


Faculty of Applied Sciences
Sabaragamuwa University of Sri Lanka

OUT OF THE PRESS
Our publications - December

Volume 2 Issue 11

06th January 2023



PEER-REVIEWED JOURNAL ARTICLES

Modelling Potential Soil Erosion and Sediment Delivery Risk in Plantations of Sri Lanka

Asha S. Karunaratne, Eranga M. Wimalasiri, Udara Piyathilake, Sunethra Kanthi Gunatilake, Nitin Muttill, and Upaka Rathnayake

ABSTRACT

The current trend in agricultural practices is expected to have a detrimental impact in terms of accelerating soil erosion. Assessment of the cumulative impact of various management strategies in a major plantation is a measure of the sustainability of soil resources. Thus, the current study aimed to develop the potential soil erosion map for a selected plantation (8734 ha in size) in tropical Sri Lanka using the Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) Sediment Delivery Ratio (SDR) model. The estimated mean annual soil loss rate of the selected plantation was 124.2 t ha^{-1} ranging from 0.1 to 6903.3 t ha^{-1} . Out of the total extent, $\sim 49.5\%$ of the area belongs to the low soil erosion hazard category ($0\text{--}5 \text{ t ha}^{-1} \text{ year}^{-1}$) while $\sim 7.8\%$ falls into very high ($25\text{--}60 \text{ t ha}^{-1} \text{ year}^{-1}$) and $\sim 1.3\%$ into extremely high ($60 < \text{t ha}^{-1} \text{ year}^{-1}$) soil erosion hazard classes. The rainfall erosivity factor (R) for the entire study area is $364.5 \pm 98.3 \text{ MJ mm ha}^{-1} \text{ hr}^{-1}$. Moreover, a relatively higher correlation was recorded between total soil loss and R factor (0.3) followed by C factor (0.2), P factor (0.2), LS factor (0.1), and K factor (<0.1). It is evident that rainfall plays a significant role in soil erosion in the study area. The findings of this study would help in formulating soil conservation measures in the plantation sector in Sri Lanka, which will contribute to the country's meeting of the UN Sustainable Development Goals (SDGs).

About the Journal

Soil Systems

Impact Factor – 4.9

<https://doi.org/10.3390/soilsystems6040097>

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Contamination and distribution of buried microplastics in Sarakkuwa beach ensuing the MV X-Press Pearl maritime disaster in Sri Lankan sea

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ABSTRACT

Abundance of buried microplastics in sand profiles and pellet pollution index at Sarakkuwa beach, at west-coast of Sri Lanka was studied as a case study due to the receipt of plastic nurdles and debris from the MV X-Press Pearl ship disaster in May 2021. Sand collected at 7 locations to a depth of 2 m in different depths for a beach segment of 200 × 25 m² during October 2021 and sand samples obtained from beach surface during March 2020 from the same location were analyzed for microplastics. Beach was contaminated with 2–5 mm sized partially pyrolyzed LDPE fragments and nurdles demonstrating a peak abundance of 13.3702 g/kg and 1 mm-500 µm sized LDPE fragments up to 2.0 m depth. High concentrations of Mo and Cr were observed in the sand collected in 2021. Sarakkuwa beach is critically polluted by nurdles, partially pyrolyzed microplastics, and toxic elements from ship disaster.

About the Journal

Marine Pollution Bulletin

Impact Factor – 7.001

<https://doi.org/10.1016/j.marpolbul.2022.114074>

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Vector transport of microplastics bound potentially toxic elements (PTEs) in water systems

