Book of Abstracts

2nd International Conference on Climate Change 2018

(ICCC 2018)

15 -16, February 2018

Colombo, Sri Lanka

Committee of the ICCC- 2018

The International Institute of Knowledge Management (TIIKM)

Tel: +94(0) 11 3132827

info@tiikm.com

Disclaimer

The responsibility for opinions expressed in articles, studies and other contributions in this publication rests solely with their authors, and this publication does not constitute an endorsement by the ICCC or TIIKM of the opinions so expressed in them.

Official website of the conference

www.climatechangeconferences.com

Book of Abstracts of 2nd International Conference on Climate Change 2018 (ICCC 2018)

Edited by Dr. Erandathie Lokupitiya

ISBN 978-955-4903-94-4

Published by The International Institute of Knowledge Management (TIIKM), No: 531/18, Kotte Road, Pitakotte ,10100, Sri Lanka

Tel: +94(0) 11 3098521

Fax: +94(0) 11 2873371

Hosting Partner:

University of Colombo, Sri Lanka

Supporting Ministry:

Climate Change Secretariat, The Ministry of Mahaweli Development and Environment**,** Sri Lanka

Academic Partner:

Colorado State University, USA

Strategic Partner:

Colombo Plan

Organized By:

The International Institute of Knowledge Management (TIIKM), Sri Lanka

ICCC 2018 Committee

DR. ERANDATHIE LOKUPITIYA	(Conference Chair, ICCC 2018) *Senior Lecturer, Department of Zoology and Environment Sciences, University of Colombo, Sri Lanka*
PROF. KEITH PAUSTIAN	(Keynote Speaker, ICCC 2018) *Department of Soil and Crop Sciences, Senior Research Scientist, Natural Resource Ecology Laboratory, Colorado State University, USA*
DR. KEVIN SCHAEFER	(Keynote Speaker, ICCC 2018) *National Snow and Ice Data Center, University of Colorado, USA*
DR. SALUT MUHIDIN	(Session Chair, ICCC 2018) *Macquarie University, Austalia*
PROF. ASHFAQUE AHMED	(Session Chair, ICCC 2018) *University of Dhaka, Bangladesh*
DR. BIJOY NANDAN	(Session Chair, ICCC 2018) *Cochin University of Science and Technology, India*

DR. MERY BISWAS	(Session Chair, ICCC 2018) *Presidency University, India*
DR. CHATURANGI WICKRAMARATNE	(Session Chair, ICCC 2018) *Environmental Foundation Limites , Sri Lanka*
DR. SURANJANA BANERJI	(Session Chair, ICCC 2018) *Presidency University, India*
PROF. NEBIYE MUSAOGLU	(Session Chair, ICCC 2018) *Istanbul Technical University, Turkey*
DR. CARLO MONTES	(Session Chair, ICCC 2018) *International Maize and Wheat Improvement Center, Bangladesh*
PROF. JANENDRA DE COSTA	(Session Chair, ICCC 2018) *University of Peradeniya, Sri Lanka*
DR. MD. MIZANUR RAHMAN	(Session Chair, ICCC 2018) *Bangabandhu Sheikh Mujibur Rahman Agricultural University, Bangladesh*
DR. MD. MAIN UDDIN MIAH	(Session Chair, ICCC 2018) *Bangabandhu Sheikh Mujibur Rahman Agricultural University, Bangladesh*
DR. MONTHIRA YUTTITHAM	(Session Chair, ICCC 2018) *Mahidol University, Thailand*
MR. ISANKA. P. GAMAGE	(Conference Convener, ICCC 2018) *The International Institute of Knowledge Management, Sri Lanka*
MR. OSHADEE WITHANAWASAM	(Conference Publication Chair, ICCC 2018) *The International Institute of Knowledge Management, Sri Lanka*
MR. KEERTHI CHANDANA	(Conference Secretariat, ICCC 2018) *The International Institute of Knowledge Management, Sri Lanka*

Editorial Board - ICCC 2018

Editor in Chief

Scientific Committee - ICCC 2018

MESSAGE FROM THE SUPPORTING MINISTRY ICCC 2018

It is an honor and a privilege to deliver this message on behalf of the Climate Change Secretariat of the Ministry of Mahaweli Development and Environment for this important event of the International Conference on Climate Change 2018 organized by the International Institute of Knowledge Management and hosted by the University of Colombo, Sri Lanka. As most of us aware, one of the major challenges faced by the world community today is the rise of global warming mainly due to human activities. With the world population increase, it seems more pollution will be taken place. Hence it is undebatable that immediate actions have to be taken to control further rise of global warming due to unsustainable consumption and production pattern and practices. During the last three decades, concerns have constantly been growing on climate change and its consequences.

At the 21st session of Conference of Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC) held in Paris in 2015, a decision was taken to act together as a global community to limit the rise of global warming below 2 degree Celsius by 2100. Additionally, the agreement aims to strengthen the ability of countries to deal with the adverse impacts of climate change. Climate change is now inevitable and it will affect all systems, sectors and communities. Some of them may be highly vulnerable and some may be less vulnerable.

In this respect, all the sectors and communities that are vulnerable to adverse effects of climate change are needed to be built resilience to overcome such impacts. Many researches and systematic observations are taken place in this aspect all over the world. Intergovernmental Panel on Climate Change (IPCC) is the main scientific body where the all findings are gathered and compiled for forecasting the vulnerability. Although many researches are going on climate change impacts in Sri Lanka, this information is scattered. In addition, qualitative and quantitative climate change impact assessments, reliable forecasting are still hard to find. Therefore, these gaps are yet to be filled.

At this juncture, I must appreciate the effort that has been taken by the University of Colombo and the International Institute of Knowledge Management to fill the gap encouraging researchers to conduct researches on climate change issues in Sri Lanka and compiling the findings for policy and ground level interventions.

Last but not least, I take this opportunity to congratulate the organizers and participants for the colossal success of this prestigious and timely event.

Dr. R.D.S. Jayathunga,
Director,
Climate Change Secretariat,
Ministry of Mahaweli Development and Environment,
Sri Lanka.

MESSAGE FROM THE HOSTING PARTNER ICCC 2018

I take the privilege of writing this on behalf of University of Colombo, the hosting partner of International Conference on Climate Change 2018 (ICCC 2018) for the second time. This year's theme on climate change and global sustainability is important to all the global nations, including those who have overexploited the earth's resources and those who are highly vulnerable to climate change impacts. Climate change has become the most important global environmental issue and it has significantly impacted the sustainable development. Similarly certain sustainable development plans across the world have not considered climate change impacts at the correct magnitude. Therefore it is high time to have more communication and information sharing in relation to the above involving all the stakeholders including scientists, policy makers, and private sector organizations. I hope ICCC 2018 will provide the ideal platform for the above purpose.

Sri Lanka has shown a great concern about the issue of climate change and a remarkable number of scientific studies have been conducted within the country. As an island nation, the country has been facing the impacts and challenges of climate change and it has been vulnerable to increased occurrence of extreme weather events and sea level rise, etc. The country needs to develop suitable sustainable development strategies with particular attention on adaptation- and mitigation measures and there is an unprecedented role to be played by academics and researchers, based on the newest developments in this field. I hope ICCC 2018 will help the scientists from Sri Lanka and other participants and resource person coming from the different parts of the world to share their experiences and benefit through developing collaborative links for better, regional and global scale research and networks.

As a university, the University of Colombo has already taken several green measures which include tree planting campaigns, minimization and management of waste, and moving towards greener energy, which will also contribute towards the efforts by the country in achieving its sustainable development goals and targets based on Paris Agreement of 2015. I hope this conference will be a landmark event which would provide a great opportunity for knowledge-sharing in relation to climate change and sustainable development. I wish to convey my best wishes to all the participants and resource persons coming from different continents of the world, for a fruitful meeting and a memorable time in Sri Lanka.

Prof. Lakshman Dissanayake,
Vice Chancellor,
University of Colombo,
Sri Lanka.

MESSAGE FROM THE CONFERENCE CHAIR ICCC 2018

Climate change has impacted the global economies and the nations worldwide have paid more attention towards sustainable development. However, due to the large magnitude of the impacts and costs associated with the adoption of remedial measures for reducing the impacts, the sustainability of the adopted measures might not always be viable. In dealing with climate change, sustainable remedial measures, international cooperation and knowledge sharing with regard to new developments in the field are essential, since no single nation alone can deal with the complicated impacts of climate change. The Paris Agreement adopted at the 21st Conference of the Parties of the UNFCCC (COP21) held in Paris in 2015 aims at limiting the global average temperature rise during the century to well below 2 ^{0}C above pre-industrial levels by taking necessary action. The 1st International Conference on Climate Change 2017 (ICCC-2017) was successfully held in Colombo, Sri Lanka in February 2017 with the theme *' Climate Change, Facing the challenge beyond COP21'*, as there is a big challenge ahead of us in facing the impacts of climate change.

The theme of the 2nd International Conference on Climate Change 2018 (ICCC-2018) is *'Climate change and global sustainability: Action for bridging the gap'*. One of the key goals of this conference is creating dialogue among those involved in research and development activities in Climate Change Mitigation, Vulnerability, and Adaptation, nationally and internationally, with an emphasis on the sustainable development. As the Chair of the conference I hope this event will create continued dialogue during and beyond the ICCC-2018, with the participation of local and international scientists. Through this event, it is envisaged to share and disseminate information relevant to research and development experiences encompassing important areas such as vulnerability and impacts of climate change on food security, biodiversity and natural resources, health and sanitation, developments in adaptation and mitigation research, remedial measures, and various other aspects such as greenhouse gas measurements, modeling and climate predictions, etc. Both ICCC 2017 and ICCC 2018 received a large number of abstracts from all around the world and it was not an easy task to select the abstracts tallying the conference program and the theme. I wish the presenters of those selected abstracts including the young scientists, representatives of the academia, research institutes, government and non-governmental institutions, etc., to have a pleasant and fruitful event and I hope ICCC-2018 will provide a great opportunity for you to share your valuable experiences.

Erandathie Lokupitiya, PhD
Senior Lecturer,
Department of Zoology and Environment Sciences,
Faculty of Science,
University of Colombo,
Sri Lanka.

Table of Contents Page No

ORAL PRESENTATIONS

CLIMATE PREDICTION: MODELING AND DETECTION OF RECENT AND FUTURE CLIMATE CHANGE (A)

CLIMATE CHANGE, ADAPTATION, MITIGATION AND SUSTAINABLE DEVELOPMENT (B)

CLIMATE CHANGE AND AGRICULTURE (C)

URBANIZATION AND CLIMATE RISK IMPLICATIONS IN COASTAL AND OTHER AREAS (D)

CLIMATE CHANGE AND TECHNOLOGY (E)

CLIMATE CHANGE IMPACTS ON BIODIVERSITY CONSERVATION AND NATURAL RESOURCE MANAGEMENT (F)

CLIMATE CHANGE: IMPACTS ON WATER, SANITATION AND HEALTH IN THE DEVELOPING WORLD (G)

POSTER PRESENTATIONS (P)

VIRTUAL PRESENTATIONS

ORAL PRESENTATIONS

A1 **[01]**

CLIMATE EXTREMES AND PRECIPITATION TRENDS IN KELANI RIVER BASIN, SRI LANKA AND IMPACT ON STREAMFLOW VARIABILITY UNDER CLIMATE CHANGE

K.D.C.R. Dissanayaka[1] and R.L.H.L. Rajapakse[2]

[1]Water Management Secretariat Office, Mahaweli Authority of Sri Lanka, Sri Lanka

[2]UMCSAWM, Department of Civil Engineering, University of Moratuwa, Moratuwa, Sri Lanka

ABSTRACT

This paper focuses on and analyses the potential hydrological impacts of climate change on the hydrologic regime of Kelani River Basin, Sri Lanka. In this research, basin wide future hydrology is simulated by using downscaled temperature and precipitation outputs from the Canadian Earth System Model, version 2 (CanESM2), and the Hydrologic Engineering Centre's Hydrologic Modeling System (HEC-HMS). The research further evaluates the long-term behavior and trends of the climate extremes based on the observed historical temperature and precipitation data. The findings suggest that the temperature and precipitation extremes are on the rise while the annual average precipitation in the basin is declining. It is also predicted with the application of statistical downscaling that temperature may rise annually for representative concentration pathways of RCP2.6, RCP4.5 and RCP8.5. A detailed modelling approach is incorporated to Hanwella sub-watershed (1799.67 km^2) of the Kelani River basin, to study the subsequent water resource management options required to ensure sustainable development alternatives with the varying streamflow of the Kelani River basin under the effect of the future (2020's, 2050's and 2080's) rainfall and temperature as impending climate change impacts. The paper reviews the current state of the catchment as well as the suitability of applying the GCM's rather than RCM's to Sri Lanka to assess this river basin, according to monthly, seasonal and annual variations of the climatology. Further, a quantitative analysis of the change of amount of surface water in the selected river basin with respected to the expected variations in precipitation and temperature is also carried out. The findings of this research and overall outcome will be useful in identifying possible sustainable water management scenarios and best management options and mitigation measures like land use and carbon emission management, etc. in a more meaningful manner in the future. This study will set the baseline for commencing and continuing quantitative studies incorporating the behavior of the basinwide climatology and streamflow variability with the use of GCM's to achieve sustainable development goals.

Keywords: Climate Change, Extremes, Kelani River Basin, Precipitation Temperature Streamflow Trends, Statistical Downscaling

A2 **[02]**

FORECASTING AVERAGE TEMPERATURE AND PRECIPITATION AND ITS IMPACT ON DROUGHT CONDITIONS IN CHINA

I. Khan, L.H. Dou, A. Ullah, and M. Zhao

College of Economics & Management, Northwest A&F University, Yangling, China

ABSTRACT

Under the background of global climate change, the temperature, precipitation and extreme weather and drought conditions continue to increase. In the context of global climate change, surface air temperature (SAT) and precipitation has become the focus of attention and an important factor causing drought condition in the country. The surface air temperature has increased since nineteenth century and the precipitation is at a decreasing trend which threatened the environment of China, and caused a significant increase in drought condition. The current study presents a methodology to determine the intensity of drought caused by global warming, designed to aid understanding of how climate change may affect future risk. The data regarding precipitation, temperature and the Palmer Drought Severity Index (PDSI) was taken for a period of 1980-2015 and forecasted for 2016-2030 to quantify the impact of variation in precipitation and temperature on the drought formation. The importance of precipitation and global warming was assessed in different region of the country. The study reveals that the drought condition varies across the regions. In north China the increasing trend of drought condition still persists under the background of global warming and show a tendency of drought expansion in the next 10 years, especially in the direction to the south parts of China. In most of the regions the declining trend of precipitation is the most important factor of drought change. However, in some parts of the country like the East, north, northeast and northwest the global warming also plays a main role in the formation of drought and showed a significant increase in the trend. Our findings have practical implications that can inform efforts to improve the management strategies.

Keywords: Climate Change, Precipitation, Temperature, Drought

A3 **[03]**

IDENTIFYING CHANGES IN RAINFALL DISTRIBUTION USING STANDARDIZED PRECIPITATION INDEX (SPI): AN APPLICATION IN UVA PROVINCE SRI LANKA

P.W. Jeewanthi [1], W. Wijesuriya [2] and A.M.C. Amarakoon [1]

[1]*Department of Export Agriculture, Uva Wellassa University, Badulla, Sri Lanka*

[2]*Biometry Section, Rubber Research Institute of Sri Lanka, Agalawatta, Sri Lanka*

ABSTRACT

Changes in rainfall pattern and distribution are very important as it is mainly connected with all agronomy practices in Agriculture sector. Standardized Precipitation Index (SPI) is one versatile tool for understanding the variations in monthly rainfall under different scenarios. Rainfall data were taken from four meteorological stations which represent different regions in Uva province; Badulla, Monaragala, Okkampitiya and Wellawaya. The 12-month SPI from January to December which implies annual rainfall anomalies and, 6-month SPI from October to March and April to September and 3-month SPI from December to February were used for the analysis. Changes in SPI time series were analyzed using Change Point Analyzer software. There are significant changes in the pattern of annual rainfall anomalies in Badulla and Wellawaya. However there is a no risk of having drought years in Badulla, Monaragala, Okkampitiya and Wellawaya after 2004, according to the 12-month SPI. There are significant changes in the pattern of 6-month SPI from October to March in Badulla and Wellawaya but no any significant change in the pattern of 6-month SPI from April to September in all four locations. The 6-month SPI for the period of October to March in Monaragala, Badulla and Okkampitiya indicate high risk of having drought conditions, nevertheless Wellawaya indicates low risk of having drought from October to March. There is no enough evidence for significant change in the pattern of 3-month SPI from December to February. However evidences are enough to conclude the changes in the pattern of rainfall anomalies in Uva Province.

Keywords: Change point, Rainfall anomalies, Standardized Precipitation Index (SPI), Uva province

A4 **[04]**

RISK BASED ASSESSMENT OF STRUCTURES SUBJECTED TO ENVIRONMENTAL ACTIONS IN A CHANGING CLIMATE

D. Diamantidis

OTH Regensburg, Germany

ABSTRACT

Environmental and climate change is a global issue that will and has already impacted the frequency and intensity of natural hazards in many regions throughout the world. Consequently the actions effect on infrastructures will be changing and present design and assessment practices will need to be adapted to provide for structures with acceptable risk and service lifetimes spanning over decades and centuries. This contribution provides first a review of climate change impact on actions on structures based on experience gained in Central Europe and South Africa. It then discusses a procedure by which extreme climate modelling and structural design and assessment for climatic actions such as snow, flood or wind can be combined in order to support present engineering practice and provisions for future climate change. An outline of the basis of structural risk assessment accounting for such actions and recommendations for future risk-based procedures are discussed. Thereby the important issues to consider include: a) use of extreme value models and implementation of changes in distribution parameters to obtain extremes with long return periods; b) implementation of modern risk assessment criteria including human, environmental and economic risks. Illustrative examples of representative infrastructures illustrating the effects of changing climatic actions on structural reliability and risk. It appears that uncertainties related to the lack of observations hinder drawing strong conclusions concerning appropriate modifications of codified procedures due to environmental and climate change. Uncertainties in the prediction of environmental and climate change have a direct influence on the selection of optimal safety measures.

Keywords: Climate Change, Design, Infrastructures, Risk, Safety

A5 **[05]**

HISTORICAL AND PROJECTED VARIABILITY IN MONSOON ONSET AND WITHDRAWAL OVER SOUTH ASIA USING NASA-NEX ENSEMBLE: IMPLICATIONS FOR AGRICULTURE

C. Montes [1], M.A. Stiller-Reeve [2,3], G. Hussain [1], S. Mason [4] and T.J. Krupnik [1]

[1]*International Maize and Wheat Improvement Center (CIMMYT) – Climate Services for Resilient Development (CSRD) in South Asia, Dhaka, Bangladesh*

[2]*Uni Research Climate, Uni Research, Bergen, Norway*

[3]*Bjerknes Centre for Climate Research, Bergen, Norway*

[4]*International Research Institute for Climate and Society, The Earth Institute of Columbia University, New York, USA*

ABSTRACT

The timing of the monsoon onset and withdrawal is a major climate feature impacting agriculture across South Asia, where over 1.5 billion people rely on monsoon *kharif* season rice followed by dry *rabi* season wheat. The timing of land preparation and sowing/transplanting of *kharif* rice are highly dependent on monsoon timing. A late onset can delay transplanting and therefore harvesting, causing further sowing delays for subsequent dry *rabi* season crops. These delays can result in heat stress for *rabi* season wheat. Overcoming these problems is crucial to mitigate agricultural risk and increasing the resilience to climate variability. In response, we assess the variability in long-term historical and climate change projections of monsoon onset and withdrawal and their implications for agriculture in South Asia. We use daily precipitation from the NASA-NEX downscaled (0.25º × 0.25º) ensemble from 21 General Circulation Models for recent climate (1950-2005) and climate change projections (2006-2099) for two representative concentration pathways (RCP4.5 and RCP8.5). The APHRODITE data product, which provides data at the same spatial resolution for the period 1951-2007, is used as an observational reference. Monsoon onset and withdrawal are determined employing a definition that has been previously applied using multiple data sources and that is adaptable to farmers' information needs and requirements. We examine the multiscale variability in monsoon timing and future projections using relative differences in spatial and interannual/inter-decadal variability, amplitude, statistical distribution and long-term trends, both to quantify differences among models, and with respect to APHRODITE. Implications for the productivity of *kharif* and *rabi* season agriculture are discussed in terms of observed and projected variability, and in relation to model uncertainty.

Keywords: Climate Variability, Climate Change, Climate Downscaling, Precipitation

B1 **[06]**

POTENTIAL FOR CLIMATE CHANGE MITIGATION THROUGH LOW-CARBON RAIL TRANSPORT IN INDIA

P. Pali

School of Law, University of Manchester, UK

ABSTRACT

It is generally accepted that anthropogenic activities are resulting in adversely affecting our environment and feeding climate change. There is a consensus amongst influential bodies and academics that the need to mitigate harmful effects of climate change and promote low carbon means of transportation have become more urgent than ever. But it is by no means an easy task. At the global level, governments are joining forces towards climate change mitigation and agreeing on ambitious CO_2 eq emissions reduction targets, most recently at the Paris Climate Change Conference in December 2015. Like other countries, India has also put measures in place to support climate change mitigation by setting up domestic targets and international commitments towards controlling/reducing the rising CO_2 eq emissions across all sectors including transport. This research paper explains and critically evaluates the key provisions, national level targets and policy framework set up by the Indian central government to address the rising CO_2 eq emissions from rail transport in India, with a view to conclude whether or not the status quo is adequate in light of the current understanding of climate change mitigation, and whether it has the potential to assist the government in achieving the domestic and international commitments set up towards mitigating climate change.

Keywords: Climate Change Mitigation, Low-Carbon, India, Rail Transport

B2 **[07]**

CLIMATE CHANGE MITIGATION THROUGH ORGANIC AND INORGANIC FERTILIZATION AND CARBON SEQUESTRATION IN SOIL OF BANGLADESH

M.A. Alam[1], M.M. Rahman[1], M.M.U. Miah[1], S. Akhter[2], J.C. Biswas[3], M. Maniruzzaman[3], A.K. Chowdhury[2], F. Ahmed[2], M.A. Mannan[1] and H.K. Shiragi[1]

[1] *Bangabandhu Sheikh Mujibur Rahman Agricultural University, Bangladesh*

[2] *Bangladesh Agricultural Research Institute, Bangladesh*

[3] *Bangladesh Rice Research Institute, Bangladesh*

ABSTRACT

Bangladesh is one of the most climate vulnerable countries in the world. Soil in Bangladesh plays a major role in releasing atmospheric carbon dioxide because of faster microbial decomposition of organic matter and intensive cultivation solely depending on inorganic fertilizers. The present study was conducted at the Research Field of Bangabandhu Sheikh Mujibur Rahman Agricultural University, Bangladesh during August to December 2016 to determine the rates of carbon sequestration and rice yield as influenced by organic materials and N fertilizer. The experiment comprising two factors viz. organic materials and N fertilizer was laid out in a factorial randomized complete block design with three replications. Five types of organic materials (rice straw, vermicompost, rice husk biochar, cow dung and poultry manure) were used considering 2 t C ha^{-1}. Three levels of nitrogen were 0, 100 and 150 kg N ha^{-1}. The data revealed that the highest amount of Soil Organic Carbon (SOC) sequestered in cow dung treated plots (1.45 t ha^{-1}) followed by rice straw (1.30 t ha^{-1}), rice husk biochar (1.24 t ha^{-1}), poultry manure (1.13 t ha^{-1}) and vermicompost (1.02 t ha^{-1}). Application of N fertilizer enhances decomposition of organic materials and therefore, carbon sequestration was found significantly lower with higher N rates. Carbon sequestrations were 1.71, 1.12 and 0.84 t ha^{-1} where N rates were 0, 100 and 150 kg ha^{-1}, respectively. Poultry manure provided maximum rice grain (6.32 t ha^{-1}) which was statistically similar to yield obtained in cow dung treated soil. Insignificant difference in rice yields was observed attributed by 100 and 150 kg N ha^{-1}, which were 6.07 and 6.15 t ha^{-1}, respectively. Carbon can be sequestered in soil using different organic fertilizers and lesser amount of nitrogen without significant reduction in crop yield which might contribute in mitigation of climate change and ensure sustainable agriculture.

B3 **[08]**

BUILDING CLIMATE CHANGE RESILIENCY THROUGH PARTNERSHIPS: A FRAMEWORK FOR STRATEGIC CROSS SECTOR COLLABORATIONS

A. Pairis and U. Abeysekera

Climate Science Alliance – South Coast, USA

ABSTRACT

There are a number of scientists and natural resource entities working to address significant climate impacts to the natural resources in the South Coast Ecoregion; however, this science does not always reach the communities that are the most affected by these impacts. The Climate Science Alliance – South Coast (Alliance) was formed to fill this gap by leading programs and creating partnerships that promote increased awareness and understanding of climate change related issues. We focus on building a science focused network of leaders, scientists, managers, and community groups across southern California and Baja with the goal of sharing ecosystem based resiliency approaches to safeguard our natural and human communities from climate change. Over the past three years the Alliance developed a framework for strategic cross sector collaboration based on working groups focused on creating a network of local scientists, climate smart conservation training, and innovative community engagement. Programs and projects in the working groups are led by a diverse group of professionals representing 200 partner organizations. Diverse partnerships lead to diverse programming such as a traveling climate art show featuring work by local artists and students, stakeholder driven scenario planning for a local lagoon in preparation for sea level rise, and a tribal climate change summit to connect tribal environmental professionals with local scientists. Through these and other programs, the Alliance reached over 90,000 community members and professionals. By creating a space and platform for cross sector collaboration, we significantly expand awareness and understanding of climate change related issues throughout the region.

Keywords: Resiliency, Community, Outreach, Partnerships

B4 **[09]**

PHOTOSYNTHETIC BIOMASS IN FOREST PLANTATIONS AND ITS ROLE IN CLIMATE CHANGE MITIGATION

W.A.R.T.W. Bandara, F.R. Senanayake and L.K.D.N. Tharaka

Department of Zoology and Environmental Management, University of Kelaniya, Kelaniya, Sri Lanka

ABSTRACT

Primary production by plant leaves synthesises photosynthetic biomass that powers carbon sequestration, oxygen generation. Trees are not given the actual value for the services they provide in addressing climate change and only wood/timber has been recognized as having commercial value in the carbon market. As the Photosynthetic biomass of terrestrial ecosystems are largely composed of leaves, this component needs a value placed on it for its environmental services. This study was conducted with the objective of identifying a measure by which the initial growth of plant leaves can be evaluated. The Belipola Analog forest and home gardens in Badulla, Sri Lanka, were selected to carry out the study. Four utility tree species *Artocarpus heterophyllus, Tecton aceliata, Persea americana* and *Mangiferra indica* were selected. From each species 10 individuals representing each age group were selected for age groups from 1-4 years. Leaf samples from each selected individual were collected and fresh weight, leaf area moisture content and carbon content of leaves as well as total tree height, crown height and light intensity values were measured. Results indicated that the photosynthetic biomass of early growth stage of four species significantly increase with age and show a significant growth after age 3. Leaf Carbon content of four species increase with age, tree height, crