The 1st Environment and Natural Resources International Conference (ENRIC 2014): Global Climate Change and Sustainability Pathways

6 – 7 November, 2014

Bangkok, Thailand

Organized by

Environment and Natural Resources Journal

Faculty of Environment and Resource Studies,

Mahidol University, Thailand

Plenary Speech on

"Asia 2030: Scenarios, Challenges and Opportunities for Sustainability"

Stefanos Fotiou, Ph.D. (Natural Resource Economics,
Aristotle University, Thessaloniki, Greece)
Programme Manager United Nations
Environment Programme
Senior Programme Manager
Group Managing Director & CEO
United Nations Environment Programme (UNEP)

Accomplished and well renowned International Development Expert with a wealth of experience in the definition, negotiation, and implementation leadership of international UN policy initiatives and programmes. A polished communicator with natural authority, this energetic, positive professional benefits from extensive experience negotiating in multi-cultural and multi-stakeholder environments, quickly building trust and respect with all partners. A motivational, visionary leader with a distinctive approach to human resources management, encouraging belief in the team and empowering members to take ownership of the objective and results achieved. Having achieved great success as a fundraiser with dozens of multi-million dollar projects conceptualized and selected for funding over the last 15 years, will quickly be an asset to the board or senior management team of any forward thinking international organization.

Plenary Speech on

"Climate Change Impact on the Agriculture and Economic Sectors and Responsive Developmental Approaches to Corporate Sustainability"

Choak Bulakul, Ph.D.
(Honorary in Animal Science, Rajmangala University of Technology Tawan-ok, Thailand)
Group Managing Director & CEO
Farm Chokchai Group

Education – Bachelor of Science (B.Sc.), major in Animal Science, The University of Vermont, USA, 1992.
– Ph.D. (Honorary) in Animal Science, Rajmangala University of Technology Tawan-ok, Thailand, 2010.

Present Positions – Group Managing Director & CEO, Farm Chokchai Group.
– Honorary Member of Mahidol University Council.
– Clinical Professor at Sasin Graduate Institute of Business Administration, Chulalongkorn University for the course Organization Behaviour.

Honors and Distinctionsreceived:

2010 – Selected by Mahidol University and approved by His Majesty the King of Thailand to be an Honorary Member of Mahidol University Council.
– Received the 11th "Thep Thong" award for Excellent Organization from the Broadcasters Association of Thailand (Under the Rayal Patronage).

2009 – Selected to be listed as one of "Thailand Top 100 HR" by Thammasat University.

2008 – Appointed as a Clinical Professor at Sasin Graduate Institute of Business Administration, Chulalongkorn University for the course Organization Behaviour.

2006 – Was selected by Her Majesty Queen Rania of the Hashemite Kingdom of Jordan to join the forum of "Young Global Leaders" association, at affiliate global network of "World Economic Forum".
– Selected to be a Member of the Advisory Team, for the Ministry of Agriculture, Thailand.

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Faculty of Environment and Resource Studies, Mahidol University

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13. Sureekarn Totaiya	14. Supalak Wattanachalarmyot

Tentative Program

Day 1: 6 November, 2014

Time	Event
Room : Kamolthip Ballroom3	
08.00 – 09.00	Registration
09.00 – 09.20	**Opening Ceremony** Conference reported by Assoc. Prof. Dr. Kitikorn Charmondusit, Conference Chair Welcome speech and conference opening remarks by Associate Professor Dr. Kampanad Bhaktikul (Dean of the Faculty of Environment and Resource Studies, Mahidol University)
09.20 – 09.30	Short Introduction about ENNR Journal by Assoc. Prof. Dr. Kitikorn Charmondusit, Conference Chair
09.30 – 10.30	**Keynote Speaker** **Dr. Stefanos Fotiou** (Senior Programme Manager, United Nations Environment Programme) "Asia 2030: Scenarios, Challenges and Opportunities for Sustainability"
10.30 – 11.00	Break
11.00 – 12.00	**Keynote Speaker** **Dr. Choak Bulakul** (Group Managing Director & CEOFarm Chokchai Group) **"Climate Change Impact on the Agriculture and Economic Sectors and Responsive Developmental Approaches to Corporate Sustainability"**

Time	Event		
12.00 – 13.00	Lunch		
13.00 – 14.30	Session 1: Sustainability Sciences and Technology Room : Kamolthip Ballroom3 Chair: Prof. Pathmalal M. Manage Co-chair: Dr. Monthira Yuttitham	Session 2: Climate Change: Policy and Strategies Room : Duangkamol Chair: Dr. Wayne N. Phillips Co-chair: Assoc.Prof. Sayam Aroonsrimorakot	Special Session : Thai Language “มุมมองเชิงเศรษฐกิจ-สิ่งแวดล้อมไทยภายหลังเปิดประชาคมอาเซียน” King Prajadhipok’s Institute Room : Kornkamol
13.00 – 13.15	No. 1_11 Specific Methanogenic Activities (SMA) and Biogas Production of Different Granules Size and Substrates **Sunwanee Jijai, Galaya Srisuwan, Sompong O-thong Norli Ismail and Chairat Siripatana**	No. 2_10 Shaping Energy Efficiency Policy and Regulatory Frameworks: A Sustainable Pathway to Address Climate Change Challenges **Sansanee Dhanasarnsombat**	กล่าวเปิดการสัมนาวิชาการโดย คุณเกียรติศักดิ์ เทพผดุงพร ประธานหลักสูตรไทยกับประชาคมอาเซียน รุ่นที่ ๒ เวทีเสวนาวิชาการเรื่อง “มุมมองเชิงเศรษฐกิจ-สิ่งแวดล้อมไทยภายหลังเปิดประชาคมอาเซียน” โดย คุณเกียรติศักดิ์ เทพผดุงพร กรรมการบริหาร บริษัท เทพผดุงพรมะพร้าว จำกัด ดร.อิสิวุฒิ ตั้งเกียรติ นายกสมาคมการค้าและการท่องเที่ยวชายแดนไทย-กัมพูชาจังหวัดจันทบุรี
13.15 – 13.30	No. 1_12 Impacts of pH and Iron Concentration on Thermophilic Biohydrogen Production from Starch Processing Wastewater **Chonlapin Sutthipattanasomboon, Jaruwan Wongthanate, Benjaphorn Prapagdee and Chumlong Arunlertaree**	No. 2_14 A Study of Greenhouse Gas Emissions from Rubber Tree Plantations in Rayong Province **Yossawadee Wongtanakarn, Phairat Usubharatana and Harnpon Phungrassami**	

Time	Event		
13.30 – 13.45	No. 1_20 Energy Consumption Analysis of Thailand Industrial Sectors by using Hybrid Unit Energy Input-output Leontief Model **Pakoon Poolsawas Harnpon Phungrassami and Phairat Usubharatana**	No. 2_31 Numerical Simulation of Heat Island Phenomena related to Traffic Pollution of Urban Atmospheric Layer **Žarko Stevanović, Ivan Lazović, Maja Đurović-Petrović**	ดร.ศิวัสน์ เหลืองสมบูรณ์ ผู้จัดการฝ่ายวิจัยการลงทุนภูมิภาค2 ศูนย์วิจัยกสิกรไทย จำกัด รองศาสตราจารย์ ดร.เศรษฐ์ สัมภัตตะกุล หัวหน้าหน่วยวิจัยเพื่อการจัดการพลังงานและเศรษฐนิเวศ มหาวิทยาลัยเชียงใหม่ ดำเนินรายการโดย ดร.อนุวัศ สาคริก ผู้อำนวยการหลักสูตรรัฐประศาสนศาสตรมหาบัณฑิต มหาวิทยาลัยรังสิต
13.45 – 14.00	No. 1_22 The Study of Sustainable Energy Saving Building Design Technique in Civil Engineering for Thailand **Jaran Ratanachotinun and Nat Kasayapanand**	No. 2_34 Spatial Based Analysis for High Risk Erosion Area along the Coast of Thailand **Siriluk Prukpitikul, Varatip Buakaew, and Nuttorn Kaewpoo**	
14.00 – 14.15	No. 1_23 Life Cycle Assessment of Lipid Production from Algae **Supasin Ladawan, Phairat Usubharatana and Harnpon Phungrassami**	No. 2_45 Evaluation of the Greenhouse Gas Emission and Removal of Dairy Farm: A Case Study of Farm Chokchai Company Limited **Tanat Lieotrakun, Kitikorn Charmondusit and Kulnasan Saikhun**	

Time	Event		
14.15 – 14.30	No. 1_29 Assessment of NO_x and SO_2 Concentrations from Waste Incinerator Using Atmospheric Dispersion Model **Sirirat Chuchue, Rachen Koomsang and Thongchai Kanabkaew**	No. 2_54 The Capacity and Network Development towards the Participation of Organic Agriculture **Dusadee Charoensuk,Anuvat Roongpisuthipong**	
14.30 – 15.00	Break		
15.00 – 16.30	Session 1: Sustainability Sciences and Technology Room : Kamolthip Ballroom3 Chair: Prof. Pathmalal M. Manage Co-chair: Dr. Monthira Yuttitham	Session 2: Climate Change: Policy and Strategies Room : Duangkamol Chair: Dr. Wayne N. Phillips Co-chair: Assoc.Prof. Sayam Aroonsrimorakot	Special Session : Thai Language “มุมมองเชิงเศรษฐกิจ-สิ่งแวดล้อมไทยภายหลังเปิดประชาคมอาเซียน” King Prajadhipok′s Institute Room : Kornkamol
15.00 – 15.15	No. 1_33 Comparative Performance of a Solar Concentrating Linear Fresnel Reflector for Electricity Generation in Nigeria and in Thailand **Ahiwe Chinwendu Francis and Supachart Chungpaibulpatana**	No. 2_73 Tourist Satisfaction on Sustainable Tourism Development, Amphawa Floating Market, Samut Songkhram, Thailand **Panisara Wiwattanakantang, Jongdee To-im**	เวทีเสวนาวิชาการเรื่อง “มุมมองเชิงเศรษฐกิจ-สิ่งแวดล้อมไทยภายหลังเปิดประชาคมอาเซียน” (ต่อ) แลกเปลี่ยนมุมมองกับผู้เข้าร่วมงาน และตอบคำถาม

Time	Event		
15.15 – 15.30	No. 1_46 Forecasting of the E-waste Generation and its Future Trends in Vietnam **Thao Quoc Tran, Alice Sharp and Jun Nakatani, Yuichi Moriguchi**	No. 2_76 Conflicts between Communities and Industry and Conflict Management from Evidence-Based Solutions: A Case Study of Zinc Mine Project, Mae Sod District, Tak Province **Chaiwat Phadermrod**	
15.30 – 15.45	No. 1_51 Firefly Algorithm for Nonlinear Parameter Identification of Grid Tied Inverter **Viritpol Vacharapanich, Naris Pratinthong and Dhirayut Chenvidhya**	No. 2_77 Forest Carbon Sequestration in Huai Kong Ngong Sub-watershed, Samoeng District, Chiang Mai Province, Thailand **Jaruayporn Saokhat and Sureeratna Lakanavichian**	
15.45 – 16.00	No. 1_58 Causal Relationship Model of IQ and AQ Integrated with Environmental Education Affecting Environmental Behavior **Nongnapas Thiengkamol**	No. 2_78 Life Cycle Greenhouse Gas Evaluation of Rice Production in Thailand **Sanwasan Yodkhum and Sate Sampattagul**	

Time	Event		
16.00 – 16.15	No. 1_60 Application of Artificial Neural Networks for Daily Temperature Prediction over Don Mueang International Airport **Sukrit Kirtsaeng, Pattara Sukthawee, Banluesak Khosuk, Nuttapong Pantong and Supap Kirtsaeng**	No. 4_25 Climate Change Impacts on Health in Lao PDR **Tayphasavanh Fengthong, Ladsamy Inthavongsa, Khampasith Phommachack, Somphone Phengphommy, Vilayvone Muangkhaseume and Buakham Tounalome**	
10.30 – 11.00 & 14.30 – 15.00	Posters and Demos Session		
	NO. 0_05 Effects of Dietary *Nelumbo Nucifera Peduncle Extract* on Growth Performance of *Nile tilapia (Oreochromis niloticus)* **Phukphon Munglue**		
	NO. 0_39 Water Quality Assessment Using Biotic Indices in the Mae Tao Creek, Mae Sot District, Tak Province, Northern Thailand Witwisitpong Maneechan and Taeng On Prommi		
	NO. 0_41 The Contribution of Temporary Habitat to Quatic Insect Biodiversity in Kasetsart University, Kamphaeng Saen Campus Donlaya Naksisuk and Taeng On Prommi		
	NO. 0_55 Investigation of *Moringa Oleifera* used as Natural Coagulant in Water Treatment Process **Nuttaphon Phuaprasert, Ranjna Jindal and Nawatch Surinkul**		

Time	Event
	NO. 0_62 Wastewater Management Among Hotels in Patong, Phuket **Wipawee Suksuwan, Jiraporn Chuckpaiwong and Kanang Kantamaturapoj**
	NO. 0_ 65 Cyanobacterial Cell Density & Intracellular MC-LR Levels in Drinking/ Irrigation Reservoirs in Anuradhapura, Sri Lanka **Indika Upuli Hettiarachchi and Pathmalal M. Manage**
18.00 - 21.00	**Welcome Reception (Gala Dinner with Special Event: Loi Krathong Festival)** Room : Kamolporn
18.00 – 18.45	Arrivals
18.45 – 18.50	Welcome & Short Intro by Assoc. Prof. Dr. Kitikorn Charmondusit, Conference Chair
18.50 – 19.00	Opening Speech
19.00 – 19.30	Occasion - Present Souvenir/Certificate to Sponsor/Chair and Co-chair Session - Outstanding Conference Papers Award
19.30 – 20.00	Special Event: Loi Krathong Festival
20.00 – 21.00	Dinner & 7 Pieces Jazz Band Continues till End

Day 2: 7 November, 2014

Time	Event	
08.00 – 09.00	Registration	
09.00 – 10.30	Session 3: Natural Resources and Environmental Management for Sustainability Room : Duangkamol Chair: Assoc.Prof.Dr. Sate Sampattagul Co-chair: Dr. Pet Techarat	Session 4: Climate Change: Vulnerability and Changes Room : Kornkamol Chair: Prof. Žarko Stevanović Co-chair: Asst.Prof.Dr. Jongdee To-im
09.00 – 09.15	No. 3_75 Exergetic Evaluation of Renewability for Non-Combustion Based Electricity Power Generation in Thailand **Surat Sedpho and Sate Sampattagul**	No. 4_15 Eco-Utopia 2121: Future Car-free Cities Across the World **Alan Marshall**
09.15 – 09.30	No. 3-07 Community Acceptance Indicators Evaluation for Petroleum Exploration and Production Business in Thailand **Thidarat Chatchaiyadej and Thitisak Boonpramote**	No. 4_18 Tourism Threats to Coral Reef Resilience at Koh Sak, Pattaya **Wayne N. Phillips**
09.30 – 09.45	No. 3-21 The Effects of Global Warming on the Environment by Leontief Method from Input-output Model **Varis Boonmunewai, Harnpon Phungrassami and Phairat Usubharatana**	No. 4_32 Adsorption and Adsolubilization of Organic Solutes Using Rhamnolipid Biosurfactant-modified Surface **Davone Keomany and Emma Asnachinda**
09.45 – 10.00	No. 3_71 Evaluation of *Cocos nucifera*, *Heavea brasiliensis* and *Bambusa* sp. based Granular Activated Carbon for the removal of	No. 4_49 Towards a Climate Vulnerability Index of Phuket City: A Preliminary Study

Time	Event	
	Microcystin-LR in water treatment **R. P. Piumie Madhushika Dilrukshi, Upali Rathnayake and Pathmalal M. Manage**	**Sukanya Muadthong and Naiyana Srichaia**
10.00 – 10.15	No. 3-44 Biogas Production from Co-digestion of Food Waste and Rain Tree Leaf Using Single-stage and Two-stage Anaerobic Digesters **Panlekha Manpetch and ChavalitRatanatamskul**	No. 4_57 Effects of Climate Variability on Growths of Two Dominant Tree Species with Lower Canopy at the Sakaerat Environmental Research Station (SERS), Nakhon Ratchasima Province, Thailand **Kritsadapan Palakit, Khwanchai Duangsathaporn, Somkid Siripatanadilok, Sujaya Ritthisorn, Worakawee Chumworathayee, Jantima Teeka, and Kanokon Bunpa**
10.15 – 10.30	No. 3_63 A Survey of Dolphin Sightings Experienced by Local Fishermen in Donsak District, Surat Thani Province **Suwat Jutapruet, Siriporn Pradit and Kongkiat Kittitwattanawong**	No. 4_59 Predicting Vulnerability of Medicinal Plants Used by Karen People in Chiang Mai Province to Climatic Change Using Species Distribution Model **Kornkanok Tangjitman, Chalobol Wongsawad, Chusie Trisonthi**
10.30 – 11.00	Break	
11.00 - 12.00	Session 3: Natural Resources and Environmental Management for Sustainability Room : Duangkamol Chair: Assoc.Prof.Dr. Sate Sampattagul Co-chair: Dr. Pet Techarat	Session 4: Climate Change: Vulnerability and Changes Room : Kornkamol Chair: Prof. Žarko Stevanović Co-chair: Asst.Prof.Dr. Jongdee To-im
11.00 - 11.15	No. 3_66 Evaluation of Antibiotic Degradation Feasibility of *Bacillus cereus*	No. 4_61 Coping Mechanism with Floods: Case Study in Ba Baong

Time	Event	
	and *Rahnella aquatilis* Strains **Sumaiya F. Idroos, Pathmalal M. Manage**	Commune,Prey Veng Province, Cambodia **Ourn Vimoil and Kallaya Suntornvongsagul**
11.15 – 11.30	No. 3_67 Quantification of *Oxytetracycline* and *Amphicillin* in Two Waste Water Discharging Points in Colombo, Sri Lanka **Yasodara Liyanage and Pathmalal M. Manage**	NO. 0_43 Forest Habitat and Fruit Availability of Hornbills in Salakphra Wildlife Sanctuary, Kanchanaburi Province, Thailand **Hiroki Hata, Rattanawat Chaiyarat, Norberto Asensio, Phaitoon Intarabutr, Vijak Chimchome and Jongdee To-im**
11.30 – 11.45	No. 3_69 Water Quality Index (CCME-WQI) based assessment study of water quality in Kelani river basin, Sri Lanka **M.G.Y.L.Mahagamage and Pathmalal M Manage**	
11.45 – 12.00	No. 3_70 Occurrence of Tetracycline Resistant Bacteria in Surface and Farm Waste Water in Sri Lanka **Pathmalal M. Manage**	
12.00 – 13.00	Lunch	

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Specific Methanogenic Activities (SMA) and Biogas Production of Different Granules Size and Substrates

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Abstract

The objective of this study was to evaluate the specific methanogenic activities (SMA) of the granular sludge of different sizes and biogas production from different substrates in wastewater. The granules and wastewater were collected from four sources: a cassava starch factory (G1, W1), a frozen seafood factory (G2), a cannery seafood factory (W2) and a palm oil mill (G3, W3). Batch systems used for anaerobic digestion were operated at ambient temperature for 45 days. The resulting granules from G1, G2 and G3 were in the size range of 1.5-1.7 mm, 0.7-1.0 mm and 0.1-0.2 mm respectively. The corresponding SMA were 0.28, 0.26 and 0.16 gCOD/gVSSd respectively. It was observed that the specific methanogenic activities increased with increased size of granules. The accumulative methane was in the range of 85-385 ml. and methane content was in the range 32.03-62.50%. The methane potential (BMP) of wastewater from W1 was higher than that of W2 and W3 (161.12, 119.44 and 104.76 mlCH_4/gCOD removed respectively)

Keywords: Specific methanogenic activities (SMA)/ Granules size/ Biochemical methane potential (BMP)/ Anaerobic digestion

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Impacts of pH and Iron Concentration on Thermophilic Biohydrogen Production from Starch Processing Wastewater

Chonlapin Sutthipattanasomboon[a]*, Jaruwan Wongthanate[a], Benjaphorn Prapagdee[a] and Chumlong Arunlertaree[a]

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Abstract

The impacts of initial pH (4.0-8.0) and iron concentration (200-1000 mg Fe/L) on hydrogen yield were investigated in batch tests by anaerobic mixed culture at 55±2 °C. The results were revealed that the hydrogen production yield was larger in neutral and slightly basic condition than acidic condition. The maximum hydrogen production yield was 35.36 mL H_2/g COD at initial pH 7.0. Moreover, the hydrogen production yield was 2-folded higher than no added iron and highest yield of 61.75 mL H_2/g COD was observed at initial iron concentration 800 mg Fe/L. Therefore, the optimal condition of initial pH 7.0 and initial iron concentration 800 mg Fe/L could be enhanced hydrogen production from starch process wastewater.

Keywords: Hydrogen/ Starch processing wastewater/ pH/ Ferrous ion

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Energy Consumption Analysis of Thailand Industrial Sectors by using Hybrid Unit Energy Input-Output Leontief Model

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Abstract

From Thailand energy use situation, energy is the most important factor in every sector and continues to increase every year. In addition, because of each sector was not produced to the final demand only, but also production to intermediate output. Energy use assessment by considering only direct energy consumption were not enough, so energy embedded which are indirect energy should be also considered for energy consumption assessment. This paper presents Hybrid unit energy input-output Leontief model for total energy analysis included direct energy consumption and indirect energy consumption to shows the relationship between 13 economic sectors and 4 energy sectors, which consist of coal and lignite, petroleum and natural gas, petroleum refineries and electricity. This research is divided into two main data for analysis. First, the monetary data, this research presents Input-Output table (IO table) to show the economic relationship between each sector. Second, the energy data, this research presents Energy Input-Output table (E-IO table) to show the energy relationship between 4 energy sectors and 13 economic sectors. These results show that the highest total energy intensity of Thailand economic sectors which are the transportation and communication sector, the non-metallic sector, and the mining are 2.0433, 1.3777 and 0.4302 TJ/M Baht, respectively. Furthermore, in the case of Thailand energy sectors, the highest total energy coefficient requirement are electricity, petroleum refineries, petroleum and natural gas, and coal and lignite which are 4.0765, 2.5426, 1.1512 and 1.0260 TJ/TJ of sector itself.

Keywords: Input-Output table (IO table)/ Energy Input-Output table (E-IO table)/ Hybrid unit energy input-output Leontief model

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The Study of Sustainable Energy Saving Building Design Technique in Civil Engineering for Thailand

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Abstract

This research is to study the energy saving building design technique in civil engineering which gives priority to the use of sustainable energy, the development of sustainable energy saving building for practice, the feasible study of practice for Tropical climate in Thailand and design factors related to construction cost and energy consumption. The results indicated that structure design affects the energy consumption such as the production of construction material. In the case study of concrete production, the results show the energy use of production for 1 m^3 of concrete equaled two times the energy of cement production. The pattern and size of structure building, different slab pattern of buildings and increasing of slab thickness affects to increase the cooling load and energy consumption of air conditioning. The design for construction materials of the building that contains the properties of low heat and low humidity are suitable for Thailand. The ultimate design and a similar structure size as much as possible reduce to construction cost. Building design with the solar chimney based on the airflow from the inside to the outside of the building by using solar energy. There is a possibility for investment for Thailand, and it is an alternative form of sustainable energy saving building.

Keywords: Energy saving building design/ Sustainable energy saving building/ Solar chimney building

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Life Cycle Assessment of Lipid Production from Algae

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Abstract

Nowadays, Algae biofuel triggers a wide interest as an alternative to fossil fuel that is going to be exhausted in the future. However, in order to make it sustainably commercially viable, both economic and environmental aspects need to be concurrently considered for the utterly effective investment. This research purposes to analyze the effects of algal lipid production on the environment, which are categorized into 3 groups; Greenhouse effect, Acidification and Eutrophication. The analysis is significantly performed through Life Cycle Assessment (LCA) and the extent of this study includes 4 main processes; algae culture in laboratory, outdoor cultivation, harvesting and lipid extraction, based on a functional unit at 1 liter of lipid or equivalent to 31.68 MJ biodiesel. The findings reveals the impact on Greenhouse effect is that the algal lipid emits Greenhouse gas at 128.7034 kg CO_2 eq./L. Its acidification effect equals to 0.3309 kg SO_2 eq./L and its eutrophication is 0.0080 kg P eq./L. The key contributors to such effects are electricity and nutrient usages, including chemicals required in the production process.

Keywords: Life Cycle Assessment/ Algae/ Lipid/ Biofuel

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Assessment of NO_x and SO_2 Concentrations from Waste Incinerator Using Atmospheric Dispersion Model

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Abstract

Oxides of nitrogen (NO_x) and sulfur dioxide (SO_2) are included in the criteria air pollutants and plays the role in acid rain formation. Waste incinerator is one of important sources of NO_x and SO_2, particularly for local source of air pollutions. This study was designed to assess concentrations of NO_x and SO_2 that emitted from the waste incinerator at Walailak University using an atmospheric dispersion model, AERMOD in two simulated years of 2010 and 2012. Stack emissions of NO_x and SO_2 were taken from stack monitoring data of the waste incinerator. Meteorological data were mainly taken from Thai Metrological Department for the study area while terrain data were taken from ASTER GDEM database. Results revealed that maximum concentrations of NO_x were 3.30, 0.30 and 0.13 µg/m^3, respectively for 1-hour, 24-hour and annual average while those for SO_2 were 18.68, 1.72 and 0.72 µg/m^3, respectively. Simulated concentrations of NO_x and SO_2 were well below the values specified in the national ambient air quality standards of Thailand and World Health Organization Guidelines.

Keywords: Oxides of nitrogen/ Sulfur dioxide/ Atmospheric dispersion model/ AERMOD

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Comparative Performance of a Solar Concentrating Linear Fresnel Reflector for Electricity Generation in Nigeria and in Thailand

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Abstract

This paper comparatively studies the performance of the solar concentrating linear Fresnel reflector (LFR) technology for electricity generation in two different locations. Bangkok (Thailand) at latitude 13.40^0N and longitude 100.37^0E and Abuja (Nigeria) at latitude 9.06^0N and longitude 7.48^0E were chosen for this study. A one year daily average clear sky direct normal radiation was obtained from the NASA surface and meteorological energy website. Total hourly beam radiation was estimated from the daily data using a formulated model. Mathematical models were formed for the LFR system and for an organic Rankine cycle (ORC) for electricity generation. An hourly simulation performance study of the system at each location was carried out and the results compared. The linear reflectors were assumed to track the sun in an east-west movement and reflecting specularly. The results of the simulation show a surprisingly close performance in both regions with a maximum average system efficiency of 5% in Abuja and 4.7% in Bangkok. Using the current value of money, the current cost rate of electricity and an assumed system life span of 20 years, the resulting levelized cost of electricity from the system in Abuja is $ 0.286 /kWh and in Bangkok $ 0.289 /kWh.

Keywords: Linear Fresnel Reflector/ hourly beam radiation/ organic Rankine cycle

Environment and Natural Resources Journal
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Forecasting of the E-waste Generation and Its Future Trends in Vietnam

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Abstract

The ongoing technological revolution and innovation have improved human livelihood in many ways. Electronic equipment and appliances have become part of our daily needs. Along with an increasing demand, the technological advances make it cheaper and more convenient to buy a new appliance instead of upgrading or repairing an old device. As a result, the growing dependence on electronic appliances has given rise to a new environmental challenge, waste electronic appliances. This study aims to forecast the generation of e-waste in Vietnam by using television sets as a case study. A questionnaire survey was employed for data collection in two major cities: Hanoi and Ho Chi Minh City. Data collection includes income, ownership ratio, and trends of disposal waste television generated. The results indicated that the generated amounts of waste-TVs depend on the share of TVs in domestic sales and trend of consumer behavior. With approximate 1.3 - 2.8 million TVs units that became waste per year during the past 5 years, it is estimated that, cumulatively, over 3.1 - 6.2 million units of TVs would be probably obsolete between 2015 and 2030. In addition, factors affecting ownership of electronic appliances are electrification, urbanization, and digital upgrading by the Vietnamese government. While TVs are only considered in this study, the estimation framework could be applied to other types of appliances. The results of this study are sufficient to support the decision makers in both government and responsible producers for considering the appropriate mitigation of the huge generation of waste electronic appliances in the near future.

Keywords: Appliance ownership/ E-waste/ E-waste management/ Television/ Vietnam

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Firefly Algorithm for Nonlinear Parameter Identification of Grid Tied Inverter

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Abstract

This research studies the parameter identification for establish the model of inverter control system which has grid-connected in distributed power systems. Identification is a method of measuring the mathematical description of a system by processing the observed inputs and outputs of the system. Along with using statistical method for analysis and used as a criteria for mathematical model in various categories. In This research, we use firefly algorithm to find nonlinear parameter identification for simulate the inverter control system which has grid-connected in distributed power systems. We present comparison of the model using Nonlinear Autoregressive Exogenous (NLARX) in 3 different categories that is Wavelet Network, Tree Partition Network and Sigmoid Network. The accomplished models have accuracy results to show that the optimal category of NLARX is Wavelet Network which has the optimal accuracy value is equal to 78.24 percent at 80 percent of training data from output model and the measured output from the validation data set from grid tied inverter mathematical modelling using firefly algorithm. This optimal model can represent for real system to use for review planning and improve system by modify the equipment of the inverter control system which has grid-connected in distributed power systems.

Keywords: Identification/ Grid tied inverter/ Modelling/ Firefly algorithm

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Causal Relationship Model of IQ and AQ Integrated with Environmental Education Affecting Environmental Behavior

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Abstract

The populations were 37,101 undergraduate student of Mahasarakham University in second semester of academic year of 2012. The Multi-stage simple random sampling technique was employed to collect the sample for 400 undergraduate students. The research instrument was the questionnaire and it was used for data collecting. LISREL was used for model verification.

The objective was to propose the structural model Intelligence Quotient (IQ), Adversity Quotient (AQ) and Environmental Education (EE) affecting to environmental behavior for global warming alleviation through inspiration of public consciousness.

Results illustrated that the structural model confirmatory factors of AQ, IQ, and EE were able to explain the variation of endogenous factors of Inspiration of Public Consciousness for Environmental Conservation (IPC) to caused Environmental Behaviors for Global Warming Alleviation (BEH) with 93.00 percents. IPC was the most effect to BEH with 0.66. Concurrently, EE, IQ, and AQ, were able to predict IPC with 87.00 percents and EE was the most effect to IPC with 0.49.

Keywords: Model / IQ / AQ / Environmental Education / Affecting / Environmental Behavior

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Application of Artificial Neural Networks for Daily Temperature Prediction over Don Mueang International Airport

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Abstract

The aims of this study are to develop the daily temperature prediction models for short-range forecast (up to 72 hours) for Don Mueang International Airport and to evaluate the performance of the developed models. Artificial neural networks (ANN) with cross validation for stopping criteria were used to develop the prediction models. Don Mueang Weather Station's meteorological data from 1980-2012 were employed for models training. Models were trained with 12,053 data patterns while weather data of 365 days from the year 2013 were left out for performance comparison purpose. Models performances were evaluated by the forecast accuracy on the set of previously chosen days. The models developed consist of daily maximum temperature forecast models (Tmax models) and daily minimum temperature forecast models (Tmin models). Performance analysis shows that forecasts from Tmax and Tmin models correlated with the recorded temperatures with the fractions of variance in the range of 0.5729 - 0.437 and 0.7809 - 0.6106, respectively. Test results indicate good performances across all the models with Tmin models slightly outperform the Tmax counterpart. Moreover, the developed perform better than currently deployed models (24 hours) in term of time of forecast with extend to 72 hours.

Keywords: Artificial Neutral Networks/ Daily temperature prediction/ Short-range forecasting model/ model development

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Shaping Energy Efficiency Policy and Regulatory Frameworks
A Sustainable Pathway to Address Climate Change Challenges for Thailand

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Abstract

Energy efficiency (EE) plays key roles in climate change mitigation. EE is also considered to be one of the most cost-effective strategies for tackling climate change. A sound EE regulatory framework could effectively contribute to greenhouse gas emissions reduction over time. This paper addresses why EE is one of the most sustainable pathways to address climate change challenges. It will focus on Thailand's experience in implementing an EE policy and a regulatory framework, aligned with its climate change policy framework, while lessons can be learned, too, from other countries, including Singapore and the United States. The paper discusses the necessity for reviewing and updating the current framework in Thailand, which includes, among other things, minimum energy performance standards (MEPS) and building energy codes, to ensure that benefits of EE are being optimized.

Keywords: Energy efficiency/ Climate change/ Policy and regulatory framework/ Minimum energy performance standards/ Building energy codes

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A Study of Greenhouse Gas Emissions from Rubber Tree Plantations in Rayong Province

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Abstract

A study of greenhouse gas emissions from rubber tree plantations in Rayong Province aims to determine the environmental impact by using Life Cycle Assessment (LCA). The scope of research is to calculate the total amount of greenhouse gas emission in the process of acquiring fresh rubber latex, measured in units of carbon dioxide equivalent and to study on the factors that affect greenhouse gas emission from the plantation. The samples are divided into three groups by the size of the areas to be the small, the medium and the large scales. The results show that 1 kilogram of fresh rubber latex triggers the emission of greenhouse gas equal to 321 gCO_2e, 190 gCO_2e and 235 gCO_2e respectively. Excessive use of fertilizers tends to increase the carbon dioxide emission whereas the size of the planting area has no effect on the release of carbon dioxide.

Keywords: Life Cycle Assessment/ Rubber tree plantation/ Fresh rubber latex/ Carbon dioxide

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Numerical Simulation of Heat Island Phenomena Related to Traffic Pollution of Urban Atmospheric Layer

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Abstract

Phenomena of urban heat island (UHI) are one of the most important issues concerning thermal pollution in urban areas. There are a lot of published papers with measurement data as well as numerical simulations of UHI, but only a few studies have been performed in order to investigate correlation of urban pollution level (primarily CO_2) with the effects on of urban heating intensity. It is a well-known fact that local temperatures are influenced by complex impacts of different effects such as wind, evaporation and rain, and even atmosphere pollution with three-atomic pollutant gases such as CO_2, NO_X, SO_X, H_2O, as well as particulate matter. Since the polluted urban air is non transparent matter, high levels of pollutants in the urban atmosphere will be heat trapping and cause the urban upper atmosphere to be hotter. The presence of pollution would then cause the downward long-wavelength radiant energy to be larger thus increasing urban heating. We developed numerical model to simulate these effects. Based on the numerical model we performed case study simulations of one part of Belgrade. The numerical model has been validated by measurement data. The measurement has been performed in different working day-times: morning, the most crowded traffic period – afternoon, and after sunset. Inside the study area, remote sensing technique has been applied to evaluate UHI parameters, whereas the data from stationary automatic weather station has been used as rural one. The basic outcome of this study is quantification of correlation levels of urban heating related to traffic intensity. It obtained a high correlation level of traffic intensity and outdoor temperatures as well as radiant temperatures.

Keywords: Urban heat island/ Traffic pollution/ Numerical simulation

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Spatial based Analysis for High Risk Erosion Area Along the Coast of Thailand

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Abstract

This spatial-based analysis for high-risk erosion areas along the coast of Thailand aims to investigate and monitor coastal erosion, create a coastal zone change map for the entire country at scale 1:100,000 and provincial maps (including risk analyses) at scales 1:50,000 and 1:25,000, and implement a coastal geo-database for long-term coastal zone management. Key activities included the following: 1) shoreline and land use analysis using medium- and high-resolution satellite images taken during 1999-2010; 2) collection of field data such as DGPS/GPS data, land use survey, and oceanographic data; and 3) implementation of a coastal geo-database and distribution data via the Internet. Coastal zone observations in 2009-2010 revealed that the coast of Thailand eroded by 18.06 km^2 and accreted by 2.60 km^2. The most heavily eroded areas were in Pattani, Trad, and Nakornsrithamarat provinces, with losses of coastal land of 2.65 km^2, 2.24 km^2, and 1.80 km^2, respectively. The largest areas of accretion were in Prachuapkhirikhan, Chumporn, and Pattani provinces, with increases in coastal land of 0.55 km^2, 0.48 km^2, and 0.25 km^2, respectively. In addition, a comparison among 23 provinces found the highest erosion rates in Samutprakarn, Samutsakorn, and Bangkok provinces, with land loss rates of 15.92 m/yr, 9.94 m/yr, and 8.48 m/yr, respectively, and the highest accretion rates in Samutprakarn, Bangkok, and Nakornsrithamarat provinces, with land accretion rates of 22.56 m/yr, 14.26 m/yr, and 12.88 m/yr, respectively. The distribution of coastal information was disseminated via GISTDA Coastal Map (GCOS), which users can access at http://ocean.gistda.or.th.

Keywords: Spatial-based analysis/ High-risk erosion area/ Coast of Thailand

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Evaluation of the Greenhouse Gas Emission and Removal of Dairy Farm: A Case Study of Farm Chokchai Company Limited

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Abstract

In every organization, there is always an opportunity to reduce its greenhouse gas emission. The organization would not only be preserving the environment, but also be able to run economically sufficient. Farm Chokchai Company Limited, one of Thailand's most well-known dairy producers is a company enthusiast to participate in evaluating its carbon footprint for organization (CFO). By evaluating and implementing CFO to the company, it is comprehended that the process of dairy production would be improved in order to reduce its greenhouse gas emission while compensating financial courses. This did not only gain positivity to the business in production matters, but also visualized by consumers as a responsible company and develop the reputation as being responsible to the environment. In addition, there is growing interest and urgency in quantifying the storage capacity of carbon sinks for inclusion in greenhouse gas emission inventories because of the need to quantify and reduce an organization's carbon footprint. The result from evaluating CFO showedthe amount of greenhouse gas emitted in the unit of Ton CO_2 equivalent from Farm Chokchai Company Limited during the 2013. The CO_2 sink evaluation, on the other hand, was done by field investigation. This research expected that the results gained would be implied to the company to improvement.

Keywords: Carbon footprint for organization/ Dairy farm/ Greenhouse Gas/ CO_2 sink

Environment and Natural Resources Journal
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The Capacity and Network Development Towards the Participation of Organic Agriculture

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Abstract

The capacity and network development of farmers and gardeners towards the participation of organic agriculture by using mixed method of quantitative and participation action research with 107 samples in the community included the leader of Tambon Kok-kram both government and local organization, Supanburi province. The results revealed the development of capacity and networking of members of sub-district administration, community members and leaders on the organic agriculture; knowledge, attitude that significantly increased 0.5 level by t-test after participation in the seminar programs and compared rice cultivation between using artificial and their organic fertilizers on the land which has the same quality of soil. The result showed, there was no difference in the rice productions. This increased the self confidence in their local wisdom in organic agriculture and the participation enhanced networking team with the sharing knowledge and good relationship among them. The awareness of using chemical substance related health problems and natural degradation had been increased with more positive attitude towards organic agriculture and King Bhumipol's Philosophy of economic sufficiency.

Keywords: Capacity/ Network/ Participation/ Organic agriculture

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Tourist Satisfaction on Sustainable Tourism Development, Amphawa Floating MarketSamut Songkhram, Thailand

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Abstract

Sustainable tourism development concerns on environment, economic, socio-cultural, and management. The purpose of this study is to measure tourist satisfaction on sustainable tourism development situation in study area, which is floating market tourism. The questionnaire was developed for data collection and was reviewed by four experts on environmental science, social science, sustainable development, tourism and management. The samples of this study were 400 tourists who visited this floating market during May to June 2014. Descriptive statistics were employed with Statistical Package for the Social Sciences (SPSS). The result indicated that tourists were partially satisfied (3.33±0.80) on the sustainable tourism development in over all aspects. The results also revealed that tourists satisfied on socio-culture aspect (3.71±0.79). While, environmental aspect (3.07±0.86), economic aspect (3.31 ±0.76), and tourism management (3.22±0.79) were satisfied in neutral level. 89% of respondents mentioned that they would visit this floating market again. They recommended about tourism management on overcrowding of tourists, cleaning, garbage bins providing, and the amount of restrooms.

Keywords: Sustainable Tourism Development/ Tourist satisfaction

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Conflicts between Communities and Industry and Conflict Management from Evidence-Based Solutions: A Case Study of Zinc Mine Project, Mae Sod District, Tak Province

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Abstract

The objectives of this study were 1) To study and analyze the cause and result of solving the conflict between the mine and communities in the event of the cadmium contamination problem in Mae Tao watershed, Tak Province in 10 years ago(Year 2004-2014) 2) To prove the effects of conflict resolution where both parties (the community and the mine) is the foundation of the evidence base. Conflict Studies that is a related problem to the many aspects of the economy, society and environment. Consisting of three sub-problems that is used as a case study of the major problems include cadmium contamination in paddy soil, cadmium contamination on rice and cadmium contamination in the case of the itai itai disease.

The first case of cadmium contamination in paddy soils showed the chronic conflict when the many stimulus factors into this conflict so occur the conflict problem again. The second case study of the cadmium contamination in rice showed the partly ended conflict problem. And the last case study is the cadmium contamination in the itai itai disease. showed the ended conflict case. The sustainable way to resolve the conflict depend on the weight of evidence base and the nature of the evidence used to prove in two dimensions: 1) The properties of the evidence base 2) The complex of the conflict problem

The properties of the evidence base is separated into three parts: 1)The credibility of the person who set the data 2) The validity of information or the data and 3) The reliability of the information or the data. Concluded that the conflict of the mine and the communities in the cadmium contamination problem study found the ideology and practice of discourse as powers for the benefit of stakeholders each department and the sustainable conflict management and resolution of the stakeholders to resolve the conflicts of the cadmium contamination problem in Mae Tao watershed, Tak province by the evidence base using so all parties seemed to agree or not to build the controversial new series, with the possibility to manage the conflicts.

Keywords: Conflict/ Evidence-base/ Cadmium contamination

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Forest Carbon Sequestration in Huai Kong Ngong Sub-watershed, Samoeng District, Chiang Mai Province, Thailand

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Abstract

The objectives of the study were to assess carbon sequestration in the watershed forests of Huai Kong Ngong sub-watershed in Mae Saab watershed, Samoeng district, Chiang Mai province, and understand forest conservation by local villagers in relation to forest diversity and carbon storage. Participatory Ecological Investigation Methodology (PEIM) was applied with villagers at all steps. Forest ecological assessments were undertaken in 2 phases: 1) stratified random sampling for classifying forest strata and calculating a number of sample plots (40 x 40 m^2 each), and 2) simple random sampling in a forest stratum of 438 hectares by setting up 4 quadrats for measurement and identification of perennial trees, saplings and seedlings. Allometric equations were applied in living biomass and carbon calculations. Species diversity index was assessed, based on a formula of Shannon-Weiner Index (SWI). The results showed that the carbon stocks of the hill evergreen forests in Huai Kong Ngong sub-watershed were 71.65, 95.56, 112.64 and 135.44 ton C ha^{-1} respectively. The SWI was 5.09 which was relatively high, based on the standard range of 0 - 7. Forest carbon sequestration of Huai Kong Ngong sub-watershed in Mae Saab village has been diverse due to various soil fertility, relatively high slope, recent successions to the hill evergreen forest ecosystems in some particular areas, and past forest concessions. The villagers have utilized natural resources optimally according to their traditional livelihoods while following rules and regulations of forest conservation formulated by the community strictly during the past four decades.

Keywords: Forest Carbon/ Carbon Sequestration/ Biomass/ Species diversity/ Hill evergreen forest

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Life Cycle Greenhouse Gas Evaluation of Rice Production in Thailand

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Abstract

By applying the Life Cycle Assessment (LCA) concept, according to ISO 14040 and Carbon Footprint of Product (CFP), this study aims to determine greenhouse gas (GHG) emissions of rice production in Thailand; organic KhaoDawk Mali 105 (KDML 105) rice farming of Chiang Mai province, Good Agricultural Practice (GAP) KDML 105 rice farming of NongKhai province and GAP Sangyod rice farming of Phatthalung province. Life cycle inventory of rice cultivation is developed in 2013 by Office of Agricutural Economics (OAE). As the results, GHG emissions of 1 kilogram of organic KDML 105 paddy of Chiang Mai, GAP KDML 105 paddy of NongKhai and GAP Sangyod paddy of Phatthalung were 2.39, 1.52 and 1.34 kg CO_2-eq/kilogram of paddy, respectively. And carbon footprint evaluation of 1 kilogram of rice in packaging was found that organic KDML 105 brown rice of Chiang Mai, GAP KDML 105 brown rice of NongKhaiand GAP Sangyod coarse rice of Phatthalung were 3.57, 2.58 and 2.29 kg CO_2-eq/kilogram of rice in packaging, respectively. It is obviously seen that the hot spot of greenhouse gas is occurred in rice cultivation stage, the improvement is introduced for the better eco-friendliness rice production of Thailand.

Keywords: Life cycle assessment/ Greenhouse gas Evaluation/ Rice production/ Thailand

Environment and Natural Resources Journal
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Climate Change Impacts on Health in Lao PDR

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Abstract

Lao PDR is not a major contribution to climate change, but is likely to be disproportionably affected. This study is to identify the general trends of climate and its impacts on health particularly infectious diseases in Lao PDR. . The meteorological data (1998~2010) and diseases under surveillance data (2005~2010) were used. Out of 7 meteorological data, 3 variables like mean maximum temperature (ºC), mean and minimum temperature (ºC), total precipitation in mm were selected because data were somewhat inaccurate and a lot of missing values. In health data, out of 21 diseases, 6 diseases were selected like dengue fever, severe diarrhea, total dysentery, food poisoning, typhoid fever, and total hepatitis based on the data quality and potential association of climate change, for the analysis. Data was grouped into 3 regions (North, Central and South) due to altitude which divided Lao PDR into three different climatic zones, to see general trends and crude relationship between weather and health. The time series analysis and Pearson correlation were used. The results showed that there was an increasing trend in 2008 for maximum and mean temperatures but no increase in the minimum temperature including humidity in the northern region. The number of heavy rain days was an increasing trend in the north and decreasing trend in the central region. The results also showed that climate was significant associated with 5 infectious disease incidences particularly dengue fever, dysentery, food poisoning, hepatitis and typhoid fever. In Lao PDR, there had been the sign of climate change and it affected Lao People health particularly some infectious diseases.

Keywords: Climate change/ Infectious Disease/ Dengue/ Dysentery and typhoid

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Exergetic Evaluation of Renewability for Non-Combustion Based Renewable Electricity Generation in Thailand

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Abstract

Thailand has targeted the use of renewable energy up to 25% of the total energy demand in the country by the year 2021, thus the renewable electricity generation under this plan has been increasing. Consequently, it is important that Thai government should have a key indicator to evaluate the renewable electricity generation system. In this paper, exergy-based indicators were used to analyze the non-combustion based renewable electricity generation system throughout the life cycle from extraction of materials, transportation to power generation system, which divide into three phases construction, operation and dismantling. In order to evaluate the resource efficiency, exergetic efficiency has been chosen. The renewability of the non-combustion based power generation systems was evaluated by renewability performance indicator and compared the results with the fossil fuel power generation system. According to the results, non-combustion based system shows the better resource efficiency than fossil fuel, solar power 85.53%, wind power 45.40% and coal-fired power 7.50%. The renewability performance indicators of renewable system more than 1, indicate that the systems are environmentally friendly (solar power 15.06, wind power 5.20), whereas fossil fuel system less than 1(0.25) which can be interpreted as environmentally unfavorable system.

Keywords: Exergetic efficiency/ Renewability/ Renewable electricity generation

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Community Acceptance Indicators Evaluation for Petroleum Exploration and Production Business in Thailand

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Abstract

It is widely recognized that the acceptance from communities surrounding an operation field is crucial to field operation achievement. Therefore; an E&P company will utilize their resources such as manpower, financial, technology and time, in order to obtain Community Acceptance. The research objective is to study community acceptance indicators for petroleum exploration and production (E&P) business in Thailand, and to rank the prioritization of the factors of corporate social responsibility (CSR). The methodology is interview for expert opinions comprising CSR professionals, community leaders and local government representatives in three E&P fields in Thailand; two onshore fields, Sirikit Field and Rattana Field and an offshore field, Nang Nuan. The resulting twenty five indicators for community acceptance of petroleum E&P business in Thailand comprised six key factors of CSR, which categorized into seven components. If the (E&P) company is able to fully perform CSR activities to represent all four key factors of CSR; i.e. environmental factors, the satisfaction of residents in communities surrounding the company, factors related to the target audience and social and the stakeholders satisfaction; the company would also automatically represent the economy and factor-in the development of society and the nation, without any company resource. The results from expert opinion from this paper will be able to define a guideline for corporate social responsibility policy with the highest value to both business and the community.

Keywords: Community Acceptance/ Indicators/ Evaluation/ CSR

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The Effects of Global Warming on the Environment by Leontief Method from Input-output Model

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Abstract

The purposes of this research are to study the impact of the carbon dioxide emissions in each sector and the relationship between the emissions of carbon dioxide in each sector of Thailand. An input-output data table in Thailand (2005) was analyzed by Leontief method. The data used in this study are domestic data only, which showed the relationship of interindustry resource consumption. In this study consider the three fuel combustion of energy sectors; coal and lignite, petroleum and natural gas and petroleum refineries in according to the principles of the IPCC. The results showed that the total carbon dioxide emissions was 0.393 teragramCO_2 or 0.5980 kgCO_2/Baht which consisted of the direct carbon dioxide emissions 0.2982 kgCO_2/Baht and the indirect carbon dioxide emissions 0.2998 kgCO_2/Baht. These results showed that the first three highest sector emitted carbon dioxide are electricity (26.26%), transportation and communication (25.66%) and non-metallic products (11.26%), respectively.

Keywords: Input-output table (IO table)/ Global warming/ Leontief/ Environmental input-output analysis

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Evaluation of *Cocos nucifera*, *Heavea brasiliensis* and *Bambusa* sp. based Granular Activated Carbon for the removal of Microcystin-LR in water treatment

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Abstract

Microcystin-LR (MC-LR) is a hepato and neurotoxic cyanotoxin present in cyanobacterial contaminated water. Cyanotoxins cause health problems as conventional water treatment and heating at 100^0C cannot remove MC-LR from drinking water. Removal of Microcystin-LR (MC-LR) from drinking water was studied by using two standard particle sizes of Granular Activated Carbon (GAC) as (1.18 – 2.36) mm and (0.425 – 1.70) mm produced by Coconut *(Cocos nucifera)* shells, rubber *(Hevea brasiliensis)* wood and bamboo *(Bambusa sp.)* in the present study. Chemical activation was carried out using Sulphuric acid, Potassium hydroxide and Zinc chloride. Zinc chloride was selected as the most suitable and efficient dehydrating reagent. Zinc chloride activated, three sources in two different particle sizes of GAC were analyzed for the adsorption of MC-LR. MC-LR concentration was quantified using PDA-HPLC and MC-LR adsorption efficiency was compared with commercial grade wood based GAC. Highest adsorption of MC-LR was observed by the smaller particle size (0.425 – 1.70) mm than larger particle size (1.18 – 2.36) mm. Large particle size GAC produced by bamboo and rubber showed highest efficiencies while bamboo GAC resulted a complete removal of MC-LR from the samples. All the varieties in the particle size of (0.425 – 1.70) mm showed similar efficiencies to the commercial grade GAC by removing total initial MC-LR (11.8 µg/ml) in the sample except coconut shells. Bamboo was identified as the most efficient low cost GAC for the removal of MC-LR. Production cost for the materials were approximately US $ 0.229 / kg and the market cost of the commercially available wood based GAC is approximately US $ 1.145 – 1.908.

Keywords: Microcystin-LR/ Granular Activated Carbon/ PDA-HPLC (Photo Diode Array- High Performance Liquid Chromatography)/ Zinc Chloride

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Biogas Production from Co-digestion of Food Waste and Rain Tree Leaf using Single-stage and Two-stage Anaerobic Digesters

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Abstract

Anaerobic co-digestion of food waste and rain tree leaf was operated semi-continuously using two pilot scales, comparing between single-stage and two-stage anaerobic digesters. Both digesters were fed with identical organic substrates and loading rate (95% Food waste with 5% rain tree leaf) at ambient temperature condition. Food waste and rain tree leaf were collected from Chulalongkorn University to convert energy from organic waste. Comparison of energy production from both systems was done by measuring biogas production. Biodegradation efficiencies were compared by measuring the total solid removal, Total volatile solid removal, percent COD removal and Volatile fatty acids. From the obtain results, it was found that the highest amount of bio gas at 0.328 ± 0.093 m^3/kg organic waste-day could be obtained by the two-stage anaerobic digester.

Keywords: Anaerobic co-digestion/ Food waste/ Rain tree leaf/ Biodegradability/ Biogas

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A Survey of Dolphin Sightings Experienced by Local Fishermen in Donsak District, Surat Thani Province

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Abstract

The dolphin sightings experienced by local fishermen and the opportunity to have an interview with them can be used as preliminary assessment for wild dolphin distribution. This study is aimed to locate areas where dolphins are found by way of conducting the interviews with fishermen and undertaking boat based surveys in the waters of Donsak District, Surat Thani Province. The boat based surveys were conducted at 07.00-14.00 from December 2011 to April 2013 along the shoreline of Donsak District and some areas of Ang Thong Islands. The areas which dolphins were seen by local fishermen are applied by geographic information system. The minimum convex polygon (MCP) of areas which dolphins were frequently resighted by local fishermen covers 138.11 km^2 while the MCP of fishing areas is 497.94 km^2 during 06.00-21.00 according to boat based survey, the weight distribution of the survey effort showed that the dolphins inhabit along the shoreline of Donsak District and around the Chuek Island. It also showed that three dolphin species were found: finless porpoises (*Neophocaena phocaenoides*), Indo-Pacific humpback dolphin (*Sousa chinensis*) and Irrawaddy dolphin (*Orcaella brevirostris*). Moreover the boat based survey data can support attitudes and experiences of local fishermen indicating the potential area for dolphin habitat in the Gulf of Thailand. The period and areas of fishing proved a small scale of the government's role in monitoring of the study area. As a result, the study in this area can be developed in terms of in depth research plan, marine mammal policies or conservation in the future.

Keywords: Cetacean/ Dolphins, Sighting/ Distribution/ Donsak/ Surat Thani

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Evaluation of Antibiotic Degradation Feasibility of *Bacillus cereus* and *Rahnella aquatilis*

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Abstract

Antibiotics are considered to be emerging pollutants due to their continuous input and persistence in the aquatic ecosystems. Oxytetracycline hydrochloride (OTC) and Ampicilin (AMP) is used as an antibacterial drug for humans and animals. OTC and AMP are released into the aquatic environment through wastewater outlets. The present study reports the biodegradation of OTC and AMP by *Bacillus cereus* and *Rahnella aquatilis* which were previously reported as degraders of the peptides Microcystins and nodularins. A 0.5 ml of overnight starved bacterial suspensions was introduced into medium containing each antibiotic at 50 ppm and 75ppm respectively. Triplicate samples were incubated at 28^{0}C with shaking at 100rpm. A 0.5ml of aliquots was removed at 2 days interval for 14 days. Samples were analyzed by High Performance Liquid Chromatography (HPLC). The Minimum Inhibition Concentration (MIC) was also studied at 50-300 ppm of OTC and AMP. *Bacillus cereus* completely removed OTC and AMP from the medium within 10 days of incubation showing a degradation rate of 1.26 ±0.15µg /day and 1.17 ±0.09µg /day respectively. *Rahnella aquatilis* showed degradation for OTC at rate of 0.56±0.01µg /day and was unable to completely remove OTC from the medium at the end of incubation period. Nevertheless, *Rahnella aquatilis* showed a complete removal of AMP within 8 days at a rate of 1.64±0.02µg /day. MIC value for OTC and AMP was; 250ppm in *Bacillus cereus*, 200ppm and 250ppm in *Rahnella aquatilis* respectively. Therefore these bacterial strains could be used as a useful bioremediation tool in the removal of antibiotics, contamination in the environment.

Keywords: Biodegradation/ Oxytetracycline hydrochloride (OTC)/ Ampicillin (AMP)/ *Bacillus cereus*/ *Rahnella aquatilis*/ Minimum inhibition concentration (MIC)

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Quantification of *Oxytetracycline* and *Amphicillin* in Two Waste Water Discharging Points in Colombo, Sri Lanka

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Abstract

Antibiotics are considered as emerging micro contaminants in water due to their potential adverse effects on ecosystems and human health. Antibiotics are used in human and veterinary medicine, agriculture and animal husbandry. Oxytetracycline (OXT), Tetracycline, Amphicillin (AMP), Amoxicillin, etc. are extensively used. Thus, the WHO has recommended a guideline value of less than 1 ppb of antibiotic residues in the aquatic environment and less than 100 ppb in soil respectively. The study records the presence of OXT and AMP in water and sediment samples collected from two wastewater discharge tanks/drains in the National Zoological Garden and Colombo South Teaching Hospital (CSTH), Sri Lanka. Sample preparation was based on solid-phase extraction (SPE) and eluted in 100% Methanol and Isopropanol. OXT and AMP were quantified using High Performance Liquid Chromatography (HPLC). Recoveries for OXT and AMP were; 90% and 85% (in water), 88% and 83% (in sediments) with less than 5% standard deviation respectively. OXT was detected in water (664.0 ±0.43 ppb) and sediment samples (223.0 ±0.31ppb) of the Zoological Garden while 841.0 ±0.28ppb of OXT was recorded for water samples collected from CSTH. AMP was detected 139.0±0.19 ppb and 0.03±0.24 ppb for water and sediment samples of the Zoological Garden while 131.0±0.43 ppb was detected in water samples from CSTH. The antibiotic concentrations recorded in both water and sediment samples have exceeded the maximum permissible level suggested by World Health Organization. Therefore, further research studies are being conducted to monitor the antibiotic contamination status of wastewater outlets of other potential sources as well.

Keywords: Oxytetracycline (OXT)/ Amphicillin (AMP)/ Solid Phase Extraction(SPE)/ High Performance Liquid Chromatography (HPLC)

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Water Quality Index (CCME-WQI) Based Assessment Study of Water Quality in Kelani River Basin, Sri Lanka

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Abstract

Kelani river is considered as one of the major river in Sri Lanka. It's contributing mainly for drinking water supply, recreation, irrigation and livestock and developing activities of the country. In last few decades to present Kelani river is the largest recipient of the industrial effluent among all the other rivers in Sri Lanka, as it's flowing through the Colombo city. Canadian Council of Ministers of the Environment (CCME) has developed Water Quality Index (WQI) which is a one of the major tool to solve the problems of data management and to evaluate success and failures in management strategies for improving water quality. The present paper describes the application of WQI for Kelani river to see the suitability of the river water for recreation, drinking, irrigation and livestock. 27 surface water sampling locations along with Kelani river basin was selected for the WQI assessment. The sampling was conducted for a period of one year from October 2012 to September 2013. CCME WQI was applied for eighteen water quality parameters namely pH value, Total Dissolved Solids, Dissolve oxygen, Total phosphate, Nitrate, Nitrite, Hardness, Conductivity, Biological oxygen demand, Chemical oxygen demand, Total coliform and Feacal coliform bacterial counts, Cd, Pb, Al, Zn, Cu and Cr. Sri Lankan Standards for drinking water guidelines and World health organization guidelines were applied to the index for drinking and recreational water quality. Irrigation and livestock indices were analyzed based on the Canadian Water Quality Guidelines (CWQGs). Based on the results, the index values and their ranks for drinking (32) and recreation (39) were recorded as poor, irrigation (77) and livestock (93) were recorded as fair and good respectively which indicate that river has poor quality for drinking and recreational due to effect of various point and non-point pollutant sources. The results alarming to take a necessary action plan for monitoring of water quality and proper management of the watershed.