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ABSTRACT

Microplastics can act as a vector to transport various organic and inorganic contaminants. Hydrophobic and hydrophilic organic contaminants tend to bind to microplastics due to their hydrophobicity and high surface area to volume ratio. Recent studies have focused their attention on evaluating the ability of microplastics to bind potentially toxic elements (PTEs). The co-occurrence of microplastics and PTEs may be facilitated by the ubiquitous presence of both in the environment. The metal adsorption of different microplastics has been investigated under different environmental factors and polymer properties to reveal possible interactions. The environmental factors such as solution pH, dissolved organics, dissolution media, and ionic strength have been studied the most and recognized as factors governing the adsorption of PTEs. Degree of aging and polymer type have been highlighted as the key polymer properties which influence the adsorption of PTEs. However, the effects may differ with different PTEs and environmental conditions. Though sorption capacities and mechanisms have been extensively studied, critical analysis of their behaviour in co-existence with other ions in aqueous media remains unexplored. This review focuses on critically assessing the partition coefficients between different microplastics and water for PTEs in the presence of various factors that influence the metal adsorption. Besides, postulated interactions for the adsorption of PTEs in the presence of dissolved organics, competitive ions, and different pH values are overviewed. Moreover, the associated health risks on biota and humans, when they are exposed to microplastics bound PTEs are also discussed.

About the Journal

Journal of the National Science Foundation
of Sri Lanka

Impact Factor – 0.682

<http://doi.org/10.4038/jnsfsr.v50i0.11240>

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Prevalence of Paternal Postpartum Depression in Anuradhapura District in Sri Lanka and Its Association with Maternal Postpartum Depression as a Risk Factor

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ABSTRACT

This study aimed to determine the prevalence of PPPD in Anuradhapura district, its association with maternal PPD, and relevant risk factors. Cross sectional study was conducted among fathers in Anuradhapura district having infants 1-5 months by giving questionnaire specifically developed for the study with Edinburgh postnatal depression scale (EPDS) and self-constructed questions. Out of 6324 fathers, 435 fathers and their partners were randomly selected and proportionately allocated to 5 Medical Officer of Health (MOH) areas. R Program and SPSS have used for the data analysis. Our results revealed that the PPPD prevalence is approximately 11% (95%CI: 8.08-14.67) based on cut off score of 7 points in the EPDS. PPPD was correlated with maternal PPD (OR 19.16, 95%CI 5.0473-85.1203), income decrement (OR 8.1571, 95%CI 2.4621-32.6289), increased time stayed at home in postpartum period (OR 3.7775, 95%CI 1.2365-13.8175). But other parameters such as infant's age, work time and number of children were not significantly influenced risk factors for PPPD. PPPD is prevalent in the Anuradhapura district and maternal postpartum depression has positively influenced. But currently, screening programmes for PPPD is lacking in Sri Lanka. Thus, these deficiencies urgently need to be addressed and should provide information and instructions to fathers regarding this new transition. However, these results need replication in more expanded case control study. Since the prevailing covid-19 pandemic at the time of data collection may have impacted the mental health of the fathers specially in countries like Sri Lanka, where mental health support is limited.

About the Journal

Journal of Family and Reproductive Health

<https://doi.org/10.18502/jfrh.v16i4.11351>

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BOOK CHAPTERS

Effects of Herbicides Application on the Sustainability of Tea Production in Sri Lanka

I. D. U. H. Piyathilake and E. P. N. Udayakumara

ABSTRACT

The chemical weed control (CWC) method is the most convenient and effective weed management method available in Sri Lankan tea plantations. Thus, the prime objective of this study is to assess the effects of herbicide application on the quality of tea and tea soil in terms of its toxic heavy metal contamination. The microwave digestion system and atomic absorption spectrometer (AAS) were mainly used to determine the levels of metal contaminations of fresh tea leaves/black tea and tea soils. The results revealed that Zn, Fe, and Pb of soils of herbicides applied tea land are significantly higher ($p < 0.05$) than the soils of herbicides-free tea land. Further, the Pb levels of green tea are slightly higher ($p < 0.05$) in herbicide-treated land. Ultimately it can be concluded that the long-term application of herbicides in tea plantations significantly affects the environment and human health. Also, it was reviewed that herbicides free integrated weed management (HFIWM) methods provide significant advantages that chemical weeding in terms of the sustainability of the tea industry in Sri Lanka.

