development using APIs such as Maps JavaScript, Gemini, and Places. The resulting application provides a functional web map with an embedded AI chatbot capable of delivering personalised travel recommendations using flexible queries without predefined keywords and phrases and using a more natural language query. This innovative solution shows substantial potential for improving the travel planning experience, offering a user-friendly platform that integrates intelligent conversation with spatial awareness. In conclusion, integrating AI chatbots and web mapping enhances travel-related applications, providing a comprehensive solution that improves user experience and engagement in travel planning.

## Keywords

Artificial intelligence, AI chatbot, Web mapping, Maps JavaScript, Gemini, Places

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**Abstract ID: 69**

# ROBUST MIRROR ARRAY-BASED CO-REGISTRATION FOR HIGH-RESOLUTION COMMERCIAL SATELLITE IMAGERY

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## Abstract

Accurate geometric alignment is essential for multi-sensor Earth observation applications, particularly as commercial satellite constellations continue to increase in spatial resolution and revisit frequency. However, conventional image matching approaches often struggle when images exhibit significant differences in spatial resolution, viewing geometry, or radiometric characteristics. This study investigates the applicability of an artificial mirror array for improving co-registration accuracy across high-resolution satellite imagery. A hybrid framework combining mirror-based global alignment with local refinement using AROSICS was evaluated using Pleiades, NewSat, and PlanetScope SuperDove imagery acquired over Ube City, Yamaguchi Prefecture, Japan. Pleiades imagery was used as the reference dataset, while independent aerial orthophotography was employed to assess absolute geolocation accuracy. The impact of mirror-assisted co-registration on image-to-image and band-to-band geometric accuracy was quantified using root mean square error (RMSE). Results demonstrate that the proposed approach consistently improves co-registration accuracy across all evaluated sensors, achieving sub-meter image-to-image RMSE and reducing band-to-band misalignment to less than half a pixel. The largest improvements were observed for imagery with larger initial geolocation errors. For PlanetScope imagery, where conventional local matching produced insufficient reliable tie points, mirror-only alignment reduced RMSE from 1.57 m to 1.14 m.These findings demonstrate the scalability of artificial mirror arrays as a practical and sensor-independent solution for improving geometric interoperability among high-resolution commercial satellite systems.

## Keywords

Co-registration, mirror array, high resolution, geolocation accuracy

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**Abstract ID: 70**

# EPIPHYTIC BRYOPHYTES ON *HEVEA BRASILIENSIS*: SOIL PHYSICOCHEMICAL AND PLANT PHYSIOLOGICAL CONDITIONS AT RUBBER PLANTATION

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## Abstract

Epiphytic bryophytes on *Hevea brasiliensis* (rubber tree) are sensitive bioindicators of microenvironmental heterogeneity within plantation ecosystems. This study characterised plant physiological, bark physicochemical, soil physicochemical, and foliar nutrient conditions across ten permanent experimental plots at Ladang Carta Bagus, Kuala Krai, Kelantan using a multi variable. Statistical analysis revealed highly significant inter-plot differentiation in plant physiological parameters, bark pH, bark thickness, soil physicochemical properties, and leaf nutrient concentrations. Bark outer pH ranged from 5.33 to 6.10 and inner bark pH from 5.63 to 6.67, while bark thickness ranged from 1.35 to 2.71 mm. Soil pH ranged from 3.73 to 7.30 and oxidation-reduction potential from -591 to +498 mV. Principal component analysis retained five components explaining 88.83% of total variance. Bark pH co-loaded with foliar manganese on PC2 (22.38%), indicating a bark-soil redox pathway that determines bryophyte microhabitat quality. Spatial analysis confirmed significant positive spatial autocorrelation in bryophyte abundance ($p = 0.0006$) and demonstrated coherent spatial gradients in chlorophyll content, soil Mn, ORP, temperature, and pH that corroborate the ground-level physicochemical measurements.

## Keywords

*Hevea brasiliensis*; epiphytic bryophytes; bark microclimate; manganese toxicity; soil redox; spatial autocorrelation

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**Abstract ID: 71**

# EMPOWERING CITIZEN SCIENCE: MOBILE APPLICATIONS AND AI-ASSISTED IDENTIFICATION FOR STREAMLINED BIODIVERSITY INVENTORY

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## Abstract

The collection and management of biodiversity data in Malaysia currently face significant bottlenecks, primarily due to fragmented monitoring efforts (Stephenson & Stengel, 2020), a lack of standardized inventory methods (Cutko, 2009), and an over-reliance on manual, expert-led processes. While citizen science offers a collaborative pathway to scale data collection (Bonney et al., 2014; Gellman, 2015), its adoption by governmental forest stakeholders is hindered by concerns regarding data accuracy (Jacobs, 2016) and the heavy human-resource burden of validating public submissions (Hecker et al., 2018). This paper repositions biodiversity data collection by focusing on mobile applications as a critical tool for structured citizen science (Haklay et al., 2021). By utilizing the "BioMap" mobile application as a case study, this paper demonstrates how automated geolocation extraction and artificial intelligence (Rathoure & Ram, 2024) streamline the inventory process. To validate the usability and objective achievement of this apps development, User Acceptance Testing (UAT) has been conducted to expert users. The findings highlight a strong user preference for the app's offline data capture and automated mapping functionalities.

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**Abstract ID: 72**

# SUPPORT VECTOR REGRESSION FOR EXTREME RAINFALL QUANTIFICATION AND FLOOD CLASSIFICATION IN A HIGHLAND MONSOON CATCHMENT: THE CASE OF TANAH RATA, CAMERON HIGHLANDS

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## Abstract

Climate change is intensifying the frequency and magnitude of extreme monsoon rainfall across Southeast Asia, increasing the demand for reliable, station-level prediction tools to support flood risk management and adaptation planning in topographically diverse tropical catchments. Building on a previously validated machine learning pipeline benchmarked at a lowland floodplain station, this study extends the framework to Tanah Rata, a highland station in the Cameron Highlands, Peninsular Malaysia, to evaluate its transferability to an orographically and climatically distinct monsoon regime. Monthly rainfall records spanning 1984 to 2014 (369 months) were combined with 59 engineered predictors derived from ERA5 atmospheric reanalysis data and rainfall history, including lagged values, rolling statistics, and cyclic monsoon encodings. Using a chronological 295-month training and 74-month test split, a Support Vector Regressor (SVR) was optimized via Bayesian hyperparameter search for continuous rainfall quantification, alongside a companion Support Vector Classifier (SVC) for binary flood versus no-flood discrimination at a 400 mm per month threshold.

On the independent test set, SVR achieved near-optimal accuracy ($R^2$ = 0.986, RMSE = 13.63 mm, NSE = 0.986, KGE = 0.935, PBIAS = 1.79%), confirming strong generalization of the SVR-based approach beyond its original lowland benchmark. The companion SVC achieved a ROC-AUC of 0.904 and 88% overall accuracy, though flood-class recall (0.44) and F1-score (0.47) highlight the persistent challenge of minority-class detection under an 11.1% flood base rate. Permutation importance analysis showed that short-term rainfall persistence, specifically the three-month rolling mean and two-month lag, dominated predictive skill, followed by geopotential height and monsoon-timing predictors, a pattern distinct from the atmospheric moisture-driven attribution observed at the lowland benchmark station. These findings demonstrate that SVR-based pipelines generalize robustly across contrasting monsoon regimes and reveal station-specific differences in predictability structure, supporting their extension toward basin-wide, climate-change-informed flood early warning systems.

## Keywords

Machine learning; Support Vector Regression; extreme rainfall prediction; flood classification; climate change adaptation; Cameron Highlands; monsoon hydrology

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**Abstract ID: 73**

# WILDLIFE BIODIVERSITY CHARACTERISATION OF PROTECTED AREAS IN MALAYSIA USING GEOSPATIAL APPROACHES: A COMPREHENSIVE REVIEW AND CONCEPTUAL FRAMEWORK

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## Abstract

Malaysia is recognized globally as one of the megadiverse nations, hosting ancient tropical rainforest ecosystems that support thousands of rare and endangered wildlife species. However, rapid socioeconomic growth, agricultural expansion, and infrastructure development have driven severe habitat fragmentation, isolating core ecological zones. Effective conservation management relies heavily on accurate wildlife biodiversity characterization within designated Protected Areas (PAs). Traditional field methodologies, such as manual trapping, physical line transects, and standalone camera-trapping networks, remain labor-intensive, localized, and logistically constrained by the rugged, dense terrain characteristic of tropical dipterocarp and montane forests. To overcome these limitations, advanced geospatial approaches have emerged as indispensable tools for non-invasive, multi-scale, and spatially continuous ecosystem characterization. This paper presents a comprehensive review of the evolution, applications, and performance of geospatial technologies in characterising wildlife habitats across Malaysian PAs. We analyze the specific contributions of multi-spectral satellite remote sensing, airborne and terrestrial Light Detection and Ranging (LiDAR), Unmanned Aerial Vehicles (UAVs), and Geographical Information Systems (GIS) coupled with advanced machine learning and ecological niche modeling frameworks. Synthesizing insights from historical and recent studies across primary conservation for example National Parks, an integrated and a conceptual framework designed specifically for tropical wildlife characterization using geospatial approach were introduced. This framework synthesizes macro-scale landscape metrics, meso-scale structural canopies, and micro-scale microclimate indicators to compute accurate Habitat Suitability Indices (HSIs) and model potential wildlife distribution dynamics under shifting environmental pressures. Finally, the critical challenges were addressed specifically to equatorial remote sensing, including persistent cloud occlusion and under-canopy structural blindness, and outline pathways for uniting geospatial architectures with next-generation technologies like environmental DNA (eDNA) and deep learning networks.

