ICCES 2025

Crafting a Sustainable Future Through Integrated Environmental Management

ICCES 2025

CONFERENCE PROCEEDINGS

Volume 4

C ENTRE FOR
E NVIRONMENTAL
S USTAINABILITY

PGIS

Ministry of Agriculture & Environmental Affairs, Central Province

Postgraduate Institute of Science
University of Peradeniya

Centre for Environmental Sustainability

University of Peradeniya

Mission

To disseminate sound environmental knowledge, develop skills necessary for efficient environmental management, and inculcate sustainable environmental attitudes among students, professionals, and the general public.

Vision

To ensure an environmentally informed and responsible society.

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Message from the Vice-Chancellor

It is with immense pleasure that I send this congratulatory message to the e-proceedings of the Fourth International Conference of the Centre for Environmental Sustainability (ICCES) 2025, hosted by the Centre for Environmental Sustainability of the University of Peradeniya.

Since its inception in 2016, the ICCES conference has evolved into a vital forum for advancing scientific dialogue and fostering collaborative action on environmental sustainability. The 2025 conference theme, *"Crafting a sustainable future through integrated environmental management,"* underscores the urgent need for responsible stewardship of the planet's limited resources, ensuring the fair use by the present generation while safeguarding the potential for generations to come.

Achieving sustainability requires insight into the complex relationships among economic development, social transformation, and ecosystem conservation. This year's conference invites innovative solutions that bridge science, policy, and practice to help build a sustainable future.
My sincere appreciation goes to the organizing committee, led by Dr. Nalin Suranjith, Director of the Centre for Environmental Sustainability and his team, and to all partners for their dedication and expertise in ensuring the success of ICCES 2025.

I look forward to the significant conclusions and recommendations that will emerge from ICCES 2025, and I extend my best wishes for a successful and impactful conference.

Prof. Terrence Madhujith
Vice-Chancellor | University of Peradeniya

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Message from the Conference Chair

It is a privilege to share this message on the occasion of the Fourth International Conference of the Centre for Environmental Sustainability (ICCES) 2025, jointly organized by the Centre for Environmental Sustainability (CES), in collaboration with the Postgraduate Institute of Science (PGIS) and the Ministry of Agriculture and Environmental Affairs of the Central Province, as a hybrid event.

The ICCES conference is a key initiative under the Strategic Plan of CES, aimed at facilitating the dissemination of new knowledge on environmental sustainability derived from research conducted around the world. This forum brings together experts in the field to exchange ideas and propose strategies for addressing and mitigating global environmental challenges.

As the world becomes increasingly inundated with environmental issues—from climate change and biodiversity loss to pollution and resource depletion—collaborative action has never been more urgent. At CES, we believe that effective environmental management is essential to building a sustainable world for future generations. Accordingly, this year's conference is organized under the timely theme: "*Crafting a Sustainable Future Through Integrated Environmental Management*". A total of sixty-seven abstracts will be presented at the conference, spanning four key thematic areas that reflect the diverse nature of environmental sustainability. These include *Environmental Science, Technology and Pollution Control*; *Biodiversity, Conservation and Ecology; and Climate Adaptation, Green Innovations & Sustainable Governance.*

On behalf of the Organizing Committee, I would like to extend our sincere gratitude to PGIS and the Ministry of Agriculture and Environmental Affairs of the Central Province for their collaboration in organizing this conference. We also wish to thank Ceylon Cold Stores for serving as the beverage partner for the event. Moreover, I deeply appreciate the support extended by the staff of CES and the organizing committee members, whose dedication has been instrumental in making this event a resounding success.

Dr. N.S. Gama-Arachchige
Director, Centre for Environmental Sustainability (CES)
University of Peradeniya

Message from the Chief Guest

Dear Friends and Esteemed scholars,

I am delighted to pen this message for the fourth International Conference of the Centre for Environmental Sustainability (ICCES), 2025, a platform to discuss the pressing need of environmental and sustainability issues.

At the outset, I am thankful for the organizing committee of ICCES, led by Dr. Nalin Suranjith for inviting me to be part of this distinguished gathering of environmental scholars, policy makers and leaders. This conference assumes significance as the need for such platform is timely and essential as we all today face a existential challenge due to environmental degradation and climate change.

India and Sri Lanka share not only has civilization link but also geographically closer and similar. In recent years, this partnership has expanded significantly in the areas of science, technology, health, and sustainable development. Platforms like this would play a vital role in strengthening this bond by bringing together minds from both nations to collaborate, innovate, and contribute to regional and global progress.

I am happy to note that this year's sub themes are inter-disciplinary, covering a wider canvass from technology to traditional knowledge, planning, restoration and recovery. Such an approach is appropriate and quintessential for bringing sustainable solutions to the day to day environmental issues.

By conducting such forum, the University of Peradeniya, plays a forerunner role in creating a environmentally intellectual and sustainable society in Sri Lanka. I hope such forum will offer a chance to enhance the spirit of regional academic collaboration, especially between Indian and Sri Lankan institutions.

I extend my best wishes to all the participants, presenters, and organizers for a meaningful, insightful, and successful conference. May this year's conference forges new partnerships, generate transformative knowledge, and inspire each of you to continue your journey of inquiry and innovation.

Saranya V. S.
Assistant High Commissioner of India to Sri Lanka

Abstract of the Key-note Speech

Environmental Protection versus Sustainable Living: Challengers for Environmental Regulatory Agencies

Tilak Hewawasam, Professor in Geology, Department of Geography, University of Peradeniya and Chairman, Central Environmental Authority (CEA), Ministry of Environment, Sri Lanka.

The environment encompasses the natural world, including all living organisms, air, water, soil, and the ecosystems they inhabit. However, human activities increasingly threaten this delicate balance, leading to a range of environmental issues. Therefore, it is essential to promote a sustainable environment that can support life and provide resources for future generations. By prioritizing environmental protection and adopting sustainable practices, we can work toward a healthier, more equitable, and resilient world. The concepts of Environmental Protection and Sustainable Living are vital for a healthy planet; while they are interconnected, they have distinct focuses and approaches. Environmental protection involves safeguarding the natural environment from degradation and pollution, aiming to maintain the planet's health for both current and future generations. In contrast, sustainable living promotes a lifestyle that minimizes an individual's or community's environmental impact through thoughtful choices. This approach seeks to balance human needs with the planet's well-being, ensuring that our activities do not deplete resources or harm the environment. Ultimately, it is crucial to protect the environment while fostering sustainable living. This dual commitment should be the primary mandate of any country's environmental regulatory agency, paving the way for a healthy planet for generations to come.

An environmental regulatory agency is responsible for three key functions: ensuring environmental quality, effective environmental planning, and mobilizing society towards sustainable living. First, it safeguards air, water, and soil quality. Second, it focuses on optimal resource use while managing social and environmental risks. Finally, it encourages individuals to play their part in achieving sustainability. The primary objective of these functions is to attain sustainable development goals, ensuring a comfortable living for both current and future generations. To navigate the dynamic technological and social landscapes of the modern era, the agency employs a variety of regulatory and market-based instruments. These include environmental licenses, approvals based on multi-scale Environmental Impact Assessments (EIAs), Strategic Environmental Assessments (SEAs) for eco-sensitive policymaking, and the declaration of protected areas. Additionally, the agency implements Extended Producer Responsibility (EPR) schemes, publishes guidelines, raises awareness through various media, and incorporates essential environmental elements into school curricula. Ultimately, an environmental agency must be a scientific entity that effectively balances development, environmental protection, and societal needs.

In this context, the Central Environmental Authority of Sri Lanka (CEA) plays a crucial role in conserving, protecting, and managing the country's environment as the leading regulatory agency while addressing societal needs. As the National Environmental Act of Sri Lanka undergoes amendments, the CEA aims to enhance its initiatives for environmental protection by introducing new policies such as Extended Producer Responsibility (EPR), the Polluter Pays Principle,

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Strategic Environmental Assessment (SEA), and Industrial Chemical Management. It is essential to highlight that safeguarding the environment is a collective responsibility shared by both the state and its citizens.

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Environmental Sciences, Technology and Pollution Control

Abstract No: 01

Exploring the Efficacy of Raw *Cocos nucifera* var. *aurantiaca* (King Coconut) Mesocarp and Its Biochar as New Green Environmental Adsorbents for Removal of Lead (II) and Methylene Blue from Artificially Contaminated Water

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Lead (II) and Methylene blue (MB) are major water pollutants due to their toxicity and persistence in aquatic systems. This study investigated the potential of raw *Cocos nucifera* var. *aurantiaca* mesocarp (RW-KCM) and its biochar (BC-KCM), previously characterized for their physicochemical, morphological and functional properties, as novel green adsorbents for Pb (II) and MB removal from artificially contaminated water. Batch adsorption experiments were conducted to systematically optimize key operational parameters of initial adsorbate concentration, contact time, adsorbent dosage, pH and temperature. Pb (II) removal was analyzed using flame atomic absorption spectrophotometer at 217 nm, while MB was determined by UV-vis spectrophotometer at 663 nm. Optimization was carried out in triplicate, altering one variable at a time. Optimum Pb (II) removal (6 mg/L) was achieved at 60 minutes contact time, 0.1 g adsorbent dosage and pH 7 for both adsorbents. RW-KCM performed best at 40°C, while BC-KCM excelled at 50°C. For MB (60 mg/L), equilibrium was reached within 10 minutes for RW-KCM and 20-40 minutes for BC-KCM. Both adsorbents exhibited peak efficiency at pH 11 and 50°C, using a 0.1 g dosage. Although these alkaline and elevated temperature conditions may limit some real-world applications, they are relevant for certain industrial wastewater treatments where pH adjustment and temperature control are feasible. Isotherm studies revealed that Pb (II) adsorption on RW-KCM followed the Langmuir isotherm, while BC-KCM aligned with the Freundlich isotherm. For MB, BC-KCM followed the Langmuir isotherm, while RW-KCM adhered to the Temkin isotherm. Adsorption kinetics for both adsorbates on both adsorbents followed the pseudo-second order model. Overall, BC-KCM exhibited superior adsorption capacities, outperforming RW-KCM for both Pb (II) and MB, while literature on *Cocos nucifera* husk-based adsorbents reports comparable or lower removal efficiencies under various conditions. Finally, future studies are recommended to explore the reusability of both adsorbents with mild chemical treatment to support their practical applicability and sustainability.

Keywords: Biochar, Biosorption, *Cocos nucifera* var. *aurantiaca*, King coconut, Lead (II), Methylene blue

Abstract No: 02

Evaluating the Potential of Bambusa *balcooa* for Sustainable Biomass Energy Production in Sri Lanka

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The energy landscape of Sri Lanka relies on biomass, which contributes 36.4% to the total energy supply of the country with firewood as a primary resource for rural households and a critical fuel for industries such as rubber, tea, tile, paper, food and beverage. Firewood demand has reached 5100 kilotons per year, while approximately 400 biomass boilers collectively consume around 3,200 tons daily. However, the primary source, the rubber wood production, has declined by 58% from 2012 to 2023. This shortage has led to increased firewood demand, putting pressure on forests, which contribute to loose 10,900 hectares between 2002 and 2023. The objective of this research is to assess the potential of *Bambusa balcooa* as a sustainable alternative biomass source to meet the growing energy demand of Sri Lanka. This includes quantifying demand for *Bambusa balcooa* in key industries, evaluating its feasibility, and assessing awareness in key sectors for adopting *Bambusa balcooa*. The study employed quantitative analysis using both primary and secondary data sources. Primary data were collected through a survey of industry stakeholders reliant on biomass, with participants selected via purposive sampling. Results indicate that *Bambusa balcooa* is highly viable, maturing in 3-5 years with yields of up to 50 tons per acre annually and a thermal energy value of 23.4 MJ/kg, surpassing rubber wood's 18 MJ/kg. Economically, *Bambusa balcooa* production costs are projected to be under LKR 20,000 per ton over 30 years, making it a cost-effective substitute for rubber wood, which currently costs LKR 21,000 per ton. Consequently, large-scale industries that use rubber wood as biomass could potentially save more than 30% on production costs by transitioning to *Bambusa balcooa*. This study concludes that promoting *Bambusa balcooa* as a sustainable, resource can reduce Sri Lanka's reliance on conventional biomass sources, enhance energy security, and ease deforestation pressures on natural forests.

Keywords: Biomass energy, *Bambusa balcooa*, Energy efficiency, Firewood demand, Renewable energy

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Abstract No: 03

Stearic Acid-Modified Fly Ash Based Epoxy Coatings for Enhanced Resistance to Fat, Oil and Grease (FOG) Deposition in Sewers

P.W.G.R.S. Wijeratne[1,2], P.R.T. De Silva[1,2], I.M.T.S. Dinuwan[1], N.M. Palliyaguru[1], K.C. Chandrasiri[1], S. Yadav[2], B.K. Pramanik[2], and K.G.N. Nanayakkara[1]*

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Fat, oil, and grease (FOG) accumulation in sewer systems poses a significant operational challenge, leading to blockages and increased maintenance costs. This study presents the development of a stearic acid-modified fly ash–epoxy composite coating with hydrophobic and oleophobic properties, designed to enhance resistance to FOG deposition while maintaining mechanical and thermal stability. Silicon dioxide-rich fly ash, obtained from a biomass-based power plant in Dehiattakandiya, Sri Lanka, with an average SiO_2 content of 34.35% was chemically modified using stearic acid to improve surface hydrophobicity. The modified fly ash was incorporated at 1 wt% into an epoxy resin-hardener-solvent formation. Coated substrate was exposed to synthetic FOG solution, and deposition was quantified via gravimetric analysis. Fourier Transform Infrared Spectroscopy (FTIR) confirmed the presence of characteristic functional groups associated with stearic acid, evidencing successful surface modification of fly ash. Contact angle measurements showed values approximately 110° for water, indicating enhanced hydrophobicity of the developed coating. Furthermore, gravimetric analysis revealed that the stearic acid-modified fly ash–epoxy coating exhibited reduced FOG absorption compared to the unmodified epoxy, as indicated by a markedly lower weight gain after immersion. Since fly ash is a locally available byproduct material, the preparation of this coating is also cost-effective, further enhancing its suitability for large-scale applications. These results underscore the potential of the modified coating as a sustainable and effective strategy for mitigating FOG fouling in wastewater infrastructure and industrial environments.

Keywords: Epoxy coating, FOG resistance, Hydrophobic coating, Stearic acid-modified fly ash

Abstract No: 04

Phytotoxicity Evaluation of *Argyreia populifolia* Aqueous Leaf Extract Using the *Allium cepa* Assay

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Argyreia populifolia (Girithilla), an endemic Sri Lankan plant of the Convolvulaceae family, is traditionally used in Ayurveda to manage asthma, cardiovascular diseases, and diabetes. Despite documented pharmacological effects, its toxicity profile remains unclear, which is essential for defining safe therapeutic doses. This study aimed to assess the phytotoxicity of an aqueous extract of *A. populifolia* using the Allium cepa root growth inhibition assay as a preliminary screening tool. An aqueous extract of *A. populifolia* leaves was prepared via maceration (1:3 w/v). Uniform *Allium cepa* bulbs were pre-germinated in dechlorinated water for 48 hours at 27 ± 2 °C. Bulbs with ~1 cm radicles were then exposed to 12 various concentrations (0.5–1000 mg/mL) of the extract for 96 hours. A 5% DMSO solution served as a positive control, and dechlorinated water as a negative control. Post-treatment, root lengths were measured, and morphological abnormalities (e.g., gelling, necrosis, hooks, swelling) were recorded to assess phytotoxicity. The aqueous extract of *A. populifolia* exhibited significant, dose-dependent inhibition of *Allium cepa* root growth, with an EC_{50} value of 40.56 mg/mL (r = 0.78, p < 0.0001), indicating moderate phytotoxicity based on established thresholds. Among the morphological abnormalities observed, root gelling was the predominant macroscopic alteration, suggesting cellular stress or damage. The maximum root length can be observed on the 1 mg mL^{-1} (8±2.4 cm), and the control root length measured 7.7 ± 2.5 cm. The aqueous extract of *A. populifolia* showed moderate, dose-related phytotoxicity and stress-related morphological changes in *Allium cepa*. These preliminary results warrant further *in vivo* studies to assess safety and isolate less toxic active compounds.