About the Book

Lecture Notes in Civil Engineering

Publisher: Springer

https://doi.org/10.1007/978-981-19-4715-5_17

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Biological Treatment of Endocrine-Disrupting Chemicals (EDCs)

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ABSTRACT

Endocrine-disrupting chemicals (EDCs) such as natural estrogens, bisphenol A, and nonylphenol are widely spread in the environment due to improper waste disposal. Emergence of EDCs mainly occurs from widely used consumer products like pharmaceuticals, personal care products, plastic preservatives, pesticides, and industrial lubricants. Both acute and chronic exposure of EDCs may influence the endocrine system of organisms arising severe health issues, thereby ultimately resulting in an imbalanced ecosystem. Degradation of EDCs has been largely studied in flocculation, precipitation, adsorption, and chemical oxidation-based wastewater treatment systems. Bioremediation of EDCs by a diverse range of taxonomical group's microorganisms provides several advantages through economically adequate environmental protection. Microbial strains such as bacteria, microalgae, and fungi participate in the biodegradation and biotransformation processes of EDCs making them less endocrine-disrupting or harmful. Using various enzymes, microorganisms degrade complex EDCs into simple compounds or end products such as CO₂ and H₂O during their metabolic process. Fungi are the most widely used microorganism taxa for the degradation of a wide variety of EDCs. This chapter provides an overview of sources, pathways, and fate of EDCs in the environment and novel biodegradation approaches. Finally, future directions are identified in terms of unrevealed degradation mechanisms and field applications.

About the Book

Biotechnology for Environmental Protection

Publisher: Springer

https://doi.org/10.1007/978-981-19-4937-1_6

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CONFERENCE PROCEEDINGS

Freshwater Fungal Diversity in Selected Anuradhapura Lakes of Sri Lanka

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ABSTRACT

Due to its topographic and climatic heterogeneity, Sri Lanka is an island with high biodiversity; nonetheless, the diversity of fungi in Sri Lanka is understudied and under documented. A recent study estimated that Sri Lanka is home to over 31,000 fungal species, however, only *ca.* 3000 taxa are currently known, and this estimation was mainly based on the host-fungi relationship of terrestrial habitats. Particularly, Sri Lanka's freshwater fungi are poorly documented. Thus, this research's main objective was to study the diversity and taxonomy of freshwater fungi in selected lentic aquatic habitats in the district of Anuradhapura located in the city of Mihintale (North-Central Province). Submerged aquatic substrates (such as dead leaves and dead woody samples) were randomly collected from selected reservoirs (*viz.*, Mihintale tank, Maha Kanadarawa tank, and Iluppukanniya tank). The specimens were transferred to the laboratory and incubated in wet chambers at room temperature with ambient light for three days to ensure the best growth of aquatic fungi. After the appropriate incubation period, single spore isolation was performed using Water Agar (WA) and Potato Dextrose Agar (PDA) as culture synthetic media to isolate fungal freshwater strains/species. Germinated spores were then transferred to a new PDA. Different fungal colonies and spore morphological characters were used to differentiate the isolated taxa. On the basis of morphological evidence, fifty targeted species were preliminarily identified and all dry fungal cultures have been deposited at the Faculty of Technology, the Rajarata University of Sri Lanka as the first culture collection of freshwater fungi in Sri Lanka. In this study, our results demonstrate that the Anuradhapura district of Sri Lanka provides a diversity rich in freshwater fungal taxa in lentic aquatic environments.

About the Conference

3rd International Eurasian Mycology Congress

7 – 9 Sep 2022

Turkey

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“Here Be Dragons”: Conserving Sri Lanka’s Unique and Endemic Agamid Lizards outside the Protected Area Network

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Sandun Perera, Dinesh Gabadage, Madhava Botejue, Majintha Madawala & Indika Peabotuwa