Keywords: Kelani river basin/Surface water/Water quality management/Water Quality Index/ CCME WQI

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Occurrence of Tetracycline Resistant Bacteria in Surface and Farm Waste Water in Sri Lanka

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Abstract

Antibiotics are important pharmaceuticals and among them tetracycline (TC) are widely used in human therapy, veterinary medicine, agriculture and aquaculture. The increase of TC resistant bacteria creates serious environmental/ health issues since both drug resistant bacteria and genes can be retained in the environment forever. This study focused the occurrence and spatial distribution of TC resistant bacteria in sediment samples in Sri Lanka. Samples were collected at five sites, three main river mouths, one lagoon and one animal farm. To enumerate the percentage of TC bacteria, 1g of wet sediment was thoroughly suspended in 9ml of sterile phosphate buffered saline by vortex and 10-fold serial dilution made. Plate counts were performed on nutrient agar (1.5%) containing 60μg/ml TC. The plates were incubated at 25^0C and CFU /ml calculated. The Total Viable Counts (TVC) were increased from 0 CFU/g to $4.5\times10^2\pm0.6$ CFU/g(river mouth at Benthota), 0 CFU/g to 65±1.5 CFU/g (Madu River mouth), 20 CFU/g to $4.5\times10^3\pm0.6$ CFU/g (Kelani River mouth), 0 CFU/g to 6.0±1.0 CFU/g (Negombo Lagoon) and $3.5\times10^2\pm1.5$ CFU/g to $2.0\times10^3\pm0.5$ CFU/g (animal farm tributary) after 5 days of incubation while increasing TVC in control respectively. The percentage of the TC bacteria to 60μg/ml was calculated as 0.86% (Benthota), 0.20% (Madu River), 1.8% (Kelani River), 0.04% (Negombo Lagoon) and 0.22% (animal farm tributary) in the sediments. So far, no information regarding both antibiotic resistant bacteria and genes in Sri Lanka was recorded and the present study is continuing to study the distribution mechanism of antibiotic resistant gene in the environment.

Keywords: Tetracycline (TC)/ Total Viable Count (TVC)/ Colony Forming Units (CFU)

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Eco-utopia 2121: Future Car-free Cities across the World

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Abstract

The futures of various cities around the world are outlined with the help of a single graphic image each. These futures are presented in eco-utopian terms whereby each city is projected to exist within some sort of planned peaceful setting that exists in socio-ecological harmony. The core common feature explored for all these future cities is their car-free character. In the vein of previous utopian imaginings, some explanation about how each city can get to this eco-utopian status (by the year 2121AD) is offered, along with a description about the social background that may be present then and there.

Keywords: Utopia/ Cities/ Future/ Car-free/ Sustainability/ Society

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Tourism Threats to Coral Reef Resilience at Koh Sak, Pattaya

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Abstract

Coral reefs provide many ecosystem goods and services and rising atmospheric greenhouse gas concentrations are resulting in higher than normal sea surface temperatures (SSTs), increasing the frequency and extent of mass coral bleaching and mortality. The loss of corals after bleaching is often followed by a shift in community structure to a reef dominated by fleshy algae especially in reefs damaged by tourism and fishing. This loss, however, is less likely in reefs experiencing fewer negative impacts. Using a mixed methods approach to data collection we used boat-traffic surveys, coral reef substrate surveys and self-complete questionnaires and interviews of scuba divers, visitors and their tour guides to assess potential tourism impacts to the coral reef at Koh Sak, Pattaya. The number of tourists, the intensity of boat traffic and poor management of activities at the island impair the structural and ecological integrity of the reef thereby affecting its resilience and capacity to survive global climate change. To improve reef resilience, there needs to be a shift from exploitative business practices to a knowledge-based industry that creates the infrastructure to ensure visitor participation in activities that help conserve the reef rather than weaken it.

Keywords: Global climate change/ coral bleaching/ Resilience/ Tourism

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Adsorption and Adsolubilization of Organic Solutes Using Rhamnolipid Biosurfactant-modified Surface

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Abstract

Surfactant-modified materials have been widely used for industrial and environmental applications such as oil recovery and remediation of contaminated soil. However, surfactant was acknowledged as a chemical-based substance which is toxic and slowly degrade in nature. Recently, biosurfactant, a biological-based surface active agent synthesized by a various type of microorganisms, has been drew highly attention in an environmental engagement to the superior benefits over conventional surfactant. Rhamnolipid is the one that characterised as the bacterial surfactant which having low toxic, higher biodegradability and better environmental compatibility. It has been used as an alternative choice for environmental applications. In this work, rhamnolipid biosurfactant-modified adsorbent was developed to remove two different types of organic solutes (styrene and phenanthrene) through adsolubilization process. Results showed that rhamnolipid surfactant-modified surface having ability to remove both of styrene and phenanthrene from aqueous solution in a specific amount. Findings also demonstrated that both of them mainly partitioned into the palisade layer where it was considered as a slightly polar region in the admicelle structure. Typically, styrene was known as an intermediate polarity organic compound while phenanthrene was considered as a smaller polar solute compare to styrene. As a result, phenanthrene tended to separate itself from the strongly polar phase in aqueous solution to the lesser polar region in the palisade layer of the admicelle and having greater adsolubilization capacity than styrene.

Keywords: Adsorption/ Adsolubilization/ Styrene/ Phenanthrene/ Rhamnolipid/ Biosurfactant.

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Towards a Climate Vulnerability Index of Phuket City: A Preliminary Study

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Abstract

The assessment of climate vulnerability clarifies the importance of issues associated with current and future climatic vulnerability. The aim of this research is to develop an appropriate Climate Vulnerability Index which is applied in Phuket municipality. Technically, vulnerability is defined as a function of three major components namely, Exposure, Sensitivity and Adaptive Capacity. The study reviewed indicators related to vulnerability assessment as well as criteria for indicator selection from the literatures. Listed indicators are pre-assessed for their appropriateness for the context of Phuket using the modified SMART filter as a set of criteria (Simple, Measurable, Achievable, Relevant and Timely). Opinions were drawn from a panel of 24 respondents from public and private sectors as well as academics on indicators and criteria using Likert-scale questionnaires. Mean score of $\geq$3.00 is the cutoff point for indicator and criteria selection. The preliminary screening resulted in 12 criteria and 19 indicators (36.84% in Exposure, 21.05% in Sensitivity and 42.11% in Adaptive Capacity). The Exposure component consists of three sub-components namely, Natural disaster, Climate variability and Monthly climate variables. The Sensitivity component consists of three sub-components: Health, Housing and Land Tenure as well as Fishing. For the Adaptive Capacity component, the sub-components are Socio-demographic profile, Infrastructure and Governance. Criteria and indicators will be further examined for their validity for vulnerability calculation. The vulnerability assessment can be used as a basis for policy planning and monitoring of strategic plans for the Livable Phuket City.

Keywords: Vulnerability Index/ Criteria/ Phuket/ Exposure/ Sensitivity/ Adaptive Capacity

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Effects of Climate Variability on Growths of Two Dominant Tree Species with Lower Canopy at the Sakaerat Environmental Research Station (SERS), Nakhon Ratchasima Province, Thailand

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Abstract

The objective of this research was to investigate effects of climate variability on monthly growths of *Aglaia odoratissima* and *Hydnocarpus ilicifolia* which were dominant tree species in lower canopies of dry evergreen forest at the Sakaerat Environmental Research Station (SERS), Nakhon Ratchasima province, Thailand. For a year of the investigation, wood anatomy was described and monthly data of leaf phenology, inside bark diameter (IBD) and outside bark diameter (OBD) increments were examined. These data were related to soil moisture content and climatic data of monthly rainfall, temperature and relative humidity. The results showed that leaf phenology of *A. odoratissima* and *H. ilicifolia* illustrated leaf maturation throughout the year, while young leaves were abundantly found in rainy season and leaf abscission rarely found throughout the year. IBD increments of these species on transverse surfaces could be detected throughout the year and the rapidest increments were found in rainy season, while OBD increments of both species shrank in dry season and swelled in rainy season. Using path analysis (PA), climate variability was significantly related to leaf phenology of *A. odoratissima* and IBD increments of *H. ilicifolia*. It was also significantly related to outside OBD increments of both species.

Keywords: Leaf phenology/ Outside bark diameter/ Path analysis/Inside bark diameter/ *Aglaia odoratissima*/ *Hydnocarpus ilicifolia*

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Predicting Vulnerability of Medicinal Plants Used by Karen People in Chiang Mai Province to Climatic Change Using Species Distribution Model

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Abstract

Global climate change can be expected to drive losses in plant diversity. To exemplifying this issue, the vulnerability of medicinal plant used by Karen people in Chiang Mai Province to climatic change was investigated using species distribution model (SDM). Total 244 medicinal plants species were evaluated. Climatic and non-climatic variables were used to develop SDM. The greenhouse gas emissions scenarios, A1B (medium-high emissions) and A2 (high emissions) of the Hadley Centre Coupled Model, along with version 3 (HadCM3) were used to examine the potential future species distribution under climatic changes for the years 2050 and 2080. It was found that a combination of climatic and non-climatic factors would result in substantial effects on the distribution of these medicinal plant species. It is predicted that more than 60% of the plants were predicted to suffer significant losses in their suitable ranges by the years 2050 and 2080, respectively. Following the International Union for Conservation of Nature and Natural Resources (IUCN) Red List criteria, four plant species were predicted to become extinct due to climate change in Chiang Mai Province under A1B or A2 scenarios by 2080. Raising the climate change awareness of the Karen people and supporting the sustainable use of medicinal plants will be crucial in preserving the medicinal plants. Cultivating threatened medicinal plants in the home-gardens of the Karen people also recommended in order to reduce the negative impacts of climate change on these plants.

Keywords: Diversity loss/ Extinction/ Conservation/ Ethnobotany/ Maxent

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Coping Mechanism with Floods: Case Study in Ba Baong Commune, Prey Veng Province, Cambodia

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Abstract

Yokohama Strategy and Plan of Action for a Safer World, and Hyogo Framework about traditional knowledge, practice and value of local communities could contribute to building resilience to disasters. Cambodia was considered as a poor country and vulnerable to floods. Surprisingly, a community in Ba Baong Commune in Prey Veng Province, Cambodia was able to cope with 2011 flood which was treated as severe one by using their own coping capacity. Research finding revealed that the community which successfully coped with floods resulted from collaboration between households and community. Strong interaction between household level and community level leads to resilience community which influenced by both household factors and community factors. Socio-economic status, demographic composition, and perspective of households on floods are factors that affect on household's coping capacity. Whilst community factors are trust, natural resources, geographical location, infrastructures, and social capital and structure in the community. According to the interviews, community mechanisms were believed to make a significant impact on local people's coping capacity against floods since they create culture of safety and resilience. Knowing community coping capacity and understanding their strong points can support governmental policy makers and NGOs, who work on this issue, to develop their strategies and actions for the right people.

Keywords: Cambodia/ Prey Veng Province/ Community mechanisms/ Flood/ Coping strategies

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Forest Habitat and Fruit Availability of Hornbills in Salakphra Wildlife Sanctuary, Kanchanaburi Province, Thailand

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Abstract

This study aimed to examine the quality of hornbill habitat in terms of forest habitat and fruit availability throughout the year in Salakphra Wildlife Sanctuary (SLP), Kanchanaburi Province, Thailand. SLP has been known for its mixed deciduous forest, disturbed condition and relatively less rainfall. All canopy trees with breast height diameter (DBH) $\geq$ 10 cm within the ten belt-transects of 2,000 m $\times$ 20 m (a total of 40 hectares) were monitored monthly. A total of 30 tree families including 81 species were observed on the belt-transects and the dominant species in terms of Important Value Index (*IVI*) were non-hornbill fruit species, namely: *Lagerstroemia cochinchinensis* var. *ovalifolia* (34.67); *Sisyrolepis muricata* (16.22); and *Millettia brandisiana* (15.77). The Fruit Availability Index (*FAI*) of all fruit species during breeding season is 23.49 % while the *FAI* of hornbill fruit species is 58.88 %. Furthermore, as an addition to this study, a pair of Great hornbill was observed during the breeding season and the male abandoned to feed the mate prior to the expected hatching period. The average estimated number of food items fed by the male Great hornbill was 220 in March (n = 3) and 13 in April 2014 (n = 4). The reduction in the availability of food may be considered as one of the factors in breeding failure. Compared to moist evergreen forest of Khao Yai National Park in Thailand, mixed deciduous forest of SLP has less quality for hornbill habitat.

Keywords: Forest habitat/ Fruit availability/ Hornbill/ Salakphra wildlife sanctuary

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Effects of Dietary *Nelumbo nucifera* (*Lotus*) *Peduncle Extract* on Growth Performance of *Nile Tilapia* (*Oreochromis niloticus*)

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Abstract

All parts of Nelumbo nucifera (Lotus) have long been used in Thai traditional medicine for the treatment of various ailments. However, the effects of supplementary N. nucifera peduncle extract (NNPE) on growth and feed utilization indices of fish have not yet been investigated. Therefore, the aims of this present study were to examine the effects of dietary supplementation with NNPE on growth performance and feed utilization of Nile tilapia (Oreochromis niloticus). N. nucifera peduncles were extracted by using 70% ethanol. In a 60-day feeding trial, fingerlings of Nile tilapia were fed diets containing 0, 0.05, 0.1 and 1% of NNPE. The results revealed that fish fed with the diets with 1% NNPE exhibited significantly higher weight gain, specific growth rate and food conversion efficiency than fish in 0 and 0.05% NNPE feed group ($P<0.05$). In addition, the average feed conversion ratio of fish fed diet containing 1% NNPE was significantly better than those of the control group ($P<0.05$). There were no significant differences in the survival rate, the hepatosomatic index and the intestinalsomatic index ($P>0.05$). Feeding behavior and appearance observed in all the fish fed experimental diets were similar to the control fed fish. Thus, these findings indicate that NNPE may be applied in fish diets as a natural feed additive to enhance fish growth and feed utilization.

Keywords: Nelumbo nucifera/ Nile tilapia/ Oreochromis niloticus/ Growth performance/ Feed additive

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Water Quality Assessment Using Biotic Indices in the Mae Tao Creek, Mae Sot District, Tak Province in Northern Thailand

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Abstract

The biodiversity of aquatic insects were studies for the application of bioindicator of water quality monitoring at five different stations at Mae Tao creek, Mae Sot District, Tak Province in the month of February 2011, 2012 and 2013. The Shannon-Wiener index, $BMWP^{THAI}$ Score and $ASPT^{THAI}$ were used to assess water quality. A total of 3,953 aquatic insect taxa from 52 families in 9 orders were identified. The score of $BMWP^{THAI}$ and $ASPT^{THAI}$ were the same that indicated water quality was moderately class. Principal Correspondence Analysis (PCA) indicated that $ASPT^{THAI}$ were related with the air temperature, oxygen dissolved, pH, orthrophosphate and ammonia-nitrogen, whereas, Shannon-Weiner index were related with water temperature, turbidity of water, electrical conductivity, total dissolved solids, alkalinity, sulfate and nitrate-nitrogen.

Keywords: Water quality/ Biotic indices/ Aquatic insects

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The Contribution of Temporary Habitat to Aquatic Insect Biodiversity in Kasetsart University, Kamphaeng Saen Campus

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Abstract

Man-made water bodies such as pond can be important habitats for aquatic insects, and may include rare and endangered species. The biodiversity of aquatic insects in temporary habitats were collected in thirteen sampling sites in Kasetsart University, Kamphaeng Saen Campus during the rainy season in the year 2010, 2011, and 2012. Five orders and 18 families of aquatic insects were found in this study. The order Hemiptera had hightest number of family (9 families), followed by order Diptera (5 families), Coleoptera (4 families), Odonata (3 family), and Ephemeroptera (1 family) respectively. The Shannon-Weiner species diversity index (*H*') in the year of 2010 to 2012 was 2.22, 1.66, 1.92. The species diversity was highest in 2010 (2.22), and lowest was in 2012 (1.66). The species diversity is depended on precipitation value and area manipulation in Kasetsart University, Kamphaene Saen Campus.

Keyword: Temporary habitat/ Aquatic insect biodiversity

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Investigation of *Moringa Oleifera* used as Natural Coagulant in Water Treatment Process

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Abstract

Moringa oleifera (*M. oleifera*) is a multipurpose tree locally available in the tropical region including Thailand. Its seeds contain water soluble cationic proteins that act as effective natural coagulant in water treatment. This study aimed at using *M. oleifera* as natural coagulant in water purification process, evaluating its efficiency in turbidity reduction as compared to alum, and assessing the use of *M. oleifera* as co-coagulant along with alum. Raw water, collected from the intake of Bangkhen Water Treatment Plant, Bangkok, Thailand, was used in this study. The efficiency of different solvents: sodium chloride (NaCl), sodium hydroxide (NaOH), and distilled water for extracting *M. oleifera* was also investigated. Based on the jar test, 0.5M NaCl and distilled water were high turbidity removal compared to 0.5M NaOH extract. However, conductivity of treated water increased with increasing dosage of *M. oleifera* for 0.5M NaCl while distilled water did not significantly change the conductivity of treated water. Therefore, distilled water is the most suitable solvent for the extraction of *M. oleifera*. The optimum dosage of *M. oleifera*, for turbidity of 40-50 NTU, was 70 mg/L whereas that of alum was 40 mg/L, giving >80% and >90% of turbidity reduction, respectively. Although *M. oleifera* required higher dosage to achieve high turbidity reduction, it did not remarkably affect pH and alkalinity, thus minimizing the corrosion problem. Further, using *M. oleifera* as co-coagulant along with alum showed further reduction in turbidity. Thus it appears that *M. oleifera* can be used as natural coagulant in water treatment process.

Keywords: *Moringa Oleifera* / Natural coagulant / Water treatment / Extraction / Turbidity / Alum replacement

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Wastewater Management among Hotels in Patong, Phuket

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Abstract

Hotel business is highly competitive due to increasing numbers of hotels in the area. The hotels make use of environmental friendly practice, not only to impress the green tourists but also to conserve the natural resources and to maintain good image. This study focused on wastewater management in the hotels. The aims of this census research were to explore the factors of hotels affecting wastewater management and to study wastewater management's practices of the hotels in Patong municipality, Phuket province. Questionnaires survey was conducted among 165 hotel entrepreneurs. Data were analyzed by the computerized program SPSS and engaged statistical methods, namely, frequency, mean and One way ANOVA. The research findings revealed that factors affecting wastewater management's behavior included hotel size and hotel standards (statistically significant 0.001). Most of the hotels implemented wastewater management at a low level as well as the reduction of water usage, water contamination, and wastewater treatment technology were found at a low level. The recommendations from this study were to distribute knowledge and to provide more training for small and medium size hotel personnel. In the meantime, the hotels should raise the environment standard to establish their highlights as well as educate personnel on additional performance rules and regulations.

Keywords: Wastewater management/ Hotels/ Phuket

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Cyanobacterial Cell Density & Intracellular MC-LR Levels in Drinking/ Irrigation Reservoirs in Anuradhapura, Sri Lanka

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Abstract

In the dry zone Sri Lanka man-made tanks are abundant; have become eutrophic due to excessive use of agrochemicals which promote growth of toxin producing cyanobacteria. Among them *Microcystis* sp., *Anabaena* sp., *Oscillatoria* sp. and *Cylindrospermopsis* sp. that produce hepatotoxic microcystins, neuro- and nephrotoxic cylindrospermopsin. The contaminated water consumption is considered one possible hypothesis for the Chronic Kidney Disease (CKD) prevailing in some parts of Sri Lanka. Microcystin-LR (MC-LR) is the most toxic (LD_{50} of 50µg/kg) among the microcystins and conventional treatment fails to remove them from water. Thus, the WHO recommended 1.0 µg/l MC-LR in drinking water. The current study records the relationship between cyanobacterial cell density and intracellular MC-LR in eight irrigation/drinking reservoirs in Anuradhapura district, Sri Lanka where the CKD prevalent. Plankton samples were collected for one year from July, 2013 to July, 2014. Identification and enumeration of cynaobcateria under microscopy, also MC-LR extraction and quantification (HPLC-PDA) were done. Mahakanadarawa reservoir reported the highest *Microcystis* sp. (95%) as dominant species where the reservoirs Rambewa (83%), Nuwarawewa (75%) Tisawewa (72%), Abhayawewa (65%) and Kalawewa (42%) contaminated with fairly high densities of *Microcystis* sp.. The highest *Cylindrospermopsis* sp. was recorded in Thuruwila reservoir (57%), while Nachchaduwa reservoir reported *Anabaena* sp. (39%) as dominant cyanobacteria. Only five reservoirs namely Mahakanadarawa (4.26±0.63 µg/ml), Tisawewa (1.12±0.55 µg/ml), Abhayawewa (5.3±0.41 µg/ml), Kalawewa (1.37±0.25 µg/ml) and Thuruwila (3.3±0.5 µg/ml) were positive for intracellular MC-LR; exceeded the WHO guideline 1.0 µg/l. Further, Pearson correlation coefficient (0.027) shows a significant correlation between cyanobacterial cell densities and intracellular MC-LR.

Keywords: Cyanotoxins/ Microcystins/ Intracellular MC-LR