Keywords: *Allium cepa assay, Argyreia populifolia*, Medicinal plant safety, Phytotoxicity, Root growth inhibition

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Abstract No: 05

Assessment of Pollution Status of Wetland Soil: A Comparative Study in the Diyawannawa Wetland Ecosystem

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The Diyawannawa wetland, situated within the Colombo flood detention area of Sri Lanka, is a vital urban ecosystem that sustains diverse native flora and fauna while offering numerous ecological services. However, rapid urbanization and infrastructure development have altered its natural landscape, potentially impacting soil quality and ecological stability. This study assessed the pollution status of Diyawannawa wetland soil using several pollution indices. Eight sampling sites were selected based on adjacent land use types, including urbanized zones, degraded areas, and home gardens. Surface soil samples (at a depth of 20 cm) were collected in triplicates within 1 meter of the water-land boundary during both dry and wet months in 2024. Samples were acid digested and analyzed for Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb), and Zinc (Zn) using Atomic Absorption Spectrophotometry (AAS). Metal concentrations were used to calculate the contamination factor, degree of contamination, pollution load index, geoaccumulation index, and ecological risk factor. Contamination Factor (CF) values for all analyzed metals ranged from low (CF < 1) to moderate ($1 \leq$ CF < 3) contamination during both sampling months. The overall Degree of Contamination (Dc) ranged from low (Dc < 7) to moderate levels ($7 \leq$ Dc < 14). The ecological risk factor followed the order Cd (60) > Cu (9.32) > Pb (6.25) > Cr (1.00) > Zn (0.21), indicating the highest potential risk from Cd. Pollution load index values (0.001–0.148) indicating that all sites remained unpolluted despite anthropogenic activities (PLI < 1). Based on geoaccumulation index, soil in the different sites were categorized from class 0 (unpolluted) for Cr and Zn to class 1 (unpolluted to moderately polluted) for Cd, Cu, and Pb. These finding highlights the importance of continuous monitoring and proper management, particularly concerning Cd, to maintain long-term ecological sustainability of the Diyawannawa wetland.

Keywords: Contamination factor, Ecological risk assessment, Geoaccumulation index, Metal contamination, Wetland

Abstract No: 06

Eco-friendly Dye Extracts from *Rhizophora mucronata* and *Thespesia populnea*: A Green Solution for the Textile Industry

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The rapid growth of the textile industry has led to environmental pollution caused by synthetic dyes. Green developments, such as extracting natural dyes, are therefore; important to minimise the impact of synthetic fabric dye. This research investigates natural dye extraction from *Rhizophora mucronata* bark and *Thespesia populnea* fruit. Both fermentation and Aqueous heat extraction were practised and Aqueous heat extraction was selected. Further investigations were carried out to evaluate the best temperature (60, 70, 80 ℃) and pH (3, 7, 12). Cotton fabrics pretreated with alum and the dyeing process was performed with only extracted dye with dye standard fixing chemicals. The colour strength was determined, and fabrics were evaluated for colour fastness to light, rubbing, water, and washing. *R. mucronata* and *T. populnea* yielded light yellow to light brown and light orange to light brown colours respectively. *T. populnea* had the highest colour strength at pH 3, but temperature had no effect on colour strength. *R. mucronata* dye strength was not significantly affected by temperature and pH, though the highest colour strength was achieved at pH 3. Dyed fabric had excellent fastness on wet and dry rubbing, water, and moderate fastness to light and wash for both *R. mucronata* and *T. populnea*. All colour fastness had better results for fabrics treated with natural dye added with standard chemicals for both *R. mucronata* and *T. populnea*. This study confirmed the potential of the two selected species for natural dye extraction via aqueous extraction. However, further research and development to explore natural mordants for fabric pre-treatment is recommended.

Keywords: Color fastness and strength, Mangrove, Natural dye, Textile industry

Abstract No: 07

Impact of Rainfall Intensity on Zooplankton Abundance and Community Structure in Eutrophic Beira Lake, Sri Lanka

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Rainfall fluctuations enhance flushing effects in tropical freshwater lakes, reducing nutrient availability and altering water circulation, which affect plankton communities. This study assessed the relationship between rainfall variation and zooplankton abundance in eutrophic Beira Lake, located in Colombo, Sri Lanka. Sampling was conducted monthly from August to December 2024 at three sites selected based on water depth, visibility, and accessibility. Zooplankton were collected using a 300 µm mesh plankton net, preserved in 5 % formalin, and identified to major taxonomic groups using a compound microscope. Rainfall during the sampling period varied from 61.93 mm to 463.67 mm. Zooplankton abundance was calculated, and Pearson correlation was conducted using Minitab version 22. Zooplankton abundance exhibited a negative correlation with rainfall. Cladocera (mean = 62, r = -0.700) and Copepoda (mean = 56, r = -0.751) showed strong negative correlation while Ostracoda (mean = 6, r = -0.738) also declined with increasing rainfall. Rotifers exhibited a lower abundance (mean = 25) and a moderate negative correlation (r = -0.407), suggesting greater tolerance to rainfall variability. This suggests that large-bodied zooplankton are more sensitive to rainfall fluctuations compared to small-bodied rotifers which are relatively resilient. The community evenness also exhibited a strong negative relationship with rainfall. Shannon-Wiener Index (r = -0.735) and Pielou's Evenness Index (r = -0.743) decreased with increasing rainfall, indicating reduced group level diversity and greater unevenness in community structure. These findings highlight the sensitivity of zooplankton communities in eutrophic lakes to rainfall variability. Long-term studies are recommended to understand the broader ecological implications of changing precipitation patterns.

Keywords: Freshwater biodiversity, Rainfall, Urban lakes, Zooplankton

Abstract No: 08

GIS and Remote Sensing Evaluation of Factors Affecting Forest Fire Severity in the Knuckles and Ella Mountain Ranges, Sri Lanka

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Climate change has increased the risk of forest fires in tropical mountains, including Sri Lanka's Knuckles and Ella ranges. This study examined the relationship between burn severity and factors influencing it, such as terrain, microclimate, and vegetation, using Geographic Information System (GIS) and Remote Sensing (RS) techniques. Two fires at Yahangala (04/08/2023) in the Knuckles and Ella (13/02/2025) were analyzed. Sentinel-2 images from Copernicus Data Space Ecosystem for pre- and post-fire, Digital Elevation Model from ASF, ERA5 hourly climate data, fire records from NASA-FIRMS, and Forest Department data were gathered. The Differenced Normalized Burn Ratio (dNBR), Differenced Normalized Difference Vegetation Index (dNDVI), terrain analysis, and supervised classification were employed as the analysis methods. Burn severity was classified using dNBR thresholds: low (0.10–0.27), moderate-low (0.27–0.44), and moderate-high (0.44–0.66). The burnt-area estimations were validated with those of the Forest Department. A strong positive correlation between dNBR and dNDVI ($R^2 = 0.89$, Yahangala and 0.97, Ella) validated the spectral indices. Although both fires occurred during the dry season with low relative humidity (<50%), severity varied because of local factors. Yahangala, with a higher temperature (31°C) and stronger southwesterly winds (3.0–4.0 m/s), showed lower severity (max dNBR: 0.49) than Ella (max dNBR: 0.53), which had a lower temperature (27°C) and gentler northeasterly winds (2.5–3.0 m/s). In Ella, steep slopes (31°–45°) enabled uphill fuel preheating, causing concentrated moderate-high severity burns. In contrast, Yahangala experienced a widespread but mostly low-severity fire (77%), with 55% of moderate-high severity on gentler slopes (17°–22°). In both fires, moderately healthy grasslands between 900–1100 m elevation were most fire-prone, while shrublands were more resistant. These findings show that slope, vegetation, temperature, and local winds shaped fire severity, highlighting the need for area-specific fire risk models for early warning and mitigation.

Keywords: Burn severity, Forest Fires, Geographic information system, Remote sensing

Abstract No: 09

Green Innovation in Palm Oil Extraction Through Low-Frequency Ultrasound Pretreatment

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Pretreatment of palm fruit using low-frequency ultrasound (45 kHz, 5-20 min) which is a green innovative technology, shows high potential in sustainable crude palm oil (CPO) production with improved quality. The study evaluated ultrasound-assisted cavitation processes to enhance effective oil recovery by using less energy and minimizing environmental effects through non-thermal processing. Ultrasound pre-treated (45 kHz, 20 min) and sterilized (121 °C, 10 kPa, 15 min), Palm fruits (*Elaeis guineensis*) showed higher extraction yield of CPO up to 32.49%. Enzymatic activity and breakage of cells releasing lipases, resulted in higher free fatty acid (FFA) content in ultrasound treated samples ($p<0.001$). The differences in color attributes were significantly different ($p<0.001$) in L*, a*, b* and chroma value and hue angle, which indicated an improvement of pigment release mechanisms. Cellular disruption caused by cavitation increased the release of oil and bioactive compounds and the release of β-carotene exhibited a parabolic dependence on treatment time. For both primary (conjugated dienes and trienes) and secondary oxidation products analyses, treated samples showed lower values compared to control sample indicating oxidative stability. The DPPH radical scavenging activity was significantly different ($p<0.001$) with duration as there were complex relationships. GC-MS analysis revealed a dramatic change in fatty acid compositions with increasing ultrasound duration. Although increased moisture necessitates additional dehydration, this clean technology aligns with the principles of the circular economy by maximizing resource use and minimizing energy consumption. The process offers a sustainable alternative to conventional palm oil extraction, resulting in a low ecological footprint for the industry without compromising product quality.

Keywords: Cavitation, Clean technology, Crude palm oil, Green innovation

Abstract No: 10

Performance Evaluation of GO-Epoxy Coating in Sulphuric Acid Aqueous Solution for Protection of Sewerage Concrete Structures

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The deterioration of sewer concrete structures due to the production of biologically produced sulfuric acid is a major issue that significantly impacts the performance, durability and lifespan of underground wastewater infrastructure systems and economic and environmental perspectives, as frequent repairs or replacements can be costly and environmentally disruptive. Among the various methods for protecting concrete structures, protective coatings are the most commonly used and effective engineering solution for isolating concrete from aggressive acidic environments. In this study, a graphene oxide-epoxy (GO-epoxy) composite material, combining inorganic and organic components, was developed and evaluated for its potential as a durable protective lining for sewer infrastructure. Graphite powder obtained from AMG Graphite, Bogala Graphite Lanka PLC, Sri Lanka was used to synthesize Graphene Oxide (GO) using the Hummers method. Synthesized GO powder was added to the coating formulation at 1 wt% of the total epoxy resin and hardener to evaluate its effect on coating performance. Fourier Transform Infrared (FTIR) spectra analysis confirmed the successful integration of GO into the epoxy matrix. The performance of the GO-epoxy coating was assessed under simulated acidic conditions using 1 M sulphuric acid to mimic biologically generated acid in sewer systems. During the sulphuric acid immersion test, both coated and uncoated concrete specimens were monitored for surface pH, mass loss and appearance change over a period of 4 days. Concrete specimens coated with the GO-epoxy composite showed significantly lower mass loss (23 %) and less surface degradation compared to uncoated samples (90 %), indicating enhanced resistance to acid attack. Overall, the GO-epoxy lining demonstrated superior protective performance and high durability compared to conventional epoxy coatings, highlighting its potential for extending the service life of concrete infrastructure in corrosive wastewater environments.

Keywords: Coating, Concrete corrosion, Epoxy, Graphene oxide, Sewerage systems

Abstract No: 11

Computational Fluid Dynamics Modeling of an Adsorption Column for Contaminant Removal from Water

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Adsorption is a promising technology to remove dissolved colour effectively, however, the application of computational fluid dynamics (CFD) in modelling and optimizing fixed-bed adsorption columns for colour removal remains limited. This study combines experimental investigation and CFD simulations to design and optimize such a column with protonated glutaraldehyde-crosslinked chitosan to treat membrane bioreactor effluent. Experiments were carried out at 25°C and pH 7, using bead sizes from 0.05×10^{-3} m to 2×10^{-3} m. The adsorption process was tested under flow rates of 8.102×10^{-9}, 1.736×10^{-8}, and 3.125×10^{-8} m³/s and bed heights of 0.14, 0.20, and 0.26 m, with atmospheric pressure at the outlet. Initial analysis showed the Thomas model fitted the experimental data reasonably well ($R^2 = 0.9111$) and was therefore selected for integration into the CFD simulation. The CFD simulation was performed in ANSYS Fluent under the optimum conditions with a bed height of 0.20 m, a flow rate of 1.736×10^{-8} m³/s, and an inlet colour intensity fixed at 4530 Pt-Co. The bead size was selected as 1.00×10^{-3} m. The model incorporated diffusion and adsorption kinetics, and the diffusion coefficient was calibrated based on experimental data. The simulated breakthrough curve closely matched the experimental results ($R^2 > 0.99$), with a maximum error of 15.5%. The calibrated diffusion coefficient was 8.014×10^{-10} m²/s. This study shows the utility of CFD modelling in optimizing adsorption-based wastewater treatment, offering insight into adsorption dynamics, enabling precise control of operating parameters, and enhancing colour removal efficiency while providing a robust framework for advanced process design.

Keywords: Adsorption column, Breakthrough curve, Colour, Computational fluid dynamics (CFD), Mathematical modelling

Abstract No: 12

Performance Optimization of Low-Cost Jet Aeration: A Comparative Study of Smooth and Grooved Cone Surfaces

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Groundwater remains a vital drinking water source in Sri Lanka, especially in rural and dry-zone regions. However, contamination with dissolved iron (Fe) and manganese (Mn) presents significant water quality and health challenges. This study developed and evaluated a low-cost plunging jet aeration system using a laboratory-scale recirculation unit with distilled water to enhance dissolved oxygen (DO) transfer and facilitate Fe and Mn oxidation. Two conical aerators, each designed with a 60° apex angle, were fabricated in two surface configurations—one smooth and the other grooved—to facilitate comparative performance evaluation. Key operational parameters, including jet velocity (0.5–2.0 m/s), water depth (0.1–0.4 m), and jet fall height (0.05–0.2 m), were varied to determine their influence on volumetric oxygen transfer coefficient (K_La_{20}) and oxygen transfer efficiency (OTE). Results indicated that higher jet velocities and moderate fall heights significantly improved DO levels through increased turbulence and air entrainment. Optimal performance was achieved at 1.5–2.0 m/s jet velocity, 0.1–0.2 m fall height, and 0.3 m water depth. Across all trials, the grooved cone demonstrated superior aeration performance compared to the smooth cone, achieving a DO level of 8.20 mg/L within 15 minutes under optimal conditions. Synthetic water tests containing Fe^{2+} (3.0–6.0 mg/L) and Mn^{2+} (0.5–1.0 mg/L) confirmed substantial contaminant removal efficiencies using spectrophotometric analysis. Importantly, the optimized grooved cone configuration, when scaled to the laboratory setup dimensions (50 cm × 35 cm × 58 cm tank, 70 L capacity), was capable of producing sufficient aerated water to meet the daily drinking needs of a typical four-person household. This highlights its potential as a practical, energy-efficient, and affordable groundwater treatment solution for decentralized rural applications, with minimal maintenance requirements and no chemical additives.

Keywords: Groundwater treatment, Jet aeration, Iron removal, Manganese removal, Oxygen transfer efficiency, K_La_{20} optimization

Abstract No: 13

Antioxidant and Antidiabetic Properties of Young Leaves from Selected Medicinal Plants: Towards Sustainable Pharmaceutical Alternatives

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Diabetes and oxidative stress are significant global health issues. Traditional medicine utilizes plants to treat these conditions, but robust scientific evidence is limited. This study investigated the antioxidant and antidiabetic properties of young leaves from *Artocarpus heterophyllus*, *Andrographis paniculata*, *Coccinia grandis*, and *Ficus racemosa*, which were selected as sustainable, natural alternatives due to their higher bioactive compound content and easier extraction compared to mature leaves or other plant parts. The study determined the total phenolic content (TPC), total flavonoid content (TFC), antioxidant activity (DPPH and FRAP assays), and alpha-amylase and alpha-glucosidase inhibitory activities. *Artocarpus heterophyllus* exhibited the highest TPC (54.225±0.754 mg GAE/g) and TFC (18.3402±0.1384 mg QE/g), while *Ficus racemosa* showed the highest FRAP value (23.836±1.133 mg TE/g). In DPPH and antidiabetic assays, plant extracts were initially tested at 10, 100, and 500 ppm, with at least 50% inhibition at 500 ppm and selected for IC50 determination. Consequently, only *Artocarpus heterophyllus* and *Coccinia grandis* were chosen for IC50 determination in DPPH radical scavenging assay. *Artocarpus heterophyllus* had the highest IC50 of 236.636±0.440 ppm. For the alpha-amylase inhibitory activity assay, *Coccinia grandis* and *Andrographis paniculata* qualified for IC50 determination. *Coccinia grandis* demonstrated the strongest alpha-amylase inhibitory activity (IC50: 9.145±0.0485 ppm), and *Artocarpus heterophyllus* exhibited the strongest alpha-glucosidase inhibitory activity (IC50: 1.49367±0.00379 ppm). The findings suggest that *Coccinia grandis*, *Ficus racemosa*, and *Artocarpus heterophyllus* possess significant antioxidant potential, while *Andrographis paniculata* and *Artocarpus heterophyllus* demonstrate promising antidiabetic properties. The findings offer a potentially cost-effective, affordable, and sustainable alternative to conventional drugs, reducing pharmaceutical waste and pollution by utilizing locally available renewable resources. However, further research, including in vivo studies, is necessary to confirm efficacy and explore their potential in functional foods and nutraceuticals.

Keywords: Antioxidant, Diabetes, Herbal, Medicinal, Sustainability

Abstract No: 14

Development of Biochar Using Palm Oil Mill Wastes to be Used in Wastewater Treatment

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Palm oil processing generates significant volumes of wastes, which have considerable adverse effects on the environment. This study assessed the feasibility of using palm oil mill waste as a cost-effective and sustainable method to develop biochar and subsequent application in wastewater treatment. The findings indicated that palm oil mills produce approximately 3.00 tons/hour of Empty Fruit Bunches (EFB) and 0.85 tons/hour of palm kernel shells. Given their abundance and high lignocellulosic content, EFB and palm kernel shells were identified as promising candidates for biochar production via gasification. On average, 20–25% of the dry weight of EFB fibers and 35–40% of the dry weight of palm kernel shells can be converted into biochar at temperatures between 350°C and 500°C. In addition, this study discussed the potential integration of biochar as an adsorption material that can be used in existing wastewater treatment system. Experiments were conducted using palm oil mill effluent (POME) with 1.5–2.0 kg of palm kernel shell biochar and EFB-derived biochar used in the tests. COD levels ranged from 7,000-8,000 mg/L and palm kernel shell biochar achieved a 71.4% COD removal efficiency, while EFB-derived biochar achieved a 55.0% COD removal efficiency. TDS levels varied from 6.0-8.0 ppt and removal efficiencies were recorded as 32.9% for palm kernel shell biochar and 20.4% for EFB-derived biochar. These findings highlight the potential integration of palm oil by-product-derived biochar into existing wastewater treatment systems as a sustainable, low-cost, and effective adsorption medium. This approach not only supports waste valorization but also contributes to circular economic practices and environmental pollution control within the palm oil industry.

Keywords: Biochar, Gasification, Lignocellulosic biomass, Palm oil mill waste, Wastewater treatment

Abstract No: 15

Analysis of Supply Chain Sustainability in the Ceylon Cinnamon Essential Oil Industry in Sri Lanka

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Ceylon Cinnamon (*Cinnamomum zeylanicum*) is globally recognized for its unique chemical composition and superior quality. The essential oil (EO) derived from cinnamon is renowned for its therapeutic and aromatic properties. Despite the growing global demand, Sri Lanka's cinnamon EO export performance remains inconsistent, and research on its sustainability dimensions is limited. This study assesses the economic, social and environmental sustainability of the Ceylon cinnamon EO industry, identifying key issues across the supply chain: cultivation, harvesting, processing, sales and marketing. Primary data were collected through 36 stakeholder-role interviews, which involved semi-structured, in-depth discussions with farmers, processors, traders, and government officials. The data were then thematically analysed. Findings reveal that steam distillation is the most widely adopted method for producing both cinnamon leaf and bark oils. From an economic perspective, although leaf oil dominates export volumes, bark oil generates higher revenue due to its greater market value. The United States is the primary export destination for both oil types from 2015 to 2024. The industry promotes economic and social sustainability by generating significant rural employment and fostering eco-tourism opportunities through cinnamon-themed experiences. Notably, women are actively involved in cinnamon peeling and value-added processing activities. Environmentally, cinnamon is a low-input, ecologically compatible crop well-suited to Sri Lanka's agro-climatic conditions. Key challenges include a shortage of skilled labour, inefficiencies in traditional distillation, limited value addition, lack of modern processing technologies, price volatility, dependence on intermediaries, and product adulteration with cheaper cassia oil. The study recommends strategic interventions including modernization of processing methods, improving direct market access for producers, and fostering innovation in high-value products. Enhancing sustainability across the supply chain can strengthen Sri Lanka's global competitiveness, empower rural communities, and position Ceylon cinnamon EO as a premium, ethical export commodity.

Keywords: Ceylon Cinnamon essential oil, Supply chain sustainability, Value addition, community development, Export competitiveness

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Abstract No: 16

Isolation and Characterization of Cellulolytic Fungi from Horton Plains, Sri Lanka: Application in the Bioethanol Industry

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Cellulosic ethanol is a very promising renewable biofuel with the potential to significantly reduce greenhouse gas emissions. However, commercial production is hindered at a large scale by the expense and difficulty of cellulose hydrolysis, the most significant process step required to convert cellulose to fermentable sugar. The aim of this study was to isolate cellulolytic fungi from the surface of decaying wood samples in Horton Plains National Park, Central Province, Sri Lanka, and assess their ability to break down cellulose through qualitative assays. Two main samples (labeled as HP-M1 and HP-M2), each with visible fungal fruiting bodies, were selected for the characterization. After the surface sterilization, they were cultured on Potato Dextrose Agar medium, and four pure strains were isolated: HP-M1.0, HP-M1.1, HP-M2.0, and HP-M2.1. For cellulolytic activity testing, 10 mm diameter fungal plugs were cultured on Carboxymethyl Cellulose agar and incubated at 28 °C for 72 hours; clear zones were visualized using 0.1% Congo red staining, followed by triple washing with 1 M NaCl to eliminate excess dye. The Enzymatic Index (EI) was calculated as the ratio of the diameter of the clear (hydrolysis) zone to the diameter of the colony to quantify cellulolytic activity. In the HP-M1 category, HP-M1.0 had the lowest enzymatic index of 1.048, while HP-M1.1 had an EI of 1.424. In the HP-M2 category, HP-M2.0 and HP-M2.1 showed higher EI values of 1.422 and 1.503, respectively. HP-M2.1 was identified as the most promising candidate due to its highest cellulolytic activity. Based on these findings, fungi isolated from decaying wood in Horton Plains appear to hold potential for application in cellulose hydrolysis processes relevant to bioethanol production. However, further studies are needed to confirm their effectiveness on a larger scale.

Keywords: Bioethanol, Cellulolytic fungi, Cellulose hydrolysis, Enzymatic index, Horton Plains

Abstract No: 17

Remote Sensing-Based Assessment of Urban Heat and Green Space Dynamics in Trincomalee Town & Gravets DS Division, Sri Lanka (2016 - 2025)

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Trincomalee Town & Gravets DS Division has an area of 148 km², a population of 97,487, and consists of 42 GN divisions. Last 10 years, it has been experiencing rapid urbanization, making it vulnerable to the combined effects of land use changes, green space reduction, and rising surface temperatures. This study examines the urban heat island and green space distribution of Trincomalee between the years 2016 and 2025, to improve sustainable urban planning. Landsat 8 imagery was used to analyse the changes in green cover and associated thermal dynamics by performing some remote sensing indices, such as NDVI, NDBI, NDWI, LST, UHI, and UTFVI. NDVI demonstrates a growth of vegetation coverage from 56.9% (2016) to 61.14% (2025), with the highest percentage of 72.11% in 2017. Conversely, from NDBI, built-up areas decreased from 21.05% to 15.89%, and the NDWI shows that water areas increased slightly from 0.85% to 1.25%. Similarly, average LST increased substantially from 31.04°C (2016) to 35.56°C (2025), reaching its highest point in 2020 (45.11°C). Meanwhile, UTFVI values rose from 11.52% to 14.95%, indicating growing ecological and thermal stress. Estimated UHI decreased from 0.34% to 0.032%, suggesting a more diffuse heat distribution rather than concentrated urban heat islands. Statistical analysis revealed strong inverse correlations between NDVI and LST, and positive correlations between NDBI and heat zones, further emphasizing the critical interplay between urban expansion and local climate conditions. Correlation analysis revealed strong inverse relationships between NDVI and LST, and a direct relationship between NDBI and heat concentration zones. Water availability trends and rainfall variability further highlighted increased vulnerability in peripheral communities. These results indicate the importance of incorporating geospatial analysis into urban planning, highlighting the need for enhanced green infrastructure to mitigate climate-induced thermal stresses, ensuring urban livability and ecological resilience in coastal cities such as Trincomalee.

Keywords: Green infrastructure, NDVI, Remote sensing, Sustainable urban planning, Urban heat island

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Biodiversity, Conservation and Ecology

Abstract No: 18

An Assessment of Community Understanding of Threats and Ecological Changes in Kayankerni Reef, Batticaloa District in Sri Lanka

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The Kayankerni marine sanctuary is a valuable marine ecosystem located on the east coast of Sri Lanka comprised of important corals and reef fish assemblages. This study aimed to assess the community's understanding and insights into the present reef status and identify primary threats and changes that have happened to the reef over time. The primary data was collected through a structured questionnaire survey (n= 50 fishermen) and focused group interviews with wildlife rangers and tourism stakeholders. Data were analyzed using descriptive statistics and thematic analysis to recognize major environmental changes and anthropogenic threats. The results revealed that many changes occurred after the 2004 Indian Ocean tsunami which led to sea erosion, loss of some islands/ gulf- like places, sedimentation transforming shallow marine areas to terrestrial zones, altered water currents, loss of mangroves and other trees and reduction in fish catches. Usage of 'surukku nets' (Purse seine/ring nets), increased fishing vessels, dynamite fishing, coral cover reduction and altered water currents are identified as the major causes for the fish catch reduction. Nearly 80% of the respondents stated that decreased fish catches are associated with the usage of illegal purse seine nets. Historical coral extraction for lime production, illegal coral smuggling, and physical damage due to unsuitable fishing gear were identified as major causes of coral degradation. Basket-like nets are used for fishing in the coral cover, and some fishermen still fish by standing on the coral reefs with lighting setups. Pollution, overfishing, usage of dynamite, climate change, natural disasters and plastic pollution are identified as major threats. Usage of 'Surukku' nets contributes to bycatch and overfishing. Major sources of pollution are from the Valaichchenai lagoon, agricultural runoff, industrial discharges and oil/fuel contamination. Therefore, the present study suggests severe enforcement of fishing regulations, improved monitoring protocols and integrated coastal zone management strategies to ensure long-term ecosystem sustainability

Keywords: Coral cover, Dynamite fishing, Marine sanctuary, Pollution, Sea erosion

Abstract No: 19

Case Study on Conservation Efforts of Sea Turtle Conservation Centres in Kosgoda, Sri Lanka

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Sea turtles are a "keystone species" that help maintain the health of marine ecosystems, and Sri Lanka provides habitat for five of the seven species in the world. Several privately operated sea turtle conservation centres are operated in the Kosgoda area to support sea turtle conservation. This study assessed the sea turtle conservation efforts of four selected centres in Kosgoda; Kosgoda Sea Turtle Conservation Project, A & A Turtle Conservation and Research Centre, Galbokka Sea Turtle Conservation and Research Centre, and Marine Turtle Protecting Centre. The selection of these four centers was purposive, based on visitor accessibility and recognition within Kosgoda. These centres were visited on two occasions during the nesting period in November 2024. A questionnaire survey with twenty structured questions was conducted only with the centre owners to assess conservation practices, challenges, and ethical concerns. The study identified several human and environmental threats, including bycatch injuries, illegal poaching of eggs, and predation of hatchlings (primarily by dogs). All centres focused only on ex-situ conservation rather than in-situ conservation methods. The four conservation centres primarily employ strategies, such as relocating eggs to hatcheries, providing rehabilitation facilities for injured sea turtles, and conducting awareness programs for visitors. However, their conservation effectiveness is debatable, as some centers appeared to prioritize profit over conservation. Reported concerns include delayed hatchling releases for commercial gains, poor water levels in tanks, a lack of updated scientific knowledge, and limited collaboration with wildlife authorities. At the Marine Turtle Protecting Center, for example, tank water levels were kept low until visitors arrived, potentially causing stress to the turtles. The center owners emphasized a lack of governmental support and significant financial struggles. To enhance the effectiveness of sea turtle conservation, it is recommended that scientific research be integrated into conservation practices and that regulatory oversight and government support be strengthened.

Keywords: Commercial purpose of conservation centers, Ex-situ conservation, Human and environmental threats, Sea turtle conservation

Abstract No: 20

Transforming Traditional Stilt Fishing Through Tourism: Opportunities and Challenges from Southern Sri Lanka

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Stilt fishing is an indigenous, artisanal fishing method confined to the Southern coast of Sri Lanka. While the challenges and opportunities faced by traditional stilt fishermen are documented, less attention has been paid to examining the possibility of the transformation of this practice into a tourism-based activity. This study attempted to fill this gap by exploring the opportunities and challenges of stilt fishery within the framework of sustainable tourism. A questionnaire survey was conducted from November to December 2024, involving 187 randomly selected stilt fishermen from eight stilt fishing sites (Kadabeddagama, Midigama, Ahangama, Kathaluwa, Koggala, Thalpe, Miripenna, and Dalawella) along the Southern coast. Data was analyzed using binary logistic regression and Wilcoxon Signed-rank test. Findings revealed that increased social recognition as a profession, generation of sufficient income, reduced conflicts of interest with other stakeholders, lower muscle fatigue due to shorter fishing duration, reduced need to obtain large catches, higher fish prices, and opportunities for additional income have positively influenced the shift toward tourism–based stilt fishing. Nevertheless, the study also identified threats to food security and increased foot traffic as negative impacts of this transformation. A majority of the respondents (83%) showed their preference in "pescatourism" initiatives as a sustainable integration of fisheries with tourism, viewing it as an opportunity to improve their income and standard of living without compromising traditional fishing practices. Key challenges include limited English language proficiency, lack of well-established community-based organizations, and inadequate government policies. Notably, introducing stilt fishing into school curricula received priority as a way of preserving this unique traditional fishery as a cultural heritage. In conclusion, the study offers valuable insights for policymakers and stakeholders interested in transitioning this iconic traditional fishery into a sustainable, tourism-based fishery.

Keywords: Artisanal fishing method, Pescatourism, Stilt fishermen, Traditional fishing practices

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Abstract No: 21

Duckweed Used as a Sustainable Protein Source for Koi Carp (*Cyprinus carpio*) in Ornamental Fish Industry

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The ornamental fish industry in Sri Lanka faces challenges with respect to feed costs, of which feed costs represent more than 80% of the total production costs. This study examined the effects of duckweed (*Lemna minor*) as a sustainable and cost-effective protein source of fish feed for Koi carp (*Cyprinus carpio*). Duckweed was cultivated in six tanks ($5'×5'×1'$), with three tanks using ornamental aquarium wastewater and three using tap water. Enriched duckweed grown in wastewater and wild duckweed grown in tap water were harvested separately after one week, then sun-dried, ground and mixed with other ingredients at 30% of the total feed weight to prepare Enriched Duckweed Feed (EDF) and Wild Duckweed Feed (WDF), respectively. Soybean-meal, fish-meal, wheat-flour, corn-flour, rice-polish, vitamins and minerals were used as other ingredients to constant across 2 diets and commercial Prima feed (PF) was used as the control. Trial was conducted four week periods with four replicates with three treatments with 10 fingerlings (21 days old; $0.02 ± 0.002$ g; $12.24 ± 0.35$ cm) per tank ($5'×5'×1'$). Fish were fed twice daily at 20% body weight and tanks were siphoned weekly (~25% water exchange) and refilled. Growth was monitored weekly using wet weight (analytical balance $±0.0001$ g) and total length (standard meter ruler), at the trail end the survival rate was measured. Repeated measures ANOVA showed significant effects of time and diet on growth ($p < 0.05$). Regression analysis showed weekly weight gains of 0.2360 g (PF, $R^2 = 0.9753$, $p < 0.05$), 0.2210 g (EDF, $R^2 = 0.9626$, $p < 0.05$), and 0.0650 g (WDF, $R^2 = 0.9573$, $p < 0.05$); weekly length increases were 7.718 cm (PF, $R^2 = 0.9927$, $p < 0.05$), 7.205 cm (EDF, $R^2 = 0.9945$, $p < 0.05$), and 3.503 cm (WDF, $R^2 = 0.9919$, $p < 0.05$). Survival rates analyzed via Kruskal–Wallis test showed no significant differences between groups ($p > 0.05$): $98.75 ± 2.5\%$ (PF), $98.75 ± 2.5\%$ (EDF) and $95 ± 10\%$ (WDF). The EDF feed achieved growth and survival rates comparable to the commercial feed, indicating its potential as a sustainable alternative protein source in ornamental aquaculture.

Keywords: Aquaculture, Duckweed, Feed, Koi, Sustainability, Wastewater

Abstract No: 22

Uncovering the Intrinsic Driving Forces behind Illegal Fishing Practices among Small-Scale Fishermen in Trincomalee, Sri Lanka

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Illegal fishing has been recognized as a long-standing problem in Sri Lanka. Even though the driving forces behind illegal fishing are documented for certain commercial fisheries in Sri Lanka, there are only a few studies that have explored the influence of intrinsic factors causing illegal fishing in small-scale fisheries. In light of this, the prime objectives of this study were to identify (1) the illegal fishing practices and (2) the intrinsic drivers of illegal fishing practices among small-scale fishers. A total of 220 small-scale fishermen in Trincomalee, Sri Lanka were interviewed from November 2024 to January 2025 using a structured questionnaire. Binary logistic regression was used to analyse data. Use of monofilament nets, dynamite fishing, lobster fishing during the closed season, fishing without a valid license, fishing with artificial light to attract fish, and use of "Laila" (a type of purse seine) and "Surukku" (a form of shore seine) nets for fishing operations within the sea limit of seven miles were recorded as frequently used illegal practices. Findings revealed that 29% of fishermen used at least one of the illegal fishing practices identified above in the study and young fishermen (18-35 years old) were more likely to engage in illegal fishing. Fishermen who believed illegal fishing practices do not significantly harm the marine environment ($p = 0.039$) and the fishermen who held the perception of low risk of being sanctioned ($p = 0.026$) were more likely to engage in illegal fishing practices. Social norms discouraged the illegal fishing practices ($p = 0.036$). Nevertheless, fishermen believed that increased awareness and education would not help change attitudes towards illegal fishing in their community ($p = 0.033$). Expanding mariculture projects, community-based monitoring and surveillance mechanisms, formalized penalties, and increased enforcement were identified as the most preferred strategies to minimize this issue, ensuring both the sustainability of marine resources and the livelihood security of fishermen.

Keywords: Dynamite fishing, Monitoring and surveillance, Illegal fishing, Small-scale fisheries

Abstract No: 23

The Power of Indigenous Knowledge in Sustaining Small-Scale Fishing Communities in Tangalle and Mawella, Sri Lanka

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Fishers' indigenous knowledge (IK) on small-scale fisheries has been transmitted culturally from generation to generation. Such experiential local knowledge and practices are not readily apparent to the world and are poorly acknowledged in modern fisheries management unless artisanal fisheries are closely examined. In light of this, fishers' IK on small-scale fishery activities related to lobster net, surrounding net, and beach seine fishery was studied to examine the level of IK related to each gear type, factors that influence the use of IK in small-scale fisheries, and fishers' preference for mode of preservation of IK as a cultural heritage. A sample of 50 fishers from each gear type was randomly selected in Tangalle and Mawella fishing communities in Sri Lanka because very unequal sizes might reduce the statistical test's power, making it harder to detect true differences between groups. Considering the fishing season, data were collected from the fishers from November 2024 to February 2025 by conducting face-to-face interviews using a structured questionnaire. Inferential statistics and descriptive statistics were used for data analysis. Different traditional methods used to identify fishing grounds, fish type, and time of harvesting, primarily based on the changes of seawater colors (folk oceanography) and physical indicators were distilled from the traditional fishers. Results indicated that a majority of fishers (90%) operated lobster nets and surrounding nets using IK but only 60% of the fishers used IK in the beach seine fishery. The number of years of fishing experience was the most influential factor in IK across all three gear types. Additionally, IK varied based on gender differences and the income level of the beach seine fishers. Community-based learning was identified as the most preferred method of preserving IK, reflecting its cultural significance for the fishing communities. Therefore, integrating fishers' IK into community-based fisheries management is proposed for sustainable utilization of these cost-effective traditional methods to produce better management outcomes.

Keywords: Folk oceanography, Fisheries management, Small-scale fishery, Traditional methods

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Abstract No: 24

A Preliminary Distribution Survey of Critically Endangered *Doona ovalifolia* Thwaites in Makeli Oya Riverbank, Kelin Kanda, Kalutara District, Sri Lanka

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Doona ovalifolia, a critically endangered species of the Dipterocarpaceae family, locally known as Pini Beraliya, is an endemic plant in Sri Lanka and is highly restricted to Wewella and Kelinkanda areas. This study aimed to investigate the distribution of *D. ovalifolia* along the Makeli Oya riverbank. The riverbank was surveyed from January 10th to March 09th, 2024, documenting all individuals of *D. ovalifolia* with a diameter at breast height (dbh) greater than 5 cm as well as saplings (height > 1 m, dbh < 5 cm) along a 4 km stretch on both sides of the riverbank. The distance from maternal trees to each sapling or seedling was measured using a measuring tape. Thirteen mature individuals with a dbh greater than 5 cm and eight saplings (height > 1 m, dbh < 5 cm) were identified. The data revealed that the species manifests seed dispersal abilities, with the maximum distance of seedlings dispersed from the maternal tree measured at 5.0 m distance and the nearest sapling just 0.3 m away. Notably, 25 seedlings below 1 m in height were recorded within 5 m distance from five maternal trees, alongside 3 saplings exceeding 1 m in height yet remaining with a dbh of less than 5 cm. The results further indicated that all recorded *D. ovalifolia* were located within 5.4 m of the riverbank edge, highlighting a significant preference of this species for riparian habitats. These findings show that *D. ovalifolia* relies on riverine ecosystems for its growth and regeneration, suggesting that conservation efforts must prioritize the protection of such habitats to ensure the prolonged survival of this critically endangered species that was once thought extinct in the wild.

Keywords: Conservation, Dipterocarpaceae, Distribution, Endemic, Riparian

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Abstract No: 25

Roles of Local Communities in Forest Landscape Restoration: A Case from Endane Biodiversity Corridor, Sri Lanka

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Forest Landscape Restoration (FLR) aims to reinstate ecological integrity while improving human well-being in degraded or deforested landscapes. This research investigated the role of local communities in FLR, focusing on Uda Delwala Village in the upper part of Endane Biodiversity Corridor (EBC). The study investigated how socio-economic, cultural, and environmental factors influence community involvement in FLR efforts and examined the challenges faced in contributing to restoration. Mixed-methodology was adopted, incorporating 30 questionnaire surveys, Participatory Rural Appraisal (PRA) techniques, and field observations to assess community involvement, key challenges, and local expectations. Qualitative data were analyzed thematically, and quantitative data were interpreted using descriptive statistics, Likert scale ratings, and Principal Axis Factoring (PAF). Findings revealed a strong correlation ($\geq$0.70, $p<0.01$) between total forest resource utilization and non-timber forest products (NTFP) usage, showing that villagers rely on NTFPs for provisioning services. The expansions of smallholder tea gardens were found to exacerbate rainforest degradation along rainforest margins. Standard deviation values indicated major land-use challenges: land making costs (4.57), climatic shifts (3.77), land ownerships (3.47), and wildlife damages (3.03) respectively. PAF and scree plot showed Protecting Forests and Water Bodies (*eigenvalues*>1) were top conservation expectations among communities. Demand ranking by PRA methods revealed tea estates, agroforestry practices, and EBC as top community priorities; public places and gem mining ranked lowest. However, a strong potential for community participation in planning, implementing, and monitoring FLR initiatives were evident. Active involvement enhances community trust, legitimacy of projects and long-term sustainability. Local communities are vital for successful forest restoration, offering hands-on involvement. A bottom-up approach empowers them to lead sustainable planting, agroforestry, and buffer zone creation. Through training and collaboration with NGOs and collaborators, FLR initiatives will benefit both people and ecosystems, ensure long-term resilience and mutual prosperity.

Keywords: Community, Conservation, Corridor, Sustainability, Well-being

Abstract No: 26

An Integrated Conservation and Development Framework For Buffer Zone Management Balancing Settlement Expansion and Ecosystem Preservation in Protected Areas – Sri Lanka

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Expansion of human settlements near protected areas poses threats to biodiversity by encroaching on buffer zones, critical interfaces that mitigate the adverse effects of human activities on protected areas such as National parks. In Sri Lanka, managing these zones is challenging due to competing development pressures and limited public awareness of their ecological importance. This study proposes an integrated conservation and development framework for effective buffer zone management that balances the settlements expansion with ecosystem preservation. The study focused on the Wilpattu National Park buffer area and assessed the ecological impacts of human settlement and community involvement. A mixed methods approach was adopted, combining mapping, literature surveys, and interviews with local stakeholders, to evaluate the effectiveness of existing management strategies and identify key conflicts between development and conservation. Findings revealed that while buffer zones contribute positively to conservation outcomes, their effectiveness is hampered by insufficient local awareness and unregulated land use practices. The study recommends strategic approaches, including enhanced community engagement, sustainable land use planning, and improved change management preparedness, to ensure sustainable development within buffer zones. The proposed framework is adaptable to other protected areas in Sri Lanka and similar Landscapes and offers practical recommendations for policymakers, conservation practitioners, and landscape architects. By integrating ecological and socioeconomic considerations, this research contributes to the development of a more sustainable buffer zone governance.

Keywords: Buffer zone management, Ecosystem preservation, Human settlement expansion, Protected areas, Sustainable development

Abstract No:27

A Study on Water Quality and Phytoplankton Composition in Kalpitiya Lagoon, Sri Lanka

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Kalpitiya Lagoon is a feasible site for commercial oyster farming and culture practices are already underway. Monitoring phytoplankton composition and water quality of the lagoon is essential to ensure food safety of oysters in terms of algal toxins. This study assessed the water quality and phytoplankton composition at three sampling sites (Kandakuliya, Kudawa and Meegamuwadiya) of Kalpitiya Lagoon. Water quality parameters were measured, and phytoplankton abundance were analysed at each site, using a Sedgewick-Rafter cell. The physicochemical parameters across all sites varied as follows: temperature (23.1-30.6 °C), BOD (0.73-1.13 mg/L), total nitrogen (0.17-0.21 mg/L), total phosphorus (0.03-0.04 mg/L). The observed phytoplankton communities were dominated by diatoms across all sites. The absolute abundance (cells/mL) and relative abundance (%) of observed diatom genera were: Kandakuliya, *Skeletonema* (810 ± 16.4,93)*, Coscinodiscus* (40±1.0,4.6), *Pleurosigma* (5±0.6,0.6), *Thalassionema* (4±0.4,0.5) and *Chaetoceros* (2±0.6,0.2); Kudawa, *Odontella* (26±1.2,57.8) and *Coscinodiscus* (14±1.2,31.1); Meegamuwadiya, *Thalassiosira* (251±5.8,60.5), *Coscinodiscus* (89±0.6, 21.4), *Odontella* (45±1.2,10.8), and *Pleurosigma* (24±2.3,5.8). *Melosira* was recorded in all sites, 10±2.3,1.1 (Kandakuliya), 5±0.6,11.1 (Kudawa), and 6±0.3,1.4 (Meegamuwadiya). Interestingly, all observed phytoplankton species were non-toxic. However, *Chaetoceros* is known for causing gill damage in oysters during algal blooms. Out of the 3 sites, only Kandakuliya had previously been studied for water quality and phytoplankton, making this study the first attempt for Kudawa and Meegamuwadiya which were identified as potential sites for future expansion of oyster farming. The findings ensured the oyster food safety in Kalpitiya Lagoon from algal toxins. Periodic monitoring of water quality and phytoplankton are necessary to understand the temporal dynamics of phytoplankton and water quality of Kalpitiya Lagoon.

Keywords: Kalpitiya Lagoon, Oyster farming, Phytoplankton, Water quality

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Abstract No: 28

A Preliminary Assessment of the Faunal Diversity and Conservation Concerns in Campbell's Lane Forest Reserve and its Buffer Zones, Knuckles Region, Sri Lanka

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The conservation significance of buffer zones and adjacent habitats of biodiversity protected areas in Sri Lanka is poorly understood. This study aimed to assess the ecological significance and faunal diversity within Campbell's Lane Forest Reserve which is an isolated part of the Knuckles Environmental Protection Area, and its adjacent community lands and State Plantation Corporation lands. Habitats of the study area included grasslands (GL), pine forests (PF), riverine forests (RF), secondary forests (SF), and buffer zones (BZ) which mainly consisted of cultivated or abandoned lands. Weekly faunal surveys were conducted from March to June, 2025, to estimate the biodiversity and threats within the area. Faunal surveys employed a combination of line and point transects supplemented by camera traps. Species were identified using standard guides. Faunal surveys recorded 85 butterfly, 5 fish, 16 amphibian, 27 reptile, 78 bird, and 19 mammal species including Sri Lankan Leopard (*Panthera pardus kotiya*), Fishing Cat (*Prionailurus viverrinus*), Eurasian Otter (*Lutra lutra*), and Purple-faced Langur (*Semnopithecus vetulus monticola*). Species richness was higher in BZ, SF, and RF, compared to GL and PF. Satellite imagery indicates that annual man-made fires have contributed to expanding PF. BZ were prone to anthropogenic disturbances due to the presence of economic crops. The connectivity between villages and forests through BZ has facilitated wildlife movement into cultivated lands, leading to human-wildlife conflicts. Reported conservation concerns included increasing livestock predation by Fishing Cat, langurs entering settlements, and spread of invasive species. In conclusion, protecting marginal forests and buffer zones is essential to minimize conflicts and enhance natural regeneration.

Keywords: Anthropogenic disturbances, Environmental protection area, Human-wildlife conflict, Marginal forests

Abstract No: 29

Assessing Public Knowledge, Attitudes, and Practices to Mitigate Snakebite Risk and Promote Snake Conservation in Sri Lanka

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Snakebite remains a significant public health concern in Sri Lanka, particularly in rural areas with limited access to healthcare and awareness. Concurrently, fear and misconceptions about snakes contribute to their unnecessary killing, threatening ecological balance. Snakebite victims often face delays in treatment due to limited knowledge and widespread myths. This study explored the current knowledge, attitudes, and practices related to snakes and snakebite management among Sri Lankans, aiming to identify key gaps and misconceptions in order to reduce snakebite risk and support conservation efforts. A mixed-methods approach was employed, combining a structured online survey with interviews. Data were collected from 122 participants aged 15–75 years across all nine provinces, with approximately equal representation from urban, suburban, and rural areas. Interviews targeted rural communities where internet access and digital literacy are limited. The questionnaire included multiple-choice, Likert-scale, and open-ended questions on venomous snake identification, snake-related myths, reactions to encounters, first aid practices, and attitudes toward snake conservation. Quantitative data were analysed using descriptive statistics, while qualitative responses were thematically coded. Results showed that 70% of participants could not reliably distinguish venomous from non-venomous snakes and 45% admitted to using harmful or inappropriate methods during snake encounters. While 78% expressed fear of snakes, 52% recognized their ecological importance, and 33% were willing to protect them if better informed. Belief in common myths and incorrect first aid measures was found across all age groups and demographic regions. Rural participants had more frequent snake encounters but less access to accurate information than urban respondents. The study highlights significant awareness gaps and recommends targeted education through public campaigns, school programs, and technological tools to help identify snakes and respond safely. In conclusion, it emphasizes the need for sustainable knowledge-sharing to reduce snakebite risk and conserve Sri Lanka's unique snake diversity.

Keywords: Biodiversity conservation, Environmental education, Public awareness, Snake identification, Snakebite prevention

Abstract No: 30

Dragging the Depths; Addressing Transboundary Bottom Trawling by India and Restoring Marine Habitats in Northern Sri Lanka

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Bottom trawling is globally recognized as one of the most destructive fishing methods, involving the dragging of a weighted net along the seabed to catch demersal fish. This practice cause extensive damage to marine habitats and biodiversity. In the waters between Northern Sri Lanka and Tamil Nadu, India, bottom trawling has intensified in recent years. Primary due to illegal, unreported, and unregulated activities by Indian trawlers, that frequently violate Sri Lanka's maritime boundaries. These incursions have resulted in severe ecological degradation, depletion of fish stocks, and disruption of livelihoods in local fishing communities. Despite Sri Lanka's legal ban on bottom trawling, implemented through the 2017 amendments to the Fisheries and Aquatic Resources Act, No. 2 of 1996, weak enforcement and limited transboundary cooperation have allowed these destructive practices to continue. This study accessed the ecological impacts of transboundary bottom trawling in northern Sri Lanka, evaluated the effectiveness of the existing of legal and governance frameworks, and identified enforcement gaps. The research adopted a black letter legal approach, drawing on International Conventions, as primary sources and journal articles, books, web articles and case laws as secondary sources. The study highlights Sri Lanka's obligations under United Nations Convention on Law of the Sea (UNCLOS) to engage in cooperative resource management with neighboring. To protect Sri lanka's marine ecosystems and uphold marine sovereignty, the study recommends strengthening transboundary legal cooperation, enhancing surveillance and enforcement mechanisms, and adopting ecosystem-based management strategies. Prioritizing marine habitat restoration alongside robust governance is essential to safeguard marine biodiversity and secure livelihoods for coastal communities.

Keywords: Bottom trawling, International obligations, Legal cooperation, Marine habitat, Transboundary

Abstract No: 31

A Comparative Study on the Legislative Framework of Sri Lanka and the United Kingdom on the Conservation of Animals in Zoological Gardens

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Zoological gardens have evolved into key institutions for ex-situ conservation of animals, a concept that has developed since the 19th century. This study aimed to identify whether the prevailing legislative framework in Sri Lanka adequately promotes animal conservation in zoological gardens, in comparison to the corresponding framework in the United Kingdom. Specifically, the study reviews the legal evolution of animal conservation within zoo settings, analyzes the provisions of Sri Lanka's National Zoological Gardens Act No. 41 of 1982, and compares it with the UK's Zoo Licensing Act 1981. A qualitative library-based methodology was employed, supplemented with a key informant interview with an expert in the field. Primary sources include legislation, international conventions (CBD, CITES), and case law, while secondary sources encompass scholarly articles, government reports, and policy documents. The analysis revealed that while Sri Lanka's legal provisions provide a basic administrative structure, they lack specific mandates for conservation initiatives such as captive breeding or reintroduction programs. The Act applies only to state-run zoos, excluding private entities, thereby limiting conservation scope and penalties for offenses are outdated, reducing deterrence. In contrast, the UK legislation incorporates detailed requirements for animal welfare, breeding programs, and public education. Moreover, the legislation also ensures regular inspection of both public and private zoos to ensure compliance with welfare/conservation standards. The findings support the hypothesis that Sri Lanka's legal framework does not sufficiently promote animal conservation in zoological gardens. The study concludes by recommending amendments to the National Zoological Gardens Act to incorporate explicit provisions related to conservation, education, and animal welfare, extend regulations to private zoos and modernize penalties and adopt UK-style licensing/inspection systems to improve accountability drawing upon best practices from the UK framework. This study fills a critical gap in Sri Lankan environmental law literature and provides a model for legislative reform in jurisdictions with underdeveloped zoo governance frameworks.

Keywords: Ex-situ conservation, Legislation, Sri Lanka, Zoological gardens

Abstract No: 32

Stakeholder Perception and Influence of Climate Change on Coral Reef Tourism in Sri Lanka

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Coral reef tourism, a vital economic driver for Sri Lanka's coastal communities, is increasingly threatened by climate change. This exploratory qualitative study investigates the stakeholder perception and influence of climate change in two key marine zones: Hikkaduwa and Pigeon Island. Data were collected through 16 in-depth, open-ended interviews using a semi-structured guide covering areas such as climate awareness, ecological changes, tourism impacts, adaptation, and stakeholder collaboration. Participants were selected through convenience sampling, and the data were analyzed using a content approach. Findings revealed that coral reef ecosystems in both locations are experiencing significant ecological stress, resulting in shifts in tourist preferences and financial losses for reef-dependent businesses. Many stakeholders demonstrated limited awareness of climate change, with difficulty linking observed environmental changes to global climate impacts. Reported impacts included declining income and reduced employment opportunities. Participants emphasized the need for stronger government intervention, targeted climate education, and more robust coastal conservation policies. These insights align with IPCC assessments, which highlight the high vulnerability of coral reef ecosystems and the importance of localized adaptation. These findings offer preliminary insights for integrating ecological sustainability with economic development in climate-sensitive coastal regions.

Keywords: Awareness, Climate change, Coral reef tourism, Stakeholder perception

Abstract No: 33

Response of Benthic Macroinvertebrate Communities to Water Quality Variations in the Walawe Basin, Sri Lanka

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Understanding the response of benthic macroinvertebrate communities to changes in water quality is essential to assess the ecological integrity and functioning of riverine ecosystems. In Sri Lanka, although several studies have examined the use of biological indicators to determine the health of watercourses, their application remains limited. This study aimed to investigate the response of macroinvertebrate-based metrics: % Ephemeroptera, Plecoptera, and Trichoptera (%EPT), Shannon Diversity Index (H′), and Species Richness (SR) to variation in turbidity, salinity, and Water Quality Index (WQI), in the Walawe basin, Sri Lanka. Macroinvertebrates were sampled at 15 tributary locations in the Walawe basin using a D-frame net and a Surber sampler during dry and wet seasons. The WQI was calculated using pH, total alkalinity, total dissolved solids, and the concentrations of sodium, calcium, magnesium, nitrate, phosphate, fluoride, chloride, and sulphate. Spearman correlation analysis showed a significant negative correlation between %EPT and turbidity ($r = -0.503$, $p < 0.01$), WQI ($r = -0.435$, $p < 0.05$), and salinity ($r = -0.403$, $p < 0.05$) and H′ ($r = -0.380$, $p < 0.05$), indicating that these parameters influence the macroinvertebrate diversity and the presence of sensitive taxa. Multiple linear regression results also confirmed that turbidity had a significant negative effect on %EPT ($\beta = -0.416$, $p = 0.017$). The General Linear Model (GLM) revealed substantial seasonal variation in turbidity ($p < 0.001$) and all three biological metrics (%EPT: $p = 0.007$), (SR: $p = 0.006$), (H′: $p = 0.014$), in sampled tributaries. These findings emphasize the sensitivity of macroinvertebrate assemblages to specific water quality parameters and seasonal fluctuations, reinforcing their value as reliable bioindicators for assessing river health in tropical catchments. The results provide baseline information to guide sustainable watershed management and support the development of efficient biomonitoring frameworks within Sri Lanka's river basins.

Keywords: Bioindicators, Ecological health, River health assessment, Turbidity

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Abstract No:34

The Role of Sand Texture, Moisture, and pH in Green Turtle (*Chelonia mydas*) Nesting Site Selection at Rekawa, Sri Lanka

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Microenvironmental conditions essential for embryonic development, emergence, and nesting success also shape marine turtle nesting behaviour. This study investigated the influence of sediment grain size, moisture content, and pH on nesting preferences of *Chelonia mydas* along the Rekawa-Kapuhenwala coast in Southern Sri Lanka. A total of 60 sand samples, 40 from nesting sites and 20 from non-nesting zones, were collected during peak nesting season (December 2024 to March 2025). Sieve analysis showed that the samples were predominantly composed of medium-to coarse-grained sand, with the 400 μm fraction being notably dominant. Nesting zones exhibited a marginally higher concentration of this fraction (mean 68%) than non-nesting zones (mean 66%). Moisture analysis showed lower water content in nesting sites (1.5–2.0%) compared to their non-nesting counterparts (2.5–4.0%), suggesting a preference for drier environments that are potentially favourable for gas diffusion and thermal stability. pH profiling further indicated that nesting sites were characterized by slightly lower (more acidic) conditions (median: 8.05; IQR: 8.00–8.10) than non-nesting sites (median: 8.22; IQR: 8.20–8.23). Although the individual variations across the parameters were modest, their synergistic interactions appeared to decisively influence site selection. The preference for substrates that are moderately coarse, less humid, and mildly acidic likely enhances embryonic viability by optimizing thermal and biochemical nest conditions and reducing microbial proliferation. These insights contribute to a broader understanding of chelonian reproductive ecology and highlight the necessity of implementing conservation strategies that maintain or restore these key microhabitat characteristics. Safeguarding these environmental parameters is critical for sustaining nesting habitat quality and ensuring the long-term viability of *Chelonia mydas* populations in this biologically significant coastal region.

Keywords: *Chelonia mydas*, pH, Sand texture, Moisture, Sea turtle conservation

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Abstract No: 35

Assessment of Early Growth Response of *Acropora muricata* on Artificial Substrates in a Degraded Reef System

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Coral reefs are among the most valuable yet vulnerable ecosystems along the Sri Lankan coastline; however, many coral reefs are threatened by various anthropogenic processes. The Bathegama, Mirissa coastal region has been significantly impacted due to the cumulative effects of global climate change and local anthropogenic pressures. Therefore, an active restoration practice was implemented in 2023 by the Sampath Bank PLC in collaboration with University of Ruhuna at Bathegama, Mirissa (5°56'26"N 80°27'54"E). Artificial reef modules were used to support coral reef restoration. They were made from cement boulders that are hemispherical in shape, with a central air cavity designed to mimic natural reef complexity and enhance water flow. In December 2023, 19 and 21 cement boulders were placed at Sub-site 1 (S1) and Sub-site 2 (S2), respectively, in Bathegama, Mirissa. Stainless steel nails (8) attached to the surface of each cement boulder, and small Acropora muricata fragments were secured to the nails using plastic cable ties in 2023. Coral growth parameters were recorded in March 2025. At S1, 5 separate Acropora muricata colonies were observed, with diameters ranging from 50 to 63 cm. Additionally, 2 merged colonies were recorded, with diameters of 420 cm (merged colony 1) and 273 cm (merged colony 2). S2 have 28 separate colonies established with diameters ranging from 8 to 200cm. Cement boulders were placed closer together in S1 compared to S2; thus, insufficient space for coral to grow outward from the boulders likely contributed to the relatively lower coral colonies at S1. Moreover, surface damage was observed on boulders at S1 (21.05%) and S2 (19.04%), indicating substantial deterioration at both sites. The coral restoration program showed positive signs of successful establishment in Bathegama, Mirissa after two years. Continuous monitoring and assessment are recommended to evaluate the success of the coral restoration at Bathegama, Mirissa.

Keywords: *Acropora muricata*, Coral restoration, Cement boulder, Colony, Sri Lankan coastline

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Climate Adaptation, Green Innovations & Sustainable Governance

Abstract No:36

Hidden Aspects of Climate Change in Humidity Data: A Spatiotemporal Analysis of the Wet Zone of Sri Lanka

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Climate change has significantly altered atmospheric moisture patterns, particularly in tropical regions. This study is aimed at assessing the spatial, temporal, and vertical variations in humidity during the Southwest Monsoon (SWM, May–September) from 1985 to 2024 in Sri Lanka's Wet Zone, using the water vapor mixing ratio to quantify the atmospheric moisture content. Humidity data were obtained from four main meteorological stations in Galle, Ratnapura, Kandy, and Nuwara Eliya, as well as radiosonde data from Colombo. It addresses important gaps in Sri Lanka's climate research in the atmospheric moisture content, which has been largely ignored. Spatial analysis revealed a significant decrease in atmospheric moisture content with increasing elevation from the Galle coast to the highlands, at a rate of approximately 4 g/kg per kilometer. Temporally, a statistically significant annual increasing humidity trend was observed at all stations, while Galle demonstrated the highest increase of 2.2 g/kg in 100 years. The month of May recorded the highest humidity during SWM out of the four locations, while monthly variations reveal rising moisture in both early and late monsoon months over the years. Correlation analysis showed temperature as the primary driver of humidity in Galle (with an R^2 value of 0.70), while Kandy exhibited moderate influence from both temperature and rainfall but Nuwara Eliya and Ratnapura showed weaker correlations. The vertical moisture profile in Colombo exhibited an average rate of decrease in mixing ratio of about 1.2g/kg per 1 km during the study period and temporally indicated slight increases in humidity but lacked statistical significance. The analysis offers insights into the moisture distribution in the Wet Zone, which can potentially be utilized by plants and play a role in cloud and rain formation processes.

Keywords: Atmospheric moisture trends, Climate, Humidity, Radiosonde, Water vapor mixing ratio

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Abstract No: 37

Integrating Durability into Life Cycle Assessment of Concrete with Supplementary Cementitious Materials

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The increasing use of supplementary cementitious materials (SCMs) as partial replacements for ordinary Portland cement (OPC) reflects a significant shift toward sustainable construction practices. This study investigates the environmental and economic impacts, as well as the durability and compressive strength of concrete incorporating SCMs such as rice husk ash (RHA) and sugarcane bagasse ash (SCBA), through a durability-based Life Cycle Assessment (LCA), compressive strength testing, Rapid Chloride Penetration Test (RCPT), and Life Cycle Cost (LCC) analysis. These agricultural byproducts have a higher silica content, making them highly reactive pozzolanic materials. The study investigates the long-term performance of RHA and SCBA in concrete using a cradle-to-grave life cycle assessment, enriched by durability data to understand their influence on degradation processes. This involves service life prediction using Life-365, data gathering from case studies, life cycle impact assessment using SimaPro software, and combining these with compressive strength results and RCPT results as a durability indicator. Five concrete mixes, which contained 100% OPC, were used in the study. The mixes were replaced with RHA at 15% and 30%, and with SCBA at 5% and 25%. The LCA study evaluated that the Global Warming Potential (GWP) was reduced with concrete with 30% RHA by 22% and 25% SCBA by 25% exhibiting the lowest environmental impact. Service life prediction using Life-365 software revealed that concrete mix with 30% RHA exhibits a longer durable service life, which is 19.08 years compared to OPC concrete (7.92 years), followed by 25% SCBA concrete with a service life of 17.33 years, which occurred due to reduced permeability according to the RCPT results when SCMs were used. The findings underscore the significant potential of SCMs to reduce the carbon footprint and enhance the durability of concrete, thereby contributing to the development of more sustainable infrastructure. This study highlights the vital role of SCMs in advancing circular economy practices within the construction industry while addressing environmental concerns. The findings provide meaningful guidance for engineers, researchers, and policymakers on the use of cementitious materials to strike a balance between sustainability and performance in the construction industry.

Keywords: Supplementary cementitious materials (SCM), Durability, Life cycle assessment (LCA), Global warming potential (GWP), Ordinary portland cement (OPC)

Abstract No: 38

Biotransformation of Petrochemical Plastic Surfaces facilitated by Anaerobic Digester Sludge Microorganisms

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Petrochemical plastics, whose global production is projected to reach about 430 to 460 million tonnes annually in 2025, are widely used but exhibit notorious resistance to degradation, posing significant environmental challenges. Although few studies have indicated the ability of anaerobic digester sludge microorganisms to biotransform plastics within anaerobic digestion (AD) systems, their degradation mechanisms are still poorly understood. Thus, this study investigated the potential biotransformation of three different plastic surfaces, polypropylene (PP), polyvinyl chloride (PVC) and polyethylene (PE), by AD system microbiota under mesophilic conditions. For this study, a laboratory-scale AD system was established and plastic samples were immersed in the sludge for a 50 day incubation period and measured for any significant mass loss. The Kruskal-Wallis test showed a significant mass loss ($p<0.05$) in PVC pieces with a 1.1 ± 0.16 mg (1.5%) average reduction, whereas PP (0.04 ± 0.02 mg, $p>0.05$) and PE (0.15 ± 0.06 mg, $p>0.05$) didn't show any significant mass loss. Surface characterization using Raman spectroscopy revealed temporarily increasing new peaks in PVC at 1729 cm^{-1} corresponding to C=O stretching vibrations. This was considered significant and compared against an unchanged marker of PVC, revealing a newly identified peak that has not been documented in prior studies of this material. Furthermore, PP samples also showed a significant new Raman shift in the spectral range of C=C stretching vibrations in the region of 1512 cm^{-1}. Atomic force microscopy (AFM) analysis of PVC surfaces showed a gradual decrease in average roughness amplitude from 100 nm in controls to 90 nm after 30 days, further declining to 65 nm after 50 days highlighting time-dependent surface modification. Phase-contrast microscopy further confirmed evidence of surface embrittlement across all plastics. Therefore, this study suggests that AD system microbes can accelerate biotransformation of certain types of plastic waste, highlighting the potential of AD-based treatment strategies.

