
Environmental Management

A comparative time series analyses on temperature change in Colombo city based on Landsat satellite data

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Abstract

More than half of the human population lives in cities and most of the cities are growing in size at a phenomenal rate. Micro climate effect, urban heat island (UHI) effect and changes to local hydro meteorological processes occur due to the urbanization driven land use changes. This study attempts investigate the urban temperature changes in Colombo city due to its urbanization. Landsat 5, 7 and 8 satellite images are used between years 2000 to 2015 time period. Several algorithms are applied to retrieve surface temperature from Landsat data. Land use classification is done under built up, green and water to identify the land use changes in the same time period. Three separate study areas are selected which are urban, suburban and rural. Threshold value is used to overcome the obstacle of finding higher temperature area due to seasonal and climate changes. This threshold value for higher temperature in the urban area of a satellite image is calculated with respect to suburban and rural areas in the same satellite image. The results indicate increasing in the higher temperature area and built up area, decreasing in green and water areas with the time. A significant increase in higher temperature areas are shown since year 2010 that is mainly due to rapid urbanization in Colombo city since year 2010.

Keywords: Urbanization, Surface temperature, Colombo, Landsat

Development of thermo-bioplastic material based on starch.

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Abstract

Plastic bags and polythene wraps are among the mostly used packaging materials on daily basis. Most of them are made up of fossil-based non-degradable plastics. Growing concerns regarding the prevention of environment pollution, waste management issues, and depletion of non-renewable resources such as fossil fuels have focused research efforts in finding materials based on renewable resources that are environmentally friendly. Therefore replacing these non-degradable food packaging with biodegradable polymers would reduce the amount of waste generation and vital when moving towards green chemistry. Starch, a natural polymer displays thermoplastic behavior under certain circumstances. Therefore starch can be considered as a candidate that can replace synthetic non-biodegradable polymers. This study is focused on developing a starch film with substances that are known as safe for human consumption with the aim of using it as a food wrap.

Starch was extracted from the selected tubers and roots (potato, sweet potato and cassava) that are commonly available in Sri Lanka. Extracted starch was analyzed for moisture, ash, fat and protein content and then used to develop starch films by casting technique. Acetic acid and sodium bicarbonate was used in the process and glycerol was used as the plasticizer. Film forming formula was developed by varying the amount of starch, and amount of glycerol while maintaining the pH of the film at pH 7. Prepared starch films were tested for their tensile strength and breakage elongation. Thin starch films could be obtained with this method which are water soluble. Films with less amount of glycerol and high amount of starch were rigid and films with high amount of glycerol and low amount of starch were sticky and brittle.

Keywords: starch, biodegradable polymers, thermoplastic

Water Usage Survey and Promotion of Sustainable Utilization of Water Resources In a commercial building complex at Yakkala

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Abstract

Water usage surveys and water quality assessments have become a major requirement in the present context in Sri Lanka due to growing pressure on water resources caused by population and economic growth, increasing urbanization, increase of pollution, climate change and various other challenges. These are posing a severe threat on the quantity and quality of the water resources. The degradation of the quality and quantity of available water resources have caused the increase in the cost of water treatment. Also improper usage and misallocations of water resources have caused scarcity of water. Therefore, considering the growing problem of water scarcity, misallocation of water resources and non-sustainable water usage practices and the lack of awareness among people on water conservation, this project mainly focused on conducting a water usage survey in a multi-storied commercial building complex, and thereby identifying the ways of occurrence of water wastage and encouraging that organization to conserve water by the implementation of sustainable water management practices. The source of water for this complex is from municipality supply and they have three major tanks to store water. This study was done with the objective to assess the various water usages within the commercial building and to identify, quantify water losses and rectify them with creating awareness among the water users. In this study a questionnaire was distributed to each of those shops in order to assess the knowledge of people on conservation of water resources and sustainable usage of water and their problems in that shopping complex on water usage was also identified. The drinking water quality within the premises was continuously assessed using the physical, chemical and biological parameters. The physical parameters analyzed were pH, temperature, total dissolved solids (TDS) and salinity. The chemical parameter analyzed was dissolved oxygen (DO) and a fecal coliform test was performed as a biological indicator to find out any occurrence of fecal contamination.

The results showed that in most of the shops, the consumed units of water has decreased from the pre-awareness period to the post-awareness period. This shows the effectiveness of the awareness program and leak rectifications. The results of the survey showed that with the rectification of water losses from the delivery system and the creation of awareness among the water users, the total overall consumption of water has decreased during the period of this project. There was significant temporal variations in the temperature, DO, pH, TDS and salinity. Fecal coliform test showed negative results for all the samples.

The results of this baseline study suggested that, identification of causes of water wastage, prioritization of causes, creation of awareness among users, rectification of leakages and implementation of water conservatory practices ensures the optimum consumption of water resources and there by paves way for sustainable usage of water.

Keywords: Water scarcity, water usage survey, water quality

Comparison of the efficiency of selected compost bins in composting of kitchen and mixed garden waste

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Abstract

Composting in bins is a commonly practiced method for the disposal of urban or suburban domestic waste. Adapting to this method significantly minimizes the accumulation of degradable organic waste at landfills. However, several configurations of compost bins are available in the local market. This study was planned to compare the efficiency of two types of compost bins in composting of kitchen and mixed garden waste, to evaluate the associate issues of each bin and to evaluate the selected parameters of resultant compost produced from each bin. The two types of bins included the compost bin available in Arpico super centers and the bin type developed by the Western Province Waste Management Authority (WMA).

During the decomposition period, moisture and aeration were maintained at optimum levels. The temperature, pH, organic carbon, total nitrogen, odour, number of worms and leachate were measured. The colour, odour, organic carbon content and total nitrogen content of the resultant compost samples were tested and compared with Sri Lankan Standards 1246:2003. Microsoft Excel and Minitab 14 were used to analyze data.

The results revealed that there were no significant differences in tested parameters between the WMA compost bin and the Arpico compost bin. Hence, the results suggest that the two types of bins could be used in composting the domestic degradable organic waste in urban/sub urban areas. The tested parameters of resultant compost were comparable to Sri Lankan Standards 1246:2003 except C and C/N ratio. The resultant compost is therefore, more suitable as a soil amendment.

Keywords: compost bins, kitchen waste, leachate, worms, odour

Use of effective microorganisms for rapid composting of mixed garden waste and kitchen waste in windrows at University of Kelaniya

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Abstract

Composting is used and recommended extensively worldwide as an effective way of handling degradable organic waste by various microorganisms and small invertebrates. This natural process normally takes about 12 weeks in favorable temperature and moisture levels for its completion.

Effective microorganisms (EM) are a group of specially selected and cultured microorganisms that can be used to accelerate a normal biological process done by conventional microorganism that are naturally present in the medium. EM used in Takakura method is been widely practiced for kitchen waste composting in small quantities throughout the South East Asian region. The present study was carried out to assess the efficacy of Takakura method over windrows of organic mixed garden waste and kitchen waste, in the University of Kelaniya. In order to make Takakura piles, 2 fermentation solutions and seed compost were prepared. The conventional piles were also made using the same waste materials and quantities used for Takakura method. Three replicates were arranged for each setup. The piles were maintained for 60 days and temperature, pH, organic carbon percentage, total nitrogen percentage, settlement, odor and color were monitored. Selected parameters of resultant compost from both piles were also tested and compared with Sri Lankan Standards 1246:2003.

Results revealed that the parameters monitored from both piles during the composting process were not significantly different. Some selected parameters of resultant compost from both piles were comparable to SLS 1246:2003 suggesting that the resultant compost could be used as a soil amendment. However, Takakura method is not significantly beneficial over the conventional method in mixed garden waste and kitchen waste composting.

Keywords: Effective microorganisms, Takakura method, compost, windrows

Development of a disaster risk map using GIS for Panadura Urban Council area: A pre-requisite to the urban planning

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Abstract

Sri Lanka is vulnerable to natural & man-made disasters. The Disaster Management Center (DMC) of Sri Lanka is responsible for keeping records on these disasters, finding the most vulnerable areas for disasters and planning disaster mitigation for the country. Disaster risk map for city planning in Panadura Urban Council area is necessary in order to reduce vulnerability for disasters. Panadura Urban Council area is urbanizing rapidly, many roads including Galle road runs through the city, toilet facilities are not available in every places in Panadura Urban Council area & the drainage network of the town is also in a very unsatisfactory state & inadequate. Therefore Panadura is one of the areas which are vulnerable to disasters and there are no study has been conducted in this area regarding disasters and its impacts. Therefore Panadura Urban Council area was selected as the study area for the case study. The main objective of the study was development of a disaster risk map for Panadura Urban Council by using ArcGIS software. To achieve this main objective, there were five sub objectives for the study. First, primary data collection through the community base participatory programs on 7 disasters (tsunami, cyclones, floods, fires, road accidents, dengue fever, and filaria) from selected 5 GN divisions and development of disaster risk maps for those disasters in 05 GN divisions. Second collect secondary data for same disasters for those selected 05 GN divisions and develop disaster risk maps. Third was comparison of primary and secondary data using sum of the scores for all disasters. It was found that there are some changes in some disasters with the time due to development of activities of the area. Forth was to develop disaster risk maps using secondary data for all 19 GN divisions. Fifth was to develop final disaster risk map by accumulation all disasters for 19 GN divisions. According to the final disaster risk map of Panadura Urban Council area, as the highest disaster

risk areas, Walana & Nallooruwa were identified. It is important to use this disaster risk map for any future development of the area to minimize disasters of the area.

Keywords: Disaster, Hazard, Map, Panadura

A case study to assess the possibilities of electrical energy conservation in an office premises

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Abstract

Energy is a key input for development of any country. Due to the increase in population and their needs, the demand for energy sources are accelerating. Therefore effective management of energy is essential for utilizing energy in a sustainable manner while being cost effective. A leading telecommunication company in Sri Lanka was selected as our study site for conducting the project. The main objectives of this project was to improve the sustainable energy usage within the company while achieving economic benefits and to guide the company to process their activities in an eco-friendly manner. Electrical energy is the most widely used type of energy in the world. Therefore, prior concern was given towards electrical energy usage within the company. Visual assessment was conducted through the company to analyze the energy flow within the company premises and to figure out the energy loop holes. In order to get an idea about the knowledge of employees on energy conservation and management a survey was done. An awareness programme was properly conducted after recognizing the vital needs which need to be fulfilled to aware the employees on sustainable energy conservation practices. Feedback questionnaires and analysis of electricity bills were used to convince the effectiveness of project. Feasible recommendations were given to the company with justifications.