## Keywords

Biodiversity Characterisation, Geospatial Approaches, Remote Sensing, Protected Areas, Malaysia, Species Distribution Modeling, Geospatial Wildlife Characterisation Framework.

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**Abstract ID: 74**

# SATELLITE-BASED ASSESSMENT OF CANOPY RECOVERY IN HEVEA BRASILIENSIS FOLLOWING PESTALOTIOPSIS FUNGICIDE APPLICATION IN PENINSULAR MALAYSIA

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## Abstract

Pestalotiopsis leaf fall disease (PLFD) poses a critical threat to the productivity and economic viability of *Hevea brasiliensis* (rubber) plantations across Peninsular Malaysia, necessitating robust, large-scale monitoring solutions. While remote sensing facilitates broad canopy health assessments, dynamically tracking canopy recovery following precision fungicide applications requires high-frequency, robust spectral frameworks. Addressing this gap, this study evaluates the spatio-temporal efficacy of aerial fungicide interventions through a multi-sensor longitudinal approach, synergising the dense spectral continuity of Sentinel imagery with the high spatial granularity and daily revisit capabilities of PlanetScope data. By correlating these time-series vegetation indices with ground-truthed canopy density measurements, the study establishes a continuous monitoring framework that isolates treatment-induced canopy restoration from background phenological variability and secondary leaf senescence. By evaluating pre- and post-treatment spectral trajectories rather than relying on static spatial controls, the quantitative normalisation of vegetation indices demonstrates high agreement with field recovery observations. This approach offers a cost-effective, scalable alternative to labour-intensive ground scouting. Ultimately, this research provides an empirical foundation for optimising precision chemical interventions, empowering plantation stakeholders to accurately monitor pathogen-induced canopy loss and safeguard long-term agroforestry resilience.

## Keywords

*Hevea brasiliensis*; Pestalotiopsis leaf fall disease (PLFD); Time-series analysis; Sentinel; PlanetScope; Multi-sensor data fusion; Precision agriculture; Phenological monitoring

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**Abstract ID: 75**

# EVALUATING THE ACCURACY OF LIDAR-DERIVED ABOVE GROUND BIOMASS ESTIMATES IN DEGRADED AND NATURALLY REGENERATING FORESTS IN SARAWAK

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## Abstract

Sarawak's forest governance framework emphasizes sustainable forest management, biodiversity conservation and the development of forest carbon markets under initiatives such as the Sarawak Forest Policy and the Forest Carbon Activity Rules. In this context, accurate and transparent estimation of above-ground biomass (AGB) is fundamental to measurement, reporting and verification (MRV) systems that support carbon trading and Verified Carbon Standard (VCS) applications. Light Detection and Ranging (LiDAR) has emerged as a promising geospatial technology for characterizing forest structure and estimating AGB. However, its reliability in degraded and naturally regenerating tropical forests remains insufficiently understood due to the structural complexity and heterogeneity of these forest conditions. This paper presents a critical review of LiDAR-derived AGB estimation approaches and evaluates their applicability to degraded and naturally regenerating forests in Sarawak. The review examines how forest condition influences estimation accuracy and identifies the major sources of uncertainty that challenge reliable biomass estimation for carbon accounting and policy implementation. By synthesizing current scientific evidence and linking technical approaches with forest governance needs, this review provides a scientific foundation for developing robust, transparent and region-specific forest monitoring systems. The findings are expected to support future research on LiDAR-based AGB estimation and contribute to strengthening Sarawak's forest carbon governance in line with national climate commitments and sustainable forest management objectives.