Keywords: AD system, Atomic force microscopy, Plastic degradation, Raman spectroscopy, Waste treatment

Abstract No: 39

Development of Biodegradable Polymers from Avocado Waste

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The growing trend towards biodegradable polymers has encouraged the utilization of agricultural waste as a sustainable raw material. This study focuses on the development of biopolymers from avocado waste, which consists of avocado peels and seeds, together comprising approximately 20 - 30 wt% of the fruit. Three different film-forming methods were employed: (1) acid hydrolysis, (2) acid hydrolysis with plasticization (glycerol), and (3) a blend preparation incorporating pectin. Nine polymer samples were developed using avocado peels, seeds, and a combination of both to produce biopolymer films. Films produced solely via acid hydrolysis exhibited brittleness, poor barrier performance, and surface cracking, resulting in non-peelable structures that were unsuitable for subsequent characterization. In contrast, films developed using acid hydrolysis with plasticization (30% glycerol) showed significantly improved flexibility, as the addition of glycerol reduced brittleness and enabled the formation of continuous, peelable films. The blend preparation method, involving avocado peel and seed powder (20%), pectin (50%), glycerol (30%), and calcium chloride ($CaCl_2$), further enhanced polymeric behavior and film integrity due to the binding ability of pectin and the cross-linking effect of calcium chloride. Among all samples, biofilms prepared using the blend preparation method exhibited lower water solubility and water absorbance compared to those prepared by acid hydrolysis with plasticization; however, they displayed higher moisture content. Avocado peel-based films exhibited lower water repellency than seed-based films, while blended peel–seed films showed the lowest overall properties. FTIR and TGA analyses provided insights into the material composition and thermal stability of the films. The addition of glycerol notably influenced the polymeric properties of the samples, while the incorporation of pectin and calcium chloride further enhanced film performance through improved structural integrity and stability. These findings demonstrate the potential of avocado waste as a source of biodegradable films, providing an environmentally friendly alternative to conventional plastics.

Keywords: Avocado seeds, Avocado peels, Biodegradable, Biopolymers, Waste valorizarion

.

Abstract No: 40

Predictive Modelling of Yodha Wewa Inflows with Artificial Neural Networks: Implications of Climate Change Scenarios

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Accurate reservoir inflow prediction is crucial for effective water resource management, especially in regions where climate variability is prevalent. For Sri Lanka, there has been minimal investigation of the application of Artificial Neural Networks (ANNs) to predict reservoir inflow under climate change scenarios for large and historically significant irrigation schemes such as Yodha Wewa (Giant's Tank) in the Northern Province. This study bridges this gap by developing and validating an ANN-based prediction model with multiple climatic parameters—rainfall, temperature, relative humidity, and wind speed—derived from historical data (1991–2020) and bias-corrected future projections under the CMIP6 Shared Socio-economic Pathways (SSP2-4.5 and SSP5-8.5). The input data, in monthly resolution, were preprocessed with scaling, bias adjustment, and imputation of missing values using statistical interpolation. The feedforward ANN model was trained and tested with algorithms including Levenberg–Marquardt, BFGS quasi-Newton, and Scaled Conjugate Gradient. The validation of models was also performed utilizing an 80–10–10 split for training, validation, and testing, with early stopping used to prevent overfitting and monitoring of performance on unseen data. Evaluation criteria—Root Mean Squared Error (RMSE), Mean Absolute Error (MAE), and correlation coefficient—also showed that the Levenberg–Marquardt algorithm gave the best predictive accuracy as opposed to conventional statistical approaches. 2021-2050 projections indicate that high-emission pathways have the potential to reduce inflow reliability, compromising agricultural productivity and water security in the region. The approach has huge scope for adaptation planning and could apply to other reservoirs in Sri Lanka's dry zone and other similar semi-arid areas in other parts of the world.

Keywords: Artificial Neural Networks (ANN), Climate Change, CMIP, Inflow Forecasting, Yodha Wewa, Reservoir Management

Abstract No: 41

Statistical Analysis of Community Support for Circular Economy in Plastic Waste Management: A Sri Lankan FMCG Perspective

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Understanding the socio-behavioural factors that influence community engagement is pivotal for the successful implementation of circular economy models in plastic waste management. In Sri Lanka, where the Fast-Moving Consumer Goods (FMCG) industry is a significant contributor to plastic waste generation, mobilizing community support is essential for transitioning toward sustainable systems. This study investigates the statistical relationships between key community-level variables such as awareness, depth of understanding, and practical implementation of circular economy principles, and the overall willingness of communities to support sustainable plastic waste initiatives. Using a quantitative approach, structured surveys were conducted with 100 participants representing both community members and industry stakeholders, including those affiliated with the FMCG sector. Correlation analysis revealed significant positive relationships between community willingness and three predictors: awareness ($r = 0.522$), implementation of circular practices ($r = 0.571$), and understanding ($r = 0.460$). Awareness also showed a very strong correlation with the perceived feasibility of adopting a circular economy model ($r = 0.981$), reinforcing its central role in public perception and behavioural intent. A multiple regression model explained 56.4% of the variability in community willingness ($R^2 = 0.564$), with all predictors statistically significant. Awareness emerged as the strongest predictor ($\beta = 0.321$, $p < 0.001$), closely followed by implementation ($\beta = 0.329$, $p < 0.001$), while understanding had a moderate but meaningful impact ($\beta = 0.236$, $p < 0.01$). These insights highlight the critical need for targeted awareness programs, community-oriented demonstrations, and educational initiatives that make circular economy concepts more accessible. By incorporating the active role of the FMCG sector and community perceptions, this study provides empirical evidence to inform collaborative, data-driven policy and practice. The findings emphasize that community engagement, supported by education and actionable frameworks, is vital for advancing sustainable and inclusive plastic waste management strategies in Sri Lanka.

Keywords: Community engagement, Circular economy, Plastic waste, Regression analysis, Sustainability awareness

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Abstract No: 42

Impact of Expressway Development on Agricultural Lands: A Case Study of the Kadawatha Highway Interchange

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The construction of the Kadawatha Expressway and interchange has had a significant impact on land use within a 2 km buffer zone. Although the expressway occupies a relatively small area of land, its secondary effects have led to the widespread conversion of agricultural land to residential and commercial use. Of land taken over for the interchange of the highway in the 2 km buffer zone, 65.2% (1,139.5 perches) was agricultural. The area was previously predominantly rural with paddy cultivation, home gardening, and mixed farming. In this research, the extent of land use change due to expressway-induced development and perceived impacts on local agriculture were examined. The research employed a mixed-method. Secondary data, like past land use from Grama Seva Niladhari reports and Social Impact Assessments (SIA), were cross-referenced with current land use to ascertain change. Primary data were collected using structured questionnaires from 32 respondents chosen based on Cochran's formula. Descriptive statistics were utilized in trend and perception analysis. Results reveal that although the expressway occupied a narrow physical space, indirect development pressure led to the conversion of most of the original farmland in the buffer zone to mainly commercial purposes. The traditional activities of paddy cropping and home gardening have drastically reduced. Around 70% of the respondents suffered adverse impacts: 40% suffered direct abandonment of cultivation by sale or conversion of land, and 30% suffered reduced productivity due to water scarcity, soil compaction, and fragmentation of land. The Kadawatha Expressway thus indirectly caused huge re-allocation of agricultural land by induced urbanization. In order to restrict further agricultural loss, this study recommends sustainable land use zoning, preservation of prime farmland, development planning along interchanges, and innovative urban agriculture options like rooftop gardening and agro-buffer strips.

Keywords: Agricultural impact, Expressway, Infrastructure development, Land use change

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Abstract No: 43

Development and Evaluation of a Hand Operated Ploughing Rake Hoe for Secondary Land Preparation for Small Scale Cultivation

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Farming to sustain families is increasingly challenged by rising land preparation costs, difficulty in transporting equipment to fields, and the labor-intensive nature of traditional agriculture. Most small-scale farmers still rely on basic hand tools due to limited capital and lower labor requirements. However, effective land preparation is crucial for achieving optimal crop yields, as it ensures favorable soil conditions for plant establishment. This study focused on the development and performance evaluation of a fabricated hand-operated machine (rake hoe), designed for use in small-scale cultivation systems The rake hoe machine was tested on two soil types and compared with conventional manually operated tools such as the rake hoe(T3). Performance metrics included ploughing rate, time consumption, ploughing depth, soil density, mechanical and field efficiency, and soil aeration. The results revealed best performance in the hoe developed as minimum time consumption, proper depth, proper density, high mechanical efficiency, high field efficiency, and maximum aeration. Similarly, other factors such as easiness, suitability for vegetable crops also high in this new treatment. However, there were no any significance difference in labour consumption as all the instruments tested tools since all were manually operated the rake hoe machine was favored in a sensory evaluation using a 5-point hedonic scale. The findings demonstrate that the rake hoe (T3) is ideally suited for small-scale farmers, particularly those engaged in leafy vegetable cultivation in Sri Lanka's upcountry regions, where excessive soil disturbance can exacerbate erosion issues. Consequently, the study concludes that the T3 machine is a viable and efficient solution for sustainable land preparation in smallholder farming cultivation practices.

Keywords: Land preparation, Labor-intensive, Rake hoe, Smallholder farming, Soil aeration

.

Abstract No: 44

Review on Cashew Nutshell Liquid for Pest Management in Sri Lanka: Potential and Challenges.

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Cashew Nutshell Liquid (CNSL) has been a rural community based application to control insect pests and fungi infections in cultivars. With low levels of technology for extraction of CSNL, inadequate knowledge about the value of CNSL and replacement of synthetic agro-chemicals lead to reduction of usage CNSL and local pest control compounds in Sri Lankan farming. The aim of this review was to summarize the nine peer-reviewed publications related to CNSL, scientifically squeezing out the scientific value of the extract for applying as a natural pesticide, commercially. CNSL contains bioactive compounds such as Anacardic acids, Cardanol, and Cardol which possess insecticidal, antifungal, and repelling qualities. Local and International researches have shown that CNSL with Hexane extract is effective against *Bactrocera dorsalis* at a concentration of 0.35 µL/cm^2 gave a higher repellency of 76%. Against *Aphis craccivora*, showing the 95.83% to 100% mortality rate under 1% concentration and 96.67% to 100% mortality rate of *Riptortus pedestris* under 2% concentration. Against *Sitophilus zeamais*, 32855ppm and 54750ppm LC$_{50}$ dosage respectively under contact and feed. Dipterans, Hymenopterans, Hemipterans and Coleopterans which are reported to cause significant crop losses in Sri Lanka. CNSL's repellent effect, toxicity for insect pests, it also has antifungal properties that help to thwart the proliferation of pathogenic fungi that causes diseases in crops. CNSL is currently used as fuel, but CNSL extract has potential to be used as organic pesticide which is generated through biproduct and alternative to synthetic pesticides. Extraction difficulties and farmers' lack of knowledge also hinder their widespread acceptance of the CNSL. Most of researches had conducted with synthetic chemical compounds which increase the effect of the Anacardic acids, Cardanol, and Cardol. Therefore, further researches are recommended to determine the effectiveness and formulation of CNSL without addition of synthetics and as cost-effective, sustainable organic pesticide.

Keywords: Biopesticide, Cashew Nutshell Liquid, Neurotoxins, Organic farming

Abstract No: 45

A Study of Applied Artefacts Made from Eco-Friendly Raw Materials in Low-Country Temple Murals

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Since ancient times, humans have created tools to simplify daily life, often using natural and environmentally friendly raw materials. Unlike today's consumerist societies, where household appliances are primarily produced from plastic and contribute heavily to water and soil pollution, ancient communities relied on sustainable resources. This study examines temple murals to explore how ancient Sri Lankan societies used appliances made from eco-friendly materials, highlighting sustainable practices that remain relevant today. The research aimed to identify household artefacts crafted from natural resources in ancient societies and to consider how such practices might be revived for contemporary use. A qualitative approach was employed through field investigations at five randomly selected 19th-century low-country temples. Systematic observation of murals enabled the identification and classification of thematic representations. Primary data were drawn from nine narrative murals depicting the *Buddha Charitaya* and other episodes from the Buddha's life, together with eight *Jataka* stories. Secondary data were sourced from scholarly works on ancient artefacts, waste management and Kandyan temple mural traditions. An iconological analysis revealed a wide variety of eco-friendly artefacts made from clay, wood, palm leaves and glass. Careful study of lines, colours and shapes allowed the recognition of specific materials. Artefacts were grouped into kitchen implements, household items and tools used for travel and food transport. Examples included clay pots, coconut-shell spoons, palm-leaf packaging, reed containers and glass vessels reflecting colonial influence. Domestic tools such as the *Hiramanaya*, *Mirisgala* (chilli-grinding stone), *Wangediya* (mortar), brooms, wooden chairs and tables were also depicted. The findings demonstrate that natural materials such as wood, clay, palm leaves and glass are reusable, biodegradable and harmless to biodiversity. To popularise such sustainable alternatives today, awareness campaigns through social media can highlight the environmental dangers of plastics. Further research is needed to enhance manufacturing processes and overcome limitations associated with traditional materials.

Keywords: Eco-friendly materials, Environmental sustainability, Household appliances, Temple murals, Traditional technology

Abstract No: 46

Feasibility of Utilizing Shark Skin in the Apparel Industry of Sri Lanka: From Waste to Value and Sustainability of Resource Harvest

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This study explores the technical, environmental, and economic feasibility of utilizing shark skin, a considerably discarded by-product of Sri Lanka's fisheries sector, as a sustainable raw material for the apparel and leather goods industries. Based on analysis of shark catch data from 2016 to 2023, accessed through the Department of Fisheries and Aquatic Resources, the study estimates an average annual skin yield of over 20,000 kg from species such as blue and silky sharks in 2023, which consistently dominate landings. A mixed-methods approach was applied; the quantitative component included skin yield estimations, structured questionnaires with 48 fishermen from Beruwala, Negombo, and Galle, along with purposive sampling of 25 leather processors, sellers, and exporters. The qualitative component comprised international market data analysis from secondary resources. In addition, semi-structured interviews were thematically analyzed, and triangulation was used to ensure the reliability of findings. Results revealed low initial awareness yet higher willingness to engage when commercial and environmental benefits are clarified. Shark skin, known for its unique texture, durability, and fiber strength, shows compatibility with existing leather processing infrastructure, though minor adaptations are needed. A comparative cost analysis indicates that while processing costs are higher due to specialized handling, the premium pricing of shark leather products, ranging from USD 79–1,000 globally, offsets these expenses, especially in luxury and eco-fashion markets. The circular economy model is emphasized, transforming marine waste into high-value, biodegradable products while reducing pressure on traditional leather sources. Regulatory alignment is demonstrated through CCRF Article 7.2.2(g), supporting the full use of legally caught sharks. The study concludes that although Sri Lanka has not explored this opportunity, with targeted investment, capacity building, and regulatory support, shark skin leather could serve as a novel, eco-conscious material enhancing product diversification and sustainability in Sri Lanka's apparel exports while encouraging the sustainable use of shark catch by reducing waste and making full use of derived by-products.

Keywords: Circular economy, Exotic leather, Fisheries by-product, Shark skin leather, Sustainable fashion, Sustainable leather

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Abstract No: 47

Paddy Harvest under Uncertain Rainfall: The Impacts of Seasonal Rainfall Variations on Paddy Cultivation in the Anuradhapura District, Sri Lanka

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Paddy, the staple crop in Sri Lanka's dry zone, particularly in the Anuradhapura district, faces significant threats due to climate change-induced rainfall variability. Current studies often ignore local impacts, focusing only on district-level analyses that compare rainfed and irrigated systems or exclude future rainfall projections, which reduces their usefulness for local policy planning. Addressing this gap is crucial for understanding how rainfall variability affects paddy farming at a more detailed spatial level, leading to more targeted strategies. This study examines current and future vulnerabilities of rainfed, major, and minor irrigated paddy systems at the Divisional Secretariat (DS) level across 22 DSDs in Anuradhapura during the Maha and Yala seasons. Rainfall data (2013–2023) of 17 weather stations from the Department of Meteorology were gathered and interpolated using ArcGIS. Future rainfall projections (2041–2060, SSP245 scenario) were obtained by downscaling the MPI-ESM1-2-HR GCM model from WorldClim, while harvested extent data were obtained from the Department of Census and Statistics. Vulnerability was quantified by combining normalized sensitivity (regression slope) with normalized exposure (coefficient of variation for current rainfall and absolute percentage change for future). Results show that, currently, minor irrigated (6 DSDs) and rainfed (5 DSDs) systems in Maha are highly vulnerable (index > 1.21), with Horowpothana (slope 4.44) among the most impacted. In Yala, minor irrigated systems are currently the most susceptible. Future forecasts suggest Maha rainfall could decrease by 25% in western DSDs, pushing 11 rainfed DSDs (e.g., Rajanganaya, Nochchiyagama) into high/very high vulnerability categories. In Yala, future rainfall might increase by 20-25% in the northeast DSDs, but minor irrigated systems stay most at risk due to their high sensitivity to extremes. Overall, major irrigated systems tend to be more stable. These findings highlight the importance of prioritizing rainfed and minor irrigated systems in local adaptation efforts and policy development.

Keywords: Climate change, Paddy cultivation, Rainfall variability, Vulnerability

Abstract No: 48

Effect of Plant Growth Regulator '2-Bromo-(1h)-Indole-3-Carboxaldehyde' on Seed Germination, Growth & Yield of Tomato (Lycopersicon esculentum L.)

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Tomato *(Lycopersicon esculentum* L.) has great economic importance in the horticultural and medicinal fields. Therefore, the present study was conducted to enhance seed germination and fruit yield of tomato using plant growth regulator 2-Bromo-(1H)-indole-3-carboxaldehyde. Well-matured seeds extracted from newly harvested fruits in 2023 and stored for more than three years were collected for seed germination testing. The seeds were treated with 1 ppm, 0.1 ppm, 0.01 ppm and 0.5 ppm of 2-Bromo-(1H)-indole-3-carboxaldehyde concentrations and seeds without any treatments were used as the control. Seeds were arranged in containers for 7 days and three replicates were used. Plant height, fruit weight, fruit width, pericarp thickness and yield were recorded at 4th, 8th and 12th weeks after planting and at the final harvest stage. Results showed that newly harvested seeds had significantly ($p < 0.05$) higher germination compared to old seeds. The application of 2-Bromo-(1H)-indole-3-carboxaldehyde increased seed germination compared to the control, while there were no significant differences between the concentrations. The interaction between concentrations and the age groups were also not significant ($p > 0.05$). The most suitable concentrations were found as 0.1 ppm to 1 ppm of 2-Bromo-(1H)-indole-3-carboxaldehyde. In the field experiment, 0.1 ppm and 1 ppm 2-Bromo-(1H)-indole-3-carboxaldehyde and 25% reduced fertilizer increased growth and yield of tomato. Higher yield was observed at 0.1 ppm concentration at 25% reduced fertilizer application, while it was at 1 ppm concentration for 100% fertilizer application, indicating the interaction effect of growth regulator and the fertilizer levels.

Keywords: Concentrations, Reduced fertilizer, Seed age

Abstract No: 49

Optimization of Hydrolysis Conditions Using Response Surface Methodology to Maximize Reducing Sugar Yield from *Panicum maximum* (Guinea grass) Collected in Sri Lanka

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Lignocellulosic biomass has gained significant global attention due to its potential as a sustainable alternative to fossil fuels. This study aimed to optimize the acid hydrolysis conditions to maximize reducing sugar yield from Panicum maximum plants collected in the Badulla District, Sri Lanka. While many studies have investigated hydrolysis of various lignocellulosic biomasses, few studies have focused specifically on Panicum maximum in a Sri Lankan Context. The whole plant composition was determined using a modified Van-Soest method. Hydrolysis was performed in a Teflon-lined hydrothermal reactor with 10% (w/v) solid-liquid ratio, using H_2SO_4 as the catalyst. Hydrolysis parameters considered were temperature (120-180 °C), H_2SO_4 concentration (2-10% v/v), and reaction time (10-60 min). Reducing sugar was quantified with the 3,5-dinitrosalicylic acid (DNSA) method after the hydrolysis process. Response Surface Methodology (RSM) was employed for optimization using Central Composite Design (CCD) with replicated center point, and statistical analysis was performed using the Design-Expert Software. The biomass composition was cellulose ($35.85 \pm 2.88\%$), hemicellulose ($22.25 \pm 0.59\%$), lignin ($6.47 \pm 0.85\%$), ash ($6.25 \pm 0.33\%$), and soluble ($29.17 \pm 3.15\%$) (w/w). This higher holocellulose content (58.10% w/w) and low lignin were ideal for hydrolysis. ANOVA indicated that temperature (*P=0.001*) and H_2SO_4 concentration (*P=0.001*) significantly influence the hydrolysis process, while reaction time (*P=0.612*) was not significant as a single factor, but their interaction effect had a significant influence. The optimized acid hydrolysis conditions were 180 °C, 2% v/v H_2SO_4, and 32 min, with a predicted reducing sugar yield of 21.43% (w/w). Experiment validation yielded 21.68 ± 0.05 % (w/w), confirming the model accuracy. This study showed the potential of Panicum maximum as a promising lignocellulosic biomass for reducing sugar production.

Keywords: Acid hydrolysis, Central composite design, Lignocellulosic biomass, *Panicum maximum*, Reducing sugar, Response surface methodology

Abstract No: 50

A Study on Impact of Cultural Ecosystem Services on Real Estate Value with Special Reference to Bellanwila-Attidiya Urban Wetland of Sri Lanka

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This study explored the economic valuation of cultural ecosystem services provided by wetlands, with a specific focus on the Bellanwila-Attidiya Wetland in Sri Lanka. Wetlands offer various ecosystem services, yet the depletion of wetlands remains a global environmental issue. This is mainly due to a lack of awareness of the value of cultural ecosystem services. Many past studies have assessed the value of provisioning, regulating, and supporting services, but few have examined cultural ecosystem services. This research aimed to address this gap by identifying prominent cultural services and examining their influence on the value of nearby real estates. The study was conducted for seven months and focused on 36 two-storey houses located within a one-kilometer radius of the wetland. Data was collected through questionnaires and formal and informal discussions with residents and stakeholders. Primary and secondary data were used to identify and prioritize ecosystem services as qualitative data, while only primary data were used for economic valuation as quantitative data. Data was analyzed using descriptive and inferential statistical methods. A hedonic pricing model based on multiple linear regression was developed to estimate how structural and locational attributes influence house prices. The study also used correlation analysis to explore relationships between specific attributes and housing prices. Findings revealed that structural attributes such as the number of bedrooms and architectural design significantly influenced house prices, whereas the aesthetic value of the wetland had no measurable impact. The model developed for identifying the impact of ecosystem services on real estate value in this study can be adapted to other locations using relevant local attributes. This research is valuable for urban planners, policymakers, and real estate professionals by highlighting both the importance of cultural ecosystem services and the factors influencing housing values in wetland areas.

Keywords: Cultural ecosystem services, Economic valuation, Ecosystem services, Real estate, Wetland

Abstract No: 51

Weaving Cultures, Sustaining Futures: A Cross-Cultural Handloom Belt Innovation for Environmental and Craft Resilience

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This study investigates the underexplored potential of Sri Lankan handloom weaving as a catalyst for sustainable fashion innovation through the development of a women's belt collection inspired by cultural diversity and informed by cross-cultural aesthetics and ethical production. Using a practice-based, primary research methodology, the study collaborated with five rural artisans from the Kegalle Handloom Community, purposively selected for their specialized weaving expertise, to co-create belts from natural fibers and plant-based dyes. Data collection was undertaken through field-based observations, participatory design workshops, and iterative prototyping, enabling the integration of heritage weaving methods with contemporary fashion silhouettes identified via global brand gap analysis (e.g., Gucci). The design approach incorporated zero-waste cutting, slow fashion principles, and ergonomic considerations to ensure functional and sustainable outcomes. Findings demonstrate that low-energy weaving significantly reduces carbon emissions, while the project's collaborative model contributes to community development through skill revitalization, increased artisan income, and cultural heritage preservation. Furthermore, the resulting collection advances circular design by producing repairable, long-lasting products and fosters craft appreciation among youth, designers, and consumers, thereby promoting mindful consumption. This research establishes a replicable, culturally embedded model for eco-conscious fashion that aligns with global sustainability goals while safeguarding intangible cultural traditions, positioning the Sri Lankan handloom belt as both a cultural emblem and a driver of environmental responsibility.

Keywords: Cultural heritage preservation, Circular design systems, Cross-cultural design integration, Handloom weaving, Sustainable fashion innovation

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Abstract No: 52

Balancing Nature and Livelihood: Community Insights into Ecotourism Development in Rural Sri Lanka

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Ecotourism is one of the most important mechanisms of sustainable rural development especially in biodiverse and culturally rich places. Though the discipline has earned itself considerable attention, research tends to lack the opinions of local populations, who are also known as the caretakers of these natural resources. The gap is filled in the present study by evaluating the perceived effects of ecotourism on the Meemure community with a specific reference to economic gains, infrastructural issues, and livelihoods of the local community. The main aim is to examine the interaction of income opportunities based on ecotourism, the perceptions of satisfaction based on ecotourism, the attainment of adequate infrastructure, and the negative local experiences to produce the communal perception about ecotourism. A survey that was made with the assistance of seven-point Likert scale was sent to the randomly chosen 115 residents. The Structural Equation Modeling was used to check five hypotheses. Constructs in the study were Income Opportunities through Ecotourism, Perceived Ecotourism Satisfaction, Lacking Infrastructure, and Negative Situations among the Local Residents. The findings prove that there is a strong positive correlation amid income and satisfaction, which shows that the higher the income, the higher the level of satisfaction with ecotourism. Lack of infrastructures, on the other hand, has an adverse effect on satisfaction, which shows the need to focus on direct infrastructure content. Although income was ascertained to moderate infrastructural deficiencies and deleterious local experiences, the determined relation between negative experience and satisfaction was not significant at the statistical level. According to these findings, it can be concluded that because economic benefits of ecotourism lead to community satisfaction and resilience, there is the issue of bottleneck related to inadequacy in infrastructure. The research also suggests a need of comprehensive ecotourism approach in which the economic, environmental, and social-culture aspects are integrated.

Keywords: Community-based tourism, Environmental sustainability, Local livelihoods, Rural development, Tourism infrastructure

Abstract No: 53

Scientific Validation of Sri Lankan Clay for Sustainable Wellness and Fashion Innovation: A Pathway to Empowering Underprivileged Craft Communities

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This study scientifically validates the potential of Sri Lankan clay as an innovative material for integration into the wellness wear category, combining therapeutic functionality with sustainable fashion principles. Employing a primary, laboratory-based experimental methodology, clay samples sourced from Molagoda and Ridi Bendi Ela were refined to <100 μm particle size and thermally stabilized through controlled firing at 850–950 °C. Comprehensive testing of thermal conductivity, bacterial inhibition, surface pH, water absorption, and biodegradability was conducted, with results benchmarked against polyester and herbal cotton. Sri Lankan clay textiles exhibited superior thermal insulation (2.8 °C gain), notable antibacterial efficacy (60%), skin-compatible pH (6.4), and exceptional biodegradability (92% within 90 days), confirming their suitability for prolonged skin contact and environmentally responsible apparel production. Field engagement with rural artisan communities demonstrated the practicality of adopting clay-integration techniques, fostering sustainable income generation, skill enhancement, and preservation of traditional craft knowledge. The convergence of scientific validation, wellness-oriented functionality, and inclusive community participation positions Sri Lankan clay textiles as a replicable, culturally grounded innovation model for eco-conscious fashion systems that advance human well-being, support circular design, and empower marginalized craft producers.

Keywords: Clay-based textiles, Community empowerment, Functional apparel, Sustainable fashion innovation, Wellness wear

Abstract No: 54

Class Transformation and Spatial Contradictions: Neoliberal Urbanism and the Reconfiguration of Informal Settlements in Sri Lanka

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This research examines the transformation of informal settlements in post-war Colombo, challenging conventional narratives of urban marginality through an in-depth case study of 'Keshtharama' settlements. Following Sri Lanka's thirty-year civil war, neoliberal economic reforms and urban beautification agendas fundamentally reshaped the city's informal landscapes, creating complex dynamics of exclusion and empowerment. Using a qualitative approach comprising focus group discussions, key informant interviews, and policy analysis, this study investigated how class structures, livelihoods, and spatial identities evolved under shifting political-economic conditions. The data were analyzed using Lefebvre's theory of the production of space and Harvey's theory on neoliberal urbanism. The research reveals significant intra-informal class transformation, where residents strategically mobilized economic, social, and cultural capital through education, savings collectives, and political affiliations. Key findings demonstrate that despite social stigmatization, households achieved remarkable upward mobility, acquiring higher incomes, luxury goods, and educational access while remaining in spatially marginalized areas. This challenges conventional formal vs. informal and center vs. periphery binaries, revealing urban space as contested terrain shaped by lived experiences and class negotiations. The study identified a 'spatial-economic paradox' where residents experience economic advancement while maintaining stigmatized spatial identities. The research contributes to Southern urban theory by positioning informal settlements not as zones of deprivation but as complex socio-spatial constructs characterized by power, resistance, and adaptive survival strategies. These findings complicate binary notions of formal versus informal sectors and reveal how neoliberal urbanism simultaneously displaces and enables, depending on residents' navigation of informal networks and spatial locations. The study calls for inclusive, participatory urban governance approaches that recognize informal settlements as organized, evolving spaces essential to sustainable urban futures. By documenting internal class stratification within informal settlements, this research contributes to broader debates on spatial justice, the right to the city, and postcolonial urbanism in the Global South.

Keywords: Class transformation, Neoliberal urbanism, Post-conflict cities, Spatial justice, Urban informality

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Abstract No: 55

Love for the Land: Reawakening Indigenous Eco-Relationships Through Emotional and Cultural Reconnection

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In a world increasingly disconnected from nature, traditional models of environmental education often overlook emotional, cultural, and spiritual dimensions that shape sustainable behaviour. In contrast, indigenous communities in Sri Lanka and beyond have long cultivated a profound sense of emotional kinship with nature, rooted in rituals, stories, and intergenerational knowledge systems. This narrative review explores how reviving such indigenous eco-relationships, anchored in love, reverence, and collective memory, can mobilize pro-environmental behaviour through community education. Drawing from literature in environmental psychology, indigenous studies, and cultural anthropology, this review highlights how Buddhist ecological ethics, rituals surrounding sacred trees, and traditional tank-based irrigation systems reflect a deep-seated love for the land. It also examines practices like 'Wew Bandi Rakma' and 'Pattini worship', where nature is personified and emotionally honoured. Literature was selected using purposive sampling across Scopus and Web of Science databases, focusing on studies linking emotion and traditional ecological knowledge from 2005 to 2024. While most studies highlight the strengths of emotional ecology, critical limitations such as the declining transmission of indigenous knowledge and challenges of adapting ritual-based practices into formal curricula are acknowledged. The traditions explored are interpreted through Fredrickson's Broaden-and-Build Theory of Positive Emotions, Wilson's Biophilia Hypothesis, and Place Attachment Theory, illustrating how emotional states like love, awe, and gratitude enhance ecological identity and encourage long-term behavioural commitment. Emerging insights suggest that emotional reconnection, especially love for nature as seen in indigenous worldviews, enhances ecological identity, stewardship, and community-led conservation. The review proposes a culturally sensitive educational model that includes elder storytelling, nature-based rituals, and emotionally intelligent leadership, and recommends pilot testing these components within rural school systems and community learning spaces. By centering love as both a psychological and cultural force, this study offers an alternative to purely cognitive or technocratic approaches to behaviour change, promoting sustainability through spiritually resonant, emotionally grounded community education.

Keywords: Environmental love, Emotional ecology, Indigenous knowledge, Sacred rituals, Narrative review, Sri Lanka

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Abstract No:56

Awareness, Attitudes, and Behavioral Trends of International Tourists Toward Responsible Tourism: A Case Study in Udawalawa Wildlife Destination, Sri Lanka

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Responsible tourism plays a pivotal role in promoting environmental conservation, cultural preservation, and community well-being through sustainable travel practices. As one of Sri Lanka's premier wildlife tourism destinations, Udawalawa faces increasing pressure to balance ecological conservation with the rising number of international tourist arrivals. This study explores the awareness, attitudes, and behavioral patterns of international tourists toward responsible tourism at Udawalawa. Data was collected from a sample of 302 international tourists using a pre-validated, self-administered questionnaire from January to February 2024, with participants selected through simple random sampling. Descriptive statistics and the Kruskal-Wallis test were employed for analysis. The majority of respondents were female (58.9%), over the age of 60 (43.7%), and predominantly from European countries (87.1%). Educational attainment was mainly at the secondary (30.8%) and tertiary (34.4%) levels. Overall awareness of responsible tourism was remarkably high, with 92.7% of participants indicating familiarity with the principles of responsible tourism. Tourists demonstrated consistently positive attitudes toward responsible tourism across all age and gender groups, reflected by a mean score of 37.10 on a 5-point Likert scale. Perceptions of the responsible tourism environment at Udawalawa were also favorable, with a mean score of 38.65 on a 7-point Likert scale. Notably, 65% of participants reported involvement in responsible tourism activities, indicating a growing commitment to environmentally and socially conscious travel behaviors. The results suggest a supportive environment for advancing responsible tourism in Udawalawa, underscoring the need for targeted educational initiatives and stakeholder engagement to foster long-term sustainability. Enhancing community-based tourism and reinforcing responsible practices can position Udawalawa as a model for sustainable wildlife destinations in the region.

Keywords: Community development, Environmental protection, Sustainability, Tourism in Sri Lanka

Abstract No: 57

Cultivating Sustainability: Comparative Study of Urban Agriculture in Bengaluru, India and Aachen, Germany

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Urban agriculture (UA) is increasingly viewed as a vital strategy for promoting sustainability and enhancing green infrastructure in cities across diverse climatic and socio-cultural contexts. This study presents a comparative analysis of UA in Bengaluru, India, and Aachen, Germany, focusing on its composition, characteristics, types, and seasonal patterns, as well as its broader planning implications. Employing a mixed-methods approach - comprising semi-structured interviews, key informant interviews, and field observations - the research investigates how environmental conditions, cultural values, and governance frameworks influence urban farming practices. In Bengaluru, UA is predominantly informal, decentralized, and practiced throughout the year, supported by the city's tropical climate. Common crops include tropical fruits such as mango and guava, and culturally significant vegetables like bitter gourd, tomato, chilli, brinjal, lemon, okra etc. In contrast, Aachen's temperate climate shapes structured and seasonal cultivation patterns, with allotment gardens and municipal-supported projects producing apples, berries, kohlrabi, and red cabbage. Despite their differences, both cities demonstrate that UA provides multiple co-benefits: enhancing green cover, regulating urban microclimates, supporting food security, and community interactions. The study highlights UA as a crucial yet underutilized component of urban green infrastructure. While Aachen illustrates strong policy integration and planning support, Bengaluru showcases adaptability and grassroots innovation. The findings argue for context-sensitive strategies to mainstream UA within urban sustainability agendas. It calls for context-sensitive strategies to embed UA within urban sustainability frameworks in cities across diverse regions.

Key words: Aachen (Germany), Bengaluru (India), Green infrastructure, Sustainable cities, Urban agriculture

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Abstract No: 58

Public Awareness and Behavioural Responses to Plastic Waste Pollution in Urban Areas: A Case Study of Colombo

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Plastic Pollution (PP) has led to rapid development around disposable plastic production in the past 70 years and has become one of the pressing environmental issues. In rapidly urbanizing cities like Colombo, PP is an escalating crisis. The focus of this study is to assess the level of awareness of the impact of plastic on society and the environment, as well as the behavioural responses of Colombo Municipal Council (CMC) residents on plastic waste management. The research's objectives are to evaluate the awareness level of residents of Colombo to plastic pollution and their plastic consumption behaviour, and to identify the main factors determining the change of behaviour, and the perceived barriers influencing that change. This study adopts a qualitative dominant mixed-method approach and using the case study of CMC by focusing Colombo 1 to 15. Utilizing purposive sampling, primary data were collected by conducting two online tools: a qualitative questionnaire (n=50) based on reaching thematic saturation, and a structured ticking questionnaire (n=51) selected to ensure a comparable sample size for quantifying behavioural patterns. The research revealed great levels of awareness about the environmental and social consequences of plastic waste among residents of the CMC, with 58.8% of respondents indicating that they were either extremely or very aware of those facets. Awareness, however, did not always translate into sustainable behaviour, which indicates a considerable intention–behaviour gap. The most prominent source of awareness was social media, followed by traditional media. Household behavioural responses varied: Complete avoidance of single-use plastics was nevertheless low. Despite 86% of respondents stating that they separate plastics, most of this waste is deemed unrecyclable or uncollected due to lacking access to a formal recycling system, further perpetuating behavioural change. Significant barriers to sustainable behaviours, as reported by respondents, include lack of infrastructure, lack of recycling systems, weak policies, and low perceived behavioural control. The implications of these findings are that systemic changes are required for awareness to be converted to action, and infrastructure needs to be improved, in addition to policies and community engagement for sustainable behavioural change.

Keywords: Awareness, Behavioural responses, Colombo Municipal Council, Plastic pollution

Abstract No: 59

Legal and Policy Analysis of Deforestation and Land Degradation: A Comparative Study of Environmental Governance in Sri Lanka and New Zealand

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Deforestation and land degradation have been identified as major concerns that hinder environmental stability and ecological integrity in a global context. This has been a common phenomenon in both developed and developing regions, regardless of their socio-economic status. This study focuses on the comparative legal and policy analysis of environmental governance between Sri Lanka and New Zealand in terms of mitigating deforestation and land degradation. It aims to identify the strengths and weaknesses of two legal and policy systems and to suggest a unified system that aligns with international environmental commitments. The analysis discloses that New Zealand comparatively has a stronger environmental governance system which is primarily anchored by the Resource Management Act 1991, judicial supervision and the role of Maori iwi. The ecosystem legal personhood can be identified as an ideal example of progressive legislative novelties that demonstrate the success of New Zealand's approach. Although having a comprehensive legal and policy framework which has been existing since the colonial era, the Sri Lankan counterpart shows a weaker association between substantive law and its implementation. Adding to this fact, unlike New Zealand, Sri Lanka has failed to integrate traditional and community-rooted environmental conserving strategies into the legal framework, such as the customary forest conservation and tank cascade model. Through the methodological approach of doctrinal and policy analysis equipped with prominent case studies and international environmental policies, this paper argues that environmental justice can only be achieved by integrating community knowledge into the legal and policy frameworks of a country. This approach has been proven to be efficacious in different socio-economic contexts in terms of alleviating deforestation and environmental degradation.

Keywords: Deforestation, Environmental governance, Sri Lanka, Land degradation, New Zealand

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Abstract No: 60

Reimagining Waste Management: A Global Derivation of Circular Economy Practices and Sustainability Models

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The escalating global waste crisis has highlighted the need to deviate beyond the conventional linear "take-make-dispose" mentality, towards circular economy (CE) models that prioritize sustainability, material recovery efficiency and methodical resilience. Within this context, integrating product-lifecycle thinking ensures environmental impacts are minimized from resource extraction to end-of-life, while redesign principles enable extended usability and waste reduction. This study examines global waste management strategies through the lens of CE, supported by robust waste management infrastructure, the systems and facilities that enable efficient collection, segregation, recycling, and resource recovery. A systematic literature review was conducted, focusing on studies from 2015 to 2024 that addressed municipal waste, industrial symbiosis, plastic circularity, waste minimization and policy integration. Successful implementations include the Netherlands' Zero-waste goal, Japan's sound Material-Cycle society, Sweden's advanced Waste-to-Energy systems and Amsterdam's Doughnut strategy by economist Kate Raworth. However, many developing nations with dense populations face challenges due to weak policy enforcement, limited infrastructure, and low public awareness. For example, in Deonar, located in Mumbai, India, informal settlements have been built and grown on poorly managed waste grounds, resulting in extreme living conditions with many adverse health effects. These areas often lack proper waste segregation systems, leading to continuous waste over-generation, open dumping and environmental degradation. In contrast, Sri Lanka is witnessing promising innovations to support circularity over the past few years. Notably, many large conglomerates in the country are increasingly incorporating sustainability into their operations, aligning business goals with environmental and social impact. In conclusion, a truly sustainable and equitable waste management system requires an integrated approach that aligns technological innovation, inclusive governance, and global stability within safe and just environmental thresholds.

Keywords: Circular economy, Circularity, Innovation, Sustainability, Waste

Abstract No: 61

Analyzing the Accomplishment of Sustainability Goals in the Development of Techcity in Sri Lanka- A Special Reference to The Homagama Urban Area

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Technology city development has become a booming trend in modern infrastructure, with "sustainability" emerging as a core guiding principle in TechCity projects. While numerous studies have examined this topic, a gap remains in evaluating the extent to which such initiatives have achieved sustainable cities and communities. This study examines the achievement of sustainability goals—specifically, sustainable cities and communities—in the TechCity development in Sri Lanka (Homagama area) across environmental, social, and economic dimensions. The target population consisted of middle-layer employees in the technology city development industry, selected through purposive sampling to ensure relevant professional insight. Data were collected from 150 respondents using a self-administered questionnaire. The use of purposive sampling ensured that respondents had relevant professional expertise, thereby strengthening the validity and generalizability of the findings. Simple linear regression analysis revealed that higher levels of TechCity development are associated with higher levels of perceived sustainability in all three contexts, meaning the variables tend to increase together. However, one-way ANOVA results showed that this association is not statistically significant for environmental sustainability, while it is strongly significant for economic and social sustainability. These findings indicate that, although TechCity development contributes meaningfully to economic and social goals, its environmental impact remains limited. Consequently, the study recommends targeted policy and planning interventions to strengthen environmental outcomes, ensuring that TechCity development not only drives economic growth and social well-being but also achieves genuine environmental sustainability in similar urban development projects.

Keywords: Development of TechCity, Sustainability, Sustainable cities, Sustainable communities

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Abstract No: 62

Digital Defenses for a Greener Future: Integrating Cybersecurity into Climate Governance to Safeguard Clean Technologies

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The digitalization of climate adaptation systems such as AI-based monitoring, smart water networks, and renewable energy platforms is vital for sustainable development. However, it exposes clean technologies to cyber threats that may destabilize infrastructure and compromise data. This study observes how climate governance can build its capacity to integrate cybersecurity in protecting clean technologies against hybrid environment-digital threats. Based on resilience theory and governance fragmentation, a qualitative comparative policy analysis was conducted in Sri Lanka, Kenya, and the Philippines. In each country, a systematic assessment of publicly available national cybersecurity strategies, climate adaptation policies, sectoral regulations were considered and two case studies of cyber incidents affecting smart water and solar energy infrastructures were conducted. The thematic content coding analysis yielded three systemic governance challenges: a siloed regulatory system, reactive cybersecurity restricted to traditionally based sectors, and weak safeguards of Indigenous and community-level environmental data sovereignty. To mitigate these risks, the research offers an Environmental Cyber Resilience (ECR) framework featuring: (1) institutional cross-sectoral governance for environmental and cybersecurity actors, (2) agile cyber risk mapping of clean technological innovations, (3) ethical data sovereignty protocols to protect vulnerable populations, and (4) alignment with global digital governance standards (e.g., NIST CSF, ISO 27001). Limitations include reliance on policy documents and publicly reported incidents, which may omit sensitive national strategies. This research presents a novel policy integration model for climate-vulnerable contexts, focusing on mutual aid toward Sustainable Development Goals 9 (Industry, Innovation, and Infrastructure), 13 (Climate Action), and 16 (Peace, Justice, and Strong Institutions).

Keywords: Climate-smart innovation, Green digital transformation, Integrated risk management, sustainable cyber governance, Resilient critical systems, Smart infrastructure security

Abstract No: 63

Reimagining Waste Governance: Rights-Based and Community-Centered Pathways Toward Circular Urban Futures

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Accelerated urbanization and rising affluence have led to an unprecedented surge in waste generation, straining conventional disposal infrastructures and reinforcing environmental injustices across the Global South. This paper interrogates the systemic barriers to sustainable waste governance—including governance asymmetries, spatial constraints, fiscal deficits, and behavioural inertia—through the integrative lenses of political ecology and legal empowerment. By conducting a comprehensive bibliometric analysis of Scopus-indexed literature (2015–2024), the study surfaces trends in scholarship while foregrounding empirical best practices from India, Indonesia, Ghana, South Africa, Brazil, and Ethiopia. Drawing upon community-led models such as kitchen-pit composting, stem fermentation, informal-sector recycling, eco-sanitation, and faith-based organic recovery, the paper articulates how low-cost, locally-adapted interventions can realign material flows with circular economy principles. Situating these practices within the normative frameworks of the Universal Declaration of Human Rights (1948), the Forest Rights Act of India (2006), and the 1972 United Nations Conference on the Human Environment, the paper underscores the legal and moral imperatives of equitable waste governance. It proposes the integration of Extended Producer Responsibility (EPR), participatory monitoring, open data regimes, and blended finance as critical enablers of zero-waste transitions. The findings offer scalable blueprints for scholars, policymakers, and practitioners committed to public health, climate resilience, and ecological justice in urban and peri-urban contexts.

Keywords: Bibliometric, Climate resilience, Ecological justice, Sustainable, Waste governance

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Abstract No: 64

Efficiently Managing Waste Fabric Cuts in the Sri Lankan Apparel Industry

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Apparel industry has served as the backbone of Sri Lanka's economy for decades, exporting clothing in large quantities and employing a large portion of the Sri Lankan population. Fabrics manufactured from a combination of cotton and synthetic components are particularly the most critical sustainability challenge due to the many recycling needs and requirements. Previous researchers have examined that apparel waste has received limited attention in developing countries. The goal of this research is to find ways for efficiently managing fabric waste cuts in Sri Lanka's apparel sector. The main objectives are to identify the primary resources of fabric waste cuts, determine the phases of the apparel life cycles that gain waste and implement strategies, identify the feasible options for the Sri Lankan apparel industry, discuss the feasibility of using 100% natural fiber for the industry, implement solutions using AI integrate blockchain applications to manage the fabric cuts, and propose a quick action plan for small, medium, and large-scale garments in Sri Lanka. Three site visits and ten interviews were undertaken to collect real-time data and suggest viable solutions to fabric cut waste in Sri Lanka's garment industry. The participants were selected based on their production scale, materials mix, information technology knowledge and the sustainability practices. The data was analyzed using thematic coding to identify challenges, feasibility constraints and opportunities. The main findings are to implement 100% natural fibers to the greatest extent possible, always adhere to closed-loop design principles, establish local mechanical recycling plants, use AI integrated with blockchain networks for traceability to improve transparency, and identify the challenges of implementing these solutions in the Sri Lankan garment sector. In conclusion, Sri Lanka may become the global apparel industry leader by 2030 through government investment in AI, Blockchain, smart design, and innovative recycling technologies that promote sustainability and global competitiveness.

Keywords: Artificial intelligence, Blockchain, Circular economy, Fabric waste, Sustainable

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Abstract No: 65

The Fate of Microplastics in Kurunegala Wastewater Treatment Plant: A Comprehensive Analysis from inflow to outflow

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Plastic particles less than 5 millimeters in size could be recognized as Microplastics (MPs), have emerged as a significant environmental pollutant. Due to their size, MPs can easily bypass filtration systems in wastewater treatment plants, leading to their widespread presence in aquatic environments. Understanding the fate and behavior of MPs in wastewater treatment processes is crucial for developing effective strategies to mitigate their environmental impact. For the first time in Sri Lanka this study analyzes the fate of MPs in a wastewater treatment plant Kurunagala, Sri Lanka. This wastewater treatment plant consists with seven tank units as grit chamber, balancing tank, anoxic tank, aeration tank, sedimentation tank, disinfection tank and sludge tank. Water samples were taken from all tanks for analysis except grit chamber and sludge tank for ten consecutive days. Recommended H_2O_2 digestion protocols were followed to digest the samples and filter through 11μm filter papers and visual identification techniques were carried out to quantify the MPs. Test results reveled that water samples obtain from anoxic tank contained significantly the highest concentration of MPs/L (6922.1 ± 61.76) followed by aeration tank (6229.8 ± 37.68 MPs/L), balancing tank (5241 ± 31.74 MPs/L) and sedimentation tank (4845.6 ± 29.44 MPs/L). Results suggest significantly the lowest concentration of MPs present in disinfection tank (609.7 ± 61.76 MPs/L). Removal of settled sludge and floating scum in sedimentation process could be the reason for less abundance of MPs in the disinfection tank. When considering the MPs concentration (MPs>11μm) of effluent from Kurunegala wastewater treatment plant approximately 88.37% reduction of MPs/L can be observed. Results indicate sedimentation is an effective measure to remove MPs from wastewater. However, to acquire higher efficiency in MP removal, more effective treatment methods should be implemented in Kurunagala wastewater treatment plant.

Keywords: Aquatic pollution, Microplastic, Sedimentation, Wastewater

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