Keywords: Energy, sustainability, survey

Current status of solid waste management in Kelaniya Pradeshiya Sabha

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Abstract

Kelaniya Pradeshiya Sabha is one of the key urban areas in the Western Province that governs its maximum capacities for the betterment of the environment and public health. It covers 21km² in its jurisdiction. A questionnaire survey followed by interviews was carried out among randomly selected 50 households in 04 GN divisions and the officers in the Pradeshiya Sabha including sanitary overseers to identify the current waste management practices, public attitudes on the existing waste management system and the major constraints in the existing system. Microsoft Excel with descriptive statistical methods was used to analyze data. Results revealed that about 84% of the households handover their waste to the waste collecting crew while 12% practice bin composting. Majority of households (more than 80%) has no interest in making compost. In addition, about 4% of the households burn their waste at their own premises. Once awareness programmes have been conducted by Kelaniya Pradeshiya Sabha, about 98% of households practice waste segregation at source and earn money by selling paper and polythene/plastic. However, the degradable or mixed waste is being piled up at the dump yard of Pradeshiya Sabha at present. No proper data base on MSW, no covers for the waste collecting tractors or lack of compactors, no site separation of mixed waste collected and the poor quality compost stock at the Manelwaththa compost unit were identified as some weaknesses in the waste management process. In addition, interferences from some external parties have been a threat in improving the existing process in the Pradeshiya Sabha. Effective capacity mobilization programmes would be beneficial in minimizing future waste accumulation at dump yard of the Pradeshiya Sabha.

Keywords: Segregation, dump yard, composting, waste management practices

Environmental Policies and Economics

**Legal strengthening for sustainable waste management in Sri Lanka,
in relation to Japan**

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Abstract

The management of solid waste has become a growing concern worldwide due to the continuous accumulation of large amounts of waste due to development of technology, urbanization and growth of human population. This situation is getting worse as accumulated wastes are complex in nature. Though Sri Lanka has a National Policy on Solid Waste Management 2007 and a few sections from Municipal Council Ordinance, Urban Council Ordinance, Pradeshiya Sabaha Act, Police Ordinance and Nuisance Ordinance, it is clear enough that current legal frame work is not sufficient at all. In municipal solid waste management, the issues on e-waste are not properly addressed. Based on the qualitative and quantitative research methodology, authors have found out that a country like Japan which has a large population, successfully able to manage their solid waste by the modes of recycling, energy recovery as well as sanitary land filling and increasing laws. Moreover, a Japan has separate Acts in this regard. Thus, contemplating the Sri Lankan legal frame work it clearly elaborates that it is essential to have a separate legal process of establishing a Municipal Solid Waste Management Act by imposing liability towards the relevant authority while giving special attention to energy recovery through solid waste, recycling and landfilling, moreover it should be able to deal with new technological wastes such as discarded electronic devices and e-waste rather than a national policy which is unable to give a fruitful output.

Keywords: Energy recovery, recycling, e-waste, Municipal Waste Management Act

Application of Green Belt concept in Sri Lanka: Lessons from South Korea, Kenya and England

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Abstract

The rise of climate change consequences is evident across the globe and Sri Lanka is no exception. Sri Lanka, being an island, is extremely vulnerable to coastal erosion due to rising of sea level, droughts, floods and earth slips. Climate change issues are not addressed sufficiently within the environmental or economic policy plans or programs in developing countries including Sri Lanka. Lack of resilience capacities of populations to climate change scenarios can therefore be viewed as a hindrance to the development of a nation. The UN General Assembly claimed that climate change must be a common concern of mankind. The Climate change-related effects threaten the effective enjoyment of a series of human rights, such as the right to adequate water and food, the right to health, right to life and right to development. In this study, the authors used the qualitative research methodology and secondary data from various sources. The basic objectives of the present study are to provide an understanding and balance the role of Sri Lankan law and its applicability to climate change within a framework of human rights, obligations imposed in Sri Lanka in both international and domestic laws to respond to the consequences arising from climate change scenarios. In the legal framework for mitigation of climate change can have additional or equal benefits that will contribute to the human development goals in a country. Nevertheless, it is essential to give prominence to the role of climate mitigation and adaptation policies within a framework of human rights context in order to identify probable synergies between development priorities and climate policy objectives.

Keywords: Climate change, human rights law, environmental law

Addressing Climate Change in Sri Lanka in light of the Human Rights Law: Legal analysis

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Abstract

The rise of climate change consequences is evident across the globe and Sri Lanka is no exception. Sri Lanka, being an island, is extremely vulnerable to coastal erosion due rising of sea level, droughts, floods and earth slips.. Climate change issues are not addressed sufficiently within the environmental or economic policy plans or programs in developing countries including Sri Lanka. Lack of resilience capacities of populations to climate change scenarios can therefore be viewed as a hindrance to the development of a nation. The UN General Assembly claimed that climate change must be a common concern of mankind. The Climate change-related effects threaten the effective enjoyment of a series of human rights, such as the right to adequate water and food, the right to health, right to life and right to development. In this study, the authors used the qualitative research methodology and secondary data from various sources. The basic objectives of the present study are to provide an understanding and balance the role of Sri Lankan law and its applicability to climate change within a framework of human rights, obligations imposed in Sri Lanka in both international and domestic laws to respond to the consequences arising from climate change scenarios. In the legal framework for mitigation of climate change can have additional or equal benefits that will contribute to the human development goals in a country. Nevertheless, it is essential to give prominence to the role of climate mitigation and adaptation policies within a framework of human rights context in order to identify probable synergies between development priorities and climate policy objectives.

Keywords: Climate change, human rights law, environmental law

Importance of Environmental Impact Assessment Regulations of Sri Lanka in Infrastructural development projects: A Comparative Legal Analysis

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Abstract

United Nations Environmental Programme (UNEP) defines Environmental Impact Assessment (EIA) as a tool used to identify the environmental, social and economic impacts of a project prior to decision-making. Objectives of an EIA are to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment and present the predictions and options to decision-makers. Many countries have incorporated EIA through their domestic legislation, so does Sri Lanka. In Sri Lanka the legal framework for this internationally accepted EIA process has been laid down in the National Environmental Act (NEA) of 1988 as part of the strategy for environmental protection and conservation. However, there is some evidence that some EIAs have failed to predict and mitigate potential impacts of various development projects.

This paper seeks to critically analyse the effectiveness of the existing level of EIA regulations in light of their current application in certain development projects, to identify shortcomings in Sri Lankan EIA procedure by comparing level of success EIA using an EIA effectiveness assessing criteria and finally to suggest possible amendments to the existing process in Sri Lanka. This analysis was based on a legal research methodology consisting of both quantitative and qualitative research based on the secondary sources. According to the findings, Sri Lankan EIA process is one of the oldest in the region and as a result, it is becoming unpopular among the stakeholders. Therefore it is time to revisit the EIA process to improve it as a tool for effective decision making.

Keywords: Environment Impact Assessment, development projects, legal tool

Water for Rupees versus Water to Live: A Reliable Social Analysis on Sri Lankan Context

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Abstract

It is well-known that a person can live without food but not without water. Thus today dishonouring the aforementioned catchphrase, we witness ample of water wastages, in which man is held liable with no offence but only a social responsibility because man is said to be shielded since he pays for water consumption. Moreover, on the other hand, there are people around the world who don't have at least a pure water drop to see. Therefore, this is the high time to strike a balance between water for rupees and water to live.

Therefore this paper seeks to critically analyse the methods of water wastages in Sri Lanka, the reasons and also to propose the ways to save water which are outstanding with traditional solutions and designing a method to distribute water for indeed tasks and to needy. This will follow a quantitative and as well as a qualitative research based on the secondary sources in order to solve the research problem and to find suitable solutions to disseminate and protect the earth's most valuable water source. Findings of this research will direct the highest usage by water for rupees eliminating the gap with water to live.

Keywords: Water usage, water wastage, water save

Environmental Pollution and Treatment

Assessment of the water quality parameters in selected sites of the Meegahawatta stream, Peliyagoda

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Abstract

Meegahawatta stream in Peliyagoda is a stream that runs through rural urbanized areas and industrial areas. This stream provides water for the general uses of the residents in the area which consists of about 400 families. This study was performed to assess aquatic pollution issues to the residents who use the Meegahawatta stream as a water source and to assess the water quality of the Meegahawatta stream at selected sites.

In this study six sites were selected along the stream. The first three sites (Site A, B and C) were located in a rural area with less anthropogenic influences and Sites D and E were located in an urbanized area with comparatively higher anthropogenic impacts. Site F was located at a place where the wastewater (treated (F1) and untreated (F2)) from the Peliyagoda Fish Market are released to the stream. The pH, dissolved oxygen, total dissolved solids and electrical conductivity of the water samples were measured.

In addition to the water quality analysis, the residents of the surrounding of the stream were interviewed to identify the health and environmental impacts of the pollution of the Meegahawatta stream.

The interviews with the residents showed that they are affected with numerous health and environmental related problems due to pollution of the Meegahawatta stream. Majority of the problems mentioned were skin diseases, mosquito problems, excessive flooding in rainy season. During the field visit, the excessive growth of algae and *Eichornia* sp was also observed.

The results of the water quality analysis indicated considerably high Total Dissolved Solids and Electrical Conductivity at Site F2, which was the place where the untreated wastewater from the Peliyagoda Fish market was discharged. The pH and dissolved oxygen concentration did not show considerable variations among the study sites. According to the

results of this stud, the wastewater discharges of the Peliyagoda Fish market can be identified as a major source of pollutants to this stream. This study was performed as a preliminary study to identify the causes and effects of aquatic pollution in the Meegahawatta stream. Therefore, to quantitatively assess the pollution it is recommended to improve this project by increasing the number of sampling sites, sampling frequency and the number of replicates.

Keywords: Water quality, Meegahawatta stream, Fish-market waste

Assessment of the effectiveness developed low cost SPE systems using dry banana peel powder for the separation and pre-concentration of Cd (II) and Pb (II) in water

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Abstract

Most heavy metals are highly toxic, non biodegradable, non thermo-degradable and can be readily accumulated to toxic levels persisting in the environment. Therefore, development of analytical methods for the determination of toxic heavy metal levels in natural water systems has been a highly researched area in the recent years. Biosorption is conveniently superior to the conventional methods of metal removal like chemical precipitation, solvent extraction, reverse osmosis, *etc.* in terms of cost, efficiency at low metal concentrations, and green chemistry.

In this research, the ability of dry banana peel powder to act as a biosorbent for Cd(II) and Pb(II) was investigated with the intention of developing a low-cost solid phase extraction (SPE) system.

The optimum contact times for Cd(II) and Pb(II) were determined in single metal systems. The concentrations of metal ions at the equilibrium were determined by varying the initial metal concentration and the contact time between the banana peel powder and metal ions. These data was used to calculate biosorption capacities and separation factors. The effect of the particle size on sorption capacity was tested using two particle sizes (less and greater than 250 μ m). Particles with the size of < 250 μ m showed better sorption capacity. The overall biosorption capacity reflecting the biosorbent quality was calculated using the metal uptake. The banana peel powder biosorbent is relatively easy to prepared, and hence can be considered as a substitute to expensive SPE sorbents. Banana peel powder has a significant biosorption capacity that can be further optimized by the manipulation of experimental and physical conditions. These systems showed a separation factor (Sf) of $0 < S_f < 1$, hence can be considered as a favourable isotherm. Therefore, banana peel biosorbent can be used as an effective biosorbent for Cd(II) and Pb(II) ions for the development of low cost SPE systems.

Keywords: Biosorption, solid phase extraction, Langmuir Isotherm, metal ion removal, separation factor.

Comparison of household sewage disposal systems of a rural and an urban Grama Niladhari Divisions with standards: A case study from North-Western Province of Sri Lanka

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Abstract

Recent urbanization and globalization at national and international level have caused improvements in standards of sewage disposal systems. However, a majority of Sri Lankans still use soakage pits and septic tanks which are onsite sewage disposal systems. Sewage disposal systems which are not up to standards can cause public health hazards and environmental pollution. This research was done to evaluate whether the standards of selecting and constructing proper sewage disposal systems were utilized and to evaluate the sanitation practices of selected rural and urban Grama Niladhari (GN) areas. Other objectives were to find out the percentage use of septic tanks and soakage pits separately, to evaluate and compare the capacity of sewage disposal tanks and to evaluate the sanitation practices of rural and urban communities. Out of the Pannala Pradeshiya Sabha Division, Makandura-South and Pannala GN divisions were selected as rural and urban areas. Fifty households were randomly selected, each from the two divisions. A questionnaire was developed for the chief occupants of the selected households and a field survey was conducted. Out of the households selected for the study, 90% still used soakage pits and only a 10% used septic tanks. More than 90% of the selected households have constructed their sewage disposal systems over 18 m distance from the nearest water source. More than 50% of the houses in the rural area have cisterns of which tank capacity exceeds the required capacity, causing a higher desludging interval. However, in urban areas, over 50% households have a lower tank capacity than the required capacity, causing frequent desludging. Majority of the households in the selected GN areas are not complying with the standards, regardless their education level and economic level. However households in both GN areas practice good hygiene practices.

Keywords: Sewage disposal systems, soakage pits, septic tanks, desludging

**Assessment of pollution of the St. Sebastian South canal,
Orugodawaththa: A case study**

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Abstract

Fresh water pollution threatens the health and the well-being of humans, plants and animals. This issue is generally observed specially in highly populated areas in our country. St. Sebastian South canal in Colombo North area is one of the main storm water drainage canals which drain the storm water in the Colombo basin through Kelani River finally in to the sea. There is a large number of low-income housing on both sides of the canal with very limited access to proper sanitary facilities, garbage disposal and garbage collecting systems. This canal is highly contaminated with human sewage, industrial waste and garbage. There are small scale commercial premises such as vehicle spare part shops, workshops, boutiques and industries in that area. Keththarama Cricket Stadium is also located close to this area.

The objectives of this case study were to identify the sources of pollution in St. Sebastian South canal, in Orugodawaththa and to identify the effects of pollution on residents in that area.

Replicate water samples were collected at three predetermined sites of the canal. Site No 01 (S1) was heavily polluted with domestic kitchen waste. Site No 02 (S2) was highly contaminated with human sewage and the third selected site (S3) showed signs of oil spills, and oil slicks on top of water. Water samples were collected from the channel and physical parameters such as temperature, odour, colour change, presence or absence of oil , conductivity and, visibility were tested on the obtained water samples , at the same time. Chemical parameters such as dissolved oxygen content (DO), pH, salinity and

biological parameters such as *E.coli* count, algal growth, presence and absence of zooplankton and phytoplankton were also tested using the obtained water samples.

Residents were interviewed regarding the problems which they face as a result of this aquatic pollution in this area. It was noted that the residents of the area frequently suffered from various skin diseases like skin sepsis and fungal infection , vector borne diseases such as Dengue, and Filariasis , water borne diseases mainly diarrhea hepatitis and typhoid etc. Problems due to breeding of scavengers, were also noted. Stray dogs and cats were real nuisance to both residents and passers-by. Unpleasant odor emanating from heaps of garbage makes the area unsuitable for living. There seemed to be no proper Garbage collection and disposal method in the area. The Residents further stated that houses were inundated with highly contaminated water during rainy days due to flooding. A few child deaths were also recorded due to drowning in contaminated flood.

Considerable variations in readings were observed in total dissolved solid, dissolved oxygen, electrical conductivity and visibility of the collected samples. The dissolved oxygen concentration was very low in the S1 and S2 sites due to the direct discharge of the sewage in to the canal from nearby houses. Algal growth was also observed in some areas of the canal. Some phytoplankton and zooplankton were also observed. The fecal coliform tests showed positive results which indicated fecal contamination of water.

The results of this preliminary study shows that St. Sebastian South canal in Orugodawatta is heavily polluted with sewage, household waste, non-degradable waste and industrial waste. The pollution proble is worsened due to over population, urbanization, decrepit infrastructure and breaches in the local government management system. The results of this study highlights the need of immediate control measures to overcome the ecological and health impacts of pollution of the St. Sebastian South canal.

Keywords: St. Sebastian South canal, water quality parameters, aquatic pollution

Socio-economic impacts of eutrophication of Beira Lake in Colombo, Sri Lanka

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Abstract

Beira Lake has remained as a conspicuous water body since the colonial past. The reclamation of certain sections of the lake, improper construction activities and the discharge of municipal and industrial waste water etc. have caused the deterioration of the lake since the latter part of the 19th century. At present, Beira Lake has become an essentially stagnant water body which is entirely dependent on the run-off of its highly urbanized catchment, which covers an area of approximately 448 ha. The current study was carried out in order to determine the impacts of eutrophication on its recreational value, public health and livelihoods of the people. An interviewer based socio-economic survey was carried out by interviewing 30 individuals who visited the recreational area at the floating market and Gangarama sites and 10 vendors at the floating market. Random sampling technique was used in selection of the individuals to be interviewed.

The results showed that 70 % of the local community who visited the floating market and Gangarama sites were belonging to the age class of 20 - 40 years, followed by 15 - 20 age class (10 %) and above 40 years (20 %). Among the interviewed individuals only 30% were aware of the phenomenon, eutrophication. Yet, 60, 70 and 10 % of the interviewed individuals complained about the bad odor, unpleasant view and the poor environmental conditions around the recreational areas, respectively. 90 % of the individuals were found to visit the selected study sites mainly to spend their leisure time, while boating was favored by only 10 %. When the frequencies of visitation are taken into consideration, more than 40 % of the respondents were visiting the lake only few times (1 to 3) times a year, followed by once a week (30 %), daily (10 %), several times a week (10 %) and once a month (10 %). Among the vendors, 80 % have been continuing their economic activities around the Beira Lake for more than

one year. 90 % of the vendors pointed out a decrease in their daily income after the restoration of the lake. 90 % of the vendors complained about the mosquito problem in the surrounding area during the evening.

The findings of the current study suggested that the negligence of the application of adequate restoration techniques and poor maintenance of the eutrophic water bodies such as Beira Lake in the heart of Colombo city could deteriorate the aesthetic value of the commercial capital of Sri Lanka. The unpleasant scenery and bad odor had caused the reduction of the interest of the community on the recreational activities around the lake. Proper maintenance by local authorities, proper effluent discharge and waste water treatment activities could be recommended to save the aesthetic value, as well as the economic value of the lake.

Keywords: Eutrophication, Beira Lake, Socio-economic impacts

Ecosystems and Social Impacts

Environmental Impacts of Gem Mining in Nivithigala Area

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Abstract

Nivithigala is a fascinating place with full of natural beauty which belongs to Rathnapura District. Not only the beauty, but also it is a well-known area where most of the precious gems are found. However, mining of gems has become the threat to the environment of the area.

Gem mining is one of the main income sources and the employment of the people live in that area. It also contributes to increase the foreign exchange for the country. However, gem mining practices that have been carried out for many years, the environment including streams, vegetation cover, soil of the Nivithigala area has been badly affected. Therefore, the general aim of the current case study was to identify the actual scenario behind this problem and to determine the environmental impacts due to gem mining. By identifying those impacts we aspired to provide some suggestions to carry out the gem mining process in a sustainable manner by mitigating the adverse environmental impacts.

In order to identify the impacts of gem mining on the environment, case study was designed in three aspects; visual observations of the adverse impacts to the environment within the study area of three villages, test the water quality parameters of the rivers affected by gem mining and questionnaire based survey among residents and mining workers in the area related to adverse impacts caused by gem mining to the environment.

According to the results, it was observed that substantial adverse environmental impacts caused by the gem mining in the study area namely water pollution of streams such as Kalu ganga and Way ganga, loss of soil fertility due to continuous removal of top soil layer, soil erosion and river bank erosion, land degradation, reduction in agricultural practices mainly for tea, damages to man-made structures such as roads, buildings, due to tunneling, reduction of the floral diversity noise pollution due to heavy machinery usage.

Therefore, it can be concluded that, authorities should take necessary actions to mitigate the environmental problems created by gem

mining while carrying out the gem mining industry in a sustainable manner.

Keywords: Nivithigala area, gem mining, environmental impacts, case study

Assessment of population status of *Crocodylus porosus* and human-crocodile relationship in Bellanwila-Attidiya Area.

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Abstract

Saltwater crocodiles' (*Crocodylus porosus*) threat to humans has been increased during the past decade: mainly in the years of 2005-2012 (Samarasinghe D.J.S., 2014). The present study intended to assess the population status of saltwater crocodiles and human-crocodile relationship along the Bolgoda canal (1.88km) within the Bellanwila-Attidiya Sanctuary. For assessing the population status eye shine surveys were conducted on 3rd of October, 2015 from 2000h to 2200h, by walking along the bank. Habitats and micro-habitats of crocodiles were recorded. In addition, some major water quality parameters including pH, DO, TDS, salinity and conductivity were measured to assess the water quality of the canal. For assessing human-crocodile relationship a structured questionnaire survey was conducted. Ten crocodiles were recorded. The population density of crocodiles in the area was 5.32 individuals km⁻¹ (n=10). Average sightings per hour was 5. One hatchling (10%) and nine EO (Eyes Only) (90%) were recorded. Two (20%) were found in open waters; one (10%) was found in shallow water near bank; five (50%) were found among aquatic vegetation; two (20%) were found among aquatic vegetation near bank. Average water quality parameters of the canal are as follows. pH is 6.66 : DO (mg/L) is 8.17: conductivity (μ S/cm) is 364.9: TDS (mg/L) is 175.5: salinity (ppt) is 0.17. All the measurements were taken within 30.3°C-32.9°C. According to the questionnaire survey, inhabitants (99%) were aware about crocodiles in the area and 62.23% had the general knowledge about crocodiles. 77.8% of inhabitants mentioned that there were no increase of recent attacks however, 66.7% of them have seen or heard of pets and livestock being attacked in the study area. It was found that the interactions of people with the water

body are minimum due to crocodiles and pollution of the canal. It is recommended to continue this study in different months of the year to have proper assessment of the crocodiles in the study area. This will help to build up a data base and thereby to identify the population trends of the species.

Keywords: Saltwater crocodiles, Bellanwila-Attidiya Sanctuary, population status, human-crocodile conflict, water quality.

***Prosopis juliflora* in Bundala National Park: Impact on floral diversity and potential of utilizing as an alternative energy source for industries in the region**

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Abstract

Prosopis juliflora has been introduced to Sri Lanka in early 1950 as a shady tree which can resist the dry salt conditions in semi-arid areas. At present it has become an invasive and threatened to the plant diversity of Bundala National Park and surrounding area. This study was carried out with the objectives of assessing the plant diversity in Bundala National park and distribution of *Prosopis juliflora* from coast towards the inland side of the Bundala National Park. Also, the secondary objective of the study is to assess the potential of using *P. juliflora* as a dry matter energy source for industries in the region. Three study sites were selected based on the preliminary survey; coastal site, inland site and control site. Three random sampling plots of 10m* 10m were laid out from each site with the total of nine plots. Diversity, evenness, dominance were calculated. Distribution of *Prosopis juliflora* was assessed by laying out three 50m* 5m belt transects from the coast of Bundala towards inland with a 50m distance among two plots. A survey was carried out subsequently with this study in order to figure out the potential of utilizing this invasive species as an alternative energy source for industries and for the community in the region. According to study results diversity and evenness depicts a minimum value for the coastal site where *P. juliflora* is dominant while higher values for other two sites. *P. juliflora* spreads fast towards the inland of the Bundala National Park while making adverse impacts towards native species such as *Salvadora persica*. Therefore, necessary control measures should be taken immediately. There are various uses from this invasive species such as fuel wood, timber, fodder and nutritional extractions from the seed pods. Results of the survey show likeliness of community and industry to use this species as an alternative energy source. However, inaccessibility to the Bundala National Park and rules and regulations is a major limitation for use this species.

Management system with a proper distribution channel of *P.Juliflora* fuel wood will be a good solution for both industries and environment. If this solution is implemented practically this problem can be solved within Sri Lanka in a sustainable manner.

Keywords: *Prosopis juliflora*, *Salvadora persica*, Bundala National Park

Agricultural Applications

Assessment of the suitability of GRAS (Generally Recognized As Safe) compounds to control anthracnose disease of guava (*Psidium guajava*)

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Abstract

Guava (*Psidium guajava* Linn.) is an important fruit of subtropical countries. It is a hardy crop, is cultivated successfully even in a neglected soils. There are number of pathogens, mainly fungal which affect guava crop besides few bacterial, algal, some physiological disorders or deficiencies. About 177 pathogens are reported on various parts of guava plant of which 167 are fungal, 3 bacterial, 3 algal, 3 nematodes and one epiphyte. About 91 pathogens are reported on fruits, they cause various symptoms in fruit rots.

Anthracnose is one of the main disease in all guava growing countries causing considerable post harvest losses. It is characterized by depressed soaked necrotic lesions with an irregular shape and brown color on the fruit surface.

Colletotrichum gloeosporioids is the causal agent of the anthracnose disease and it grows in intracellular hemibiotrophic manner. Therefore proper spraying pattern should be followed to control anthracnose in guava in addition to other management tools. There are chemical fungicides recommendations to control post harvest diseases of fruits. There is increasing public concern over the level of pesticide residues in food and this is caused to reveal some innovative considerations to search for alternatives to synthetic fungicides. Recently there has been considerable interest in safe compounds that are the compounds of naturally occurring biological active compounds of plants and inorganic compounds. These safe compounds assumed to be more acceptable and less hazardous than synthetic fungicides. Hence this study was focused on GRAS (Generally Recognized as Safe) compounds to control anthracnose disease of guava fruits.

Symptom showing fruits of Horana White and Horana Red were collected and pieces were surfaced sterilized and aseptically inoculated into solidified agar media composed with different concentrations of selected

GRAS compounds viz. sodium bicarbonate (10000, 20000, 30000, 40000 and 50000ppm) , ammonium bicarbonate (5000,10000, 20000, 30000 and 40000ppm) , sodium meta bisulphate(500, 1000, 1500, 2000 and 2500ppm) ,calcium chloride(10000, 20000, 30000, 40000 and 50000ppm) , sodium benzoate (10000, 20000,30000 and 40000ppm) , acetaldehyde (50, 100, 102, 105 and 110ppm), cinnamaldehyde (1, 4, 5, 6, 8, 10, 15 and 20ppm), benzaldehyde (1, 5, 10, 20, 30 and 40ppm) and daconil). Pathogenicity was proved by using healthy fruits. According to the price, compounds were selected for field evaluation. Both invitro proved and one concentration higher than that value was experimented in field conditions.Selected GRAS compounds were field evaluated with ten replicates in Randomized Complete Block Design at a research field of Fruit Research and Development Institute, Horana from 2013 to 2014. Then sprayed fruits were plucked at proper harvesting stage and they were surface sterilized by washing off with teepol and followed by running tap water and dipped in relavant GRAS compound aqueous solution prior to artificial inoculation and sample size was 10 fruits from each treatment. Artificially inoculated fruits were humidified in a closed chamber at room temperature. Lesion diameter was recorded in inoculated fruits at two days interval and data was analyzed by using SAS statistical software..

In-vitro studies revealed that sodium bicarbonate(40000ppm), ammonium bicarbonate(10000ppm), sodium meta bisulphate(1500ppm) , sodium benzoate(30000ppm), acetaldehyde(110ppm), cinnamaldehyde(5ppm) and daconil(3ppm) were effective treatments and calcium chloride has no effective control.. Field studies revealed that frequently spraying of both concentrations of sodium metabisulphite has some possibilities to use as a safe compound to control the anthracnose disease. Horana white fruits showed more susceptibility to anthracnose than Horana Red guava fruits and it may be due to the polyphenolic compound content of fructoplane of fruits and they give protection from biotic factors especially fungi like *Colletotrichum gloeosporioids*.

Keywords: Guava, anthracnose, GRAS compounds

Alternative pot material for budded fruit plant production

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Abstract

Quality planting material production is the basic requirement for fruit plant production. Current conventional planting material produced by government and private sector nurseries system involves 1:1:1 topsoil: sand: compost in black polythene bags (300 gauge, 8-10 inches length, 6-8 inches diameter). In this conventional system, large pots with standard composition of growth media is cost effective.

Therefore; low cost, low weight easy transportable pots or potting materials are needed to planting material production system. Alternative pot/potting material for budded planting material production was studied at the horticulture nursery Fruit Research and Development Institute (FRDI) Kananvila, Horana during the period of 2013- 2014 with the objectives of introducing low weight, low cost, easy transportable pot for budded fruit planting material production system.

Randomize Complete Block Design with 7 treatments (3 replicates were experimented and each treatment has 30 sub units). Treatments were as follows:

T₁ – Compress coir dust pellet; T₂- Conventional method; T₃- Soil: sand: compost mixture; T₄- Coir dust; T₅- Half burn paddy husk ; T₆- Refuse tea; T₇- Soil: half burn paddy husk : coir dust : refuse tea 1:1:1

Black polythene bags with 300 gauge and 4x 6.5 inches were selected for filling above treatments. Number of germinated seeds, number of plants survived up to budding stage, success number of plants after budding, success number of plants up to 6 months and success number of plants up to one year were recorded and data was analyzed by using SAS statistical software.

The results revealed that there was no significant deference in seed germination, plant were survived up to budding stage, successful number of plants after budding, successful number of plants up to six months and success no successful number of plants up to one year period between compress coir dust pellet and conventional method. .But economic comparison showed that the cost of production of conventional pots were two fold higher than compress coir dust pellet .Also comparison of the

benefits of two methods showed that compress coir dust pellet is more beneficial than conventional method. The compressed coir dust method was easy to maintain, easy to handle and transport, also the compress coir dust pots are biodegradable.

Therefore, compressed coir dust pellets can be used as an alternative potting material for fruit planting material production.

Keywords: Compressed coir dust pellets, planting material production, plant nurseries

Rice yield estimation using free satellite images

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Abstract

Rice yield forecasting before harvest time is very important for assessment of seasonal production for strategic planning purposes. This is very significant work for a country like Sri Lanka because Sri Lankans major food source is rice. This study was focused to estimate rice yield in Kurunegala district which gives higher contribution for the total rice production in the country.

In this study, a new method has been suggested to identify cultivated paddy fields through a temporal analysis of NDVI time series. 8-day composite images (250m spatial resolution) from Moderate Resolution Imaging Spectroradiometer (MODIS) sensor onboard the NASA EOS Terra satellite were used from 2007 to 2014. Accuracy assessment results show that the suggested method has ability to identify cultivated paddy lands with 74% average accuracy. The other part of this study was focused to build up rice yield prediction models based on NDVI and EVI2 vegetation indices. Linear and exponential relationships between rice yield and related vegetation indices (NDVI and EVI2) were identified in this study. An accuracy assessment of rice yield estimations were performed by comparing estimated rice yield with national statistical data. According to the accuracy assessment results, it was clearly observed that both linear and exponential models produce approximately similar estimations. NDVI and EVI2 based models give more reliable estimations about 96 days after beginning time of the season. However, EVI2 based model (derived at 96 days) give more reliable estimations than NDVI based model with 92% average accuracy. Therefore accurate yield estimation can be provided before one month to harvest time using EVI2 based model. So, this procedure can successfully be applied to forecast rice yield in Kurunegala district.

Keywords: Rice yield, Vegetation indices, MODIS