## Keywords

LiDAR; above-ground biomass (AGB); degraded forests; naturally regenerating forests; forest carbon MRV; Sarawak.

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# Integrating Ground Surveys and Drone Photogrammetry for Monitoring Dipterocarp Enrichment Planting for Forest Landscape Restoration in Sarawak

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## Abstract

The common means of accelerating the recovery of degraded tropical forest is enrichment planting of native dipterocarps and monitoring is frequently the element that is curtailed. Field inventories are accurate yet slow and they sample only a small part of the planted area. Drone surveys are rapid and spatially complete, but their measurements still require validation against reference data. This study brings the two approaches together. We assessed six permanent restoration plots at two Sarawak sites in 2024 and again in 2025 and flew a centimetre-scale drone survey over one of them. The Sabal Forest Reserve holds five line-planted plots of *Rubroshorea leprosula, Dryobalanops beccar*ii and *Calophyllum soulattri*. Whereas a sixth plot at Labang, near Bintulu, carries *Rubroshorea parvifolia, Eusideroxylon zwageri* and *Rubroshorea argentifolia* in pioneer regrowth. Taken as living stems in 2024 relative to the number planted for establishment survival at Sabal is declined from 63.3% in Plot 1 to 18.4% in Plot 5. Stems that reached 2024 mostly persisted: retention to 2025 ranged from 64.5% to 90.0% and pooled to 72.5% across 91 stems. These survivors added 0.48 cm in diameter (+26.8%) and 0.22 m in height (+10.5%) over the year. Labang performed better on every measure, retaining 86.7% of its stems and gaining 0.75 cm in diameter (+30.2%) and 0.79 m in height (+34.6%). The Labang drone survey, a DJI Zenmuse L2 flown in RGB mode at 50.2 m, produced a 1.12 cm/pixel orthomosaic and a photogrammetric surface model at 4.49 cm/pixel, georeferenced to within 9.83 cm. Cross-sections of the point cloud resolve individual crowns above a distinct low understorey, and the heights they show are consistent with the tallest stems measured in the field. We treat field inventory and drone survey as one monitoring system rather than as competitors, and we state clearly which products (canopy cover, gap fraction, a laser-based canopy height model) remain to be produced before the comparison can be made fully quantitative.

## Keywords

Forest landscape restoration; dipterocarp enrichment planting; UAV photogrammetry; structure-from-motion; seedling survival; Sarawak.

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# ANALYSIS OF POTENTIAL LANDSLIDE AREA USING LANDSLIDE SUSCEPTIBILITY MAP (LSM) AT TAMAN NEGERI ROMPIN, PAHANG

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## Abstract

Landslides are among the most significant natural hazards affecting tropical forested regions in Malaysia, particularly in areas characterized by steep terrain, high rainfall, and increasing anthropogenic disturbances. Taman Negeri Rompin (TNR), Pahang, as the largest state park in Peninsular Malaysia and a designated High Conservation Value Area (HCVA), faces growing concerns regarding slope instability that may threaten biodiversity, ecotourism, and ecosystem services. This study aims to identify and analyze potential landslide-prone areas within TNR through the development of a Landslide Susceptibility Map (LSM) using Remote Sensing and Geographic Information System (GIS) techniques. Nine landslide conditioning factors were considered, including elevation, slope, aspect, curvature, Normalized Difference Vegetation Index (NDVI), distance to river, rainfall distribution, soil series, and Topographic Wetness Index (TWI). Two modelling approaches were applied: the Analytical Hierarchy Process (AHP) and the Random Forest (RF) machine learning algorithm. The AHP method was used to assign weights based on expert judgment and pairwise comparison, while the Random Forest model was employed to evaluate nonlinear relationships and determine variable importance. Model validation was conducted using ground verification data and accuracy assessment techniques. The results indicate that slope gradient, rainfall distribution, and soil characteristics are among the most influential factors contributing to landslide susceptibility in TNR. The Random Forest model demonstrated higher predictive performance compared to the AHP model, producing more accurate spatial classification of high-risk zones. High susceptibility areas were predominantly located in steep terrains with high rainfall intensity and reduced vegetation cover. This study highlights the importance of integrating geospatial technology and machine learning approaches in forest hazard assessment. The generated landslide susceptibility map provides valuable information for forest managers and policymakers to support sustainable land-use planning, biodiversity conservation, and disaster risk reduction in Taman Negeri Rompin.

## Keywords

Landslide Susceptibility Map (LSM); Random Forest, Analytical Hierarchy Process (AHP); geospatial technology; machine learning

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