ABSTRACT

Sri Lanka is a global biodiversity hotspot, and also harbour a unique and largely endemic assemblage of reptiles, especially agamid lizards. Twenty (90%) out of the 22 species in the island are endemic and nearly 68% of these are threatened with extinction. Several species are restricted to a single, small range (<100 km²; i.e. micro-endemics). Due to ever-increasing habitat loss, even some of the broadly-distributed species are in decline. Sri Lanka’s wildlife protected area system is predominantly designed to protect large-bodied iconic animals and does not provide in-situ legal protection for most agamid lizards or reptiles in general. In this backdrop, we identified the critical need to understand the distribution of agamid lizards outside protected areas (“trees-outside-forests”), including novel ecosystems sustained by substantial anthropogenic influences. This need is more urgent and prominent in the biodiversity-rich, but also rapidly urbanizing wet zone of Sri Lanka where the lowlands and the three mountainous regions (Central Highlands, Rakwana Range, and Knuckles Range) harbour more than 80% of Sri Lankan agamids. Through systematic surveys at regional scale, we identified agamid hotspots within Sri Lanka’s conservation gaps and local and landscape-scale predictors of agamid diversity. This increased understanding of the species distributions would now provide quantitative and objective information for conservation assessments and spatially-explicit distribution maps, both which were not available before. The knowledgebase we develop could help conservation practitioners to promote conservation outside protected areas, restore degraded ecosystems and identify “trees-outside-forests” suitable for agamid life-histories.

About the Conference

The Second Rufford in-Country Conference
27 - 29 Jan 2022
Sri Lanka

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Potential of School Children as Active Participants in Biodiversity Conservation; A Case Study from Bandarawela Education Zone

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ABSTRACT

Global biodiversity is in danger due to anthropogenic threats causing an accelerated loss of species. Conservation education plays a key role in combatting biodiversity loss, urging the need to engage communities including school children in biodiversity education and participatory conservation. Various stakeholders have already begun such initiatives, which have seldom been built into the school education system. Hence the present study intended to examine the knowledge on biodiversity and conservation of school children in the Bandarawela Education Zone. Our questionnaire survey involving eight schools representing both Sinhala and Tamil mediums of instructions (n=155; 85 Sinhala and 70 Tamil), revealed a low level of interest in biodiversity among children, especially on flora (6.5%). However, most of them have a particular species of interest (63.2%), but 27.1% represent interests in non-native species). A review of the current school curriculum for children aged 12-15 years in Sri Lanka revealed only less than 3% of contact hours on biodiversity and conservation education, whereas students of advanced level biology stream aged 16-18 years have 46.7% of the same. The only noteworthy extracurricular activity that involves biodiversity conservation was the “Environment Pioneers” program. Interviews on extracurricular conservation education/training opportunities provided by external stakeholders revealed a lack of attention on the study area, despite their long-term involvements elsewhere, especially around major cities. The ability to improve school children’s knowledge on biodiversity and conservation through a one-day tailor-made awareness program was evaluated with the comparison of means between pre- and post-test scores (Paired sample t-test). Pre-test results showed a poor (only 35%) biodiversity and conservation consciousness among school children, while the perceptions on biodiversity among Sinhala and Tamil medium students were different. The t-test revealed that a one-day training program is not capable of improving these conditions (with significant reduction of marks in post-test; $p=0.036$), suggesting the need for long-term actions to enhance their conservation literacy.

About the Conference

Applied Sciences Undergraduate Research
Symposium of Sabaragamuwa University of Sri Lanka
06 Apr 2022
Sri Lanka

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Exotic and Invasive Alien Species of Plants in the Sabaragamuwa University Nature Reserve

D.H.M. Dangalla, W.A. Ireshika, W.D.U. Premarathna, D.A.S.D.K. Wijewardena, H.M.A.A. Herath, S.J. Perera, and R.G.U. Jayalal

ABSTRACT

“Sabaragamuwa University Nature Reserve” (SaUNaR) is an institutionally managed protected area especially for watershed protection, which covers an extent of 13.2 Acres (about 10% of the total area of the university premises). This protected area provides different habitats for the rich native biodiversity it possesses. Exotic and invasive alien species (IAS) of plants marks a rapidly increasing threat to the native biodiversity around the world, in fact the second most serious threat to biodiversity according to the Millennium Ecosystem Assessment. Hence, we conducted an opportunistic survey covering the entire watershed area of the SaUNaR to explore exotic and IAS of plants in it. The survey recorded 15 exotic and 8 IAS of plants representing 17 families altogether. Shanon diversity index for exotic and invasive alien species are 1.68 and 2.24 respectively. Those IAS arranged according to their relative abundance in the study area can be given as; *Leucaena leucocephala* (0.33), *Acacia auriculiformis* (0.32), *Clidemia hirta* (0.11), *Panicum maximum* (0.08), *Austroeupeatorium inulifolium* (0.07), *Alstonia macrophylla* (0.04), *Lantana camara* (0.03) and *Sphagneticola trilobata* (0.02). The study identifies the urgent need for implementation of a carefully designed IAS management plan that should include complete removal (eradication) by uprooting, hand pulling, or cutting of all above IAS, as all of them show high growth rates and higher level of impacts to native biota in the site. Exotic species found individually with least impact for native biota such as *Cupressus leylandii*, *Dracaena fragrans*, *Ficus benjamina*, *Citrus sp.*, *Salix sp.* and *Artocarpus altilis* are recommended to be remained under surveillance due to their food and shade value for the habitat and/or medicinal and ornamental values for the humanity.

About the Conference

Applied Sciences Undergraduate Research
Symposium of Sabaragamuwa University of Sri Lanka
06 Apr 2022
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INVENTIONS / PATENTS

Continuous-wave organic thin-film distributed feedback laser and electrically driven organic semiconductor laser diode

Chihaya Adachi, Sangarange Don Atula Sandanayaka, Toshinori Matsushima, Kou Yoshida, Jean-charles Ribierre, Fatima Bencheikh, Kenichi Goushi, Takashi Fujihara

ABSTRACT

Disclosed are a current excitation type organic semiconductor laser containing a pair of electrodes, an organic laser active layer and an optical resonator structure between the pair of electrodes and a laser having an organic layer on a distributed feedback grating structure. The lasers include a continuous-wave laser, a quasi-continuous-wave laser and an electrically driven semiconductor laser diode.

About the Patent

Patent office - US

Application number - PCT / JP2017 / 033366

Publication date 2022/9/29

Our Inventor

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Laser element, compound, method for producing compound and lasing sensitizer

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ABSTRACT

Disclosed is a laser device containing a compound represented by the following formula in a light-emitting layer. R^1 and R^5 each represent a substituent having a positive Hammett's σ_p value, and R^2 to R^4 , and R^6 to R^{15} each represent a hydrogen atom or a substituent.

About the Patent

Patent office - EU

Application number - PCT/JP2020/036305

Publication date - 10 Aug 2022

Our Inventor

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Electrically driven organic semiconductor laser diode, and method for producing same

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ABSTRACT

Disclosed is an electrically driven organic semiconductor laser diode comprising a pair of electrodes, an optical resonator structure having a distributed feedback (DFB) structure, and one or more organic layers including a light amplification layer composed of an organic semiconductor, in which the distributed feedback structure is composed of a first-order Bragg scattering region, a two-dimensional distributed feedback, or a circular distributed feedback.

About the Patent

Patent office - US

Application number - PCT / JP2020 / 012809

Publication date - 21 Jul 2022

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Compound, Organic Semiconductor Laser and Method for Producing Same

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ABSTRACT

A compound of the formula (1) exhibits high photoluminescence quantum yields, high radiative decay constant and low ASE thresholds from solution-processed neat and blend films. Ar 1 and Ar 2 are aryl groups, L is a divalent group having a group of the formula (2), and R is H or a diarylamino group. At least one alkyl group having at least five carbon atoms which are bonded is present in the formula (1).

About the Patent

Patent office - US

Application number - PCT / JP2020 / 022326

Publication date - 02 Jun 2022

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Current-injection organic semiconductor laser diode, method for producing same and program

Sangarange Don Atula Sandanayaka, Fatima Bencheikh, Kenichi Goushi, Jean-charles Ribierre, Chihaya Adachi, Takashi Fujihara, Toshinori Matsushima

ABSTRACT

Disclosed is a current-injection organic semiconductor laser diode comprising a pair of electrodes, an optical resonator structure, and one or more organic layers including a light amplification layer composed of an organic semiconductor, which has a sufficient overlap between the distribution of excitor density and the electric field intensity distribution of the resonant optical mode during current injection to emit laser light.

About the Patent

Patent office - US

Application number - PCT / JP2018 / 005362

Publication date - 03 Feb 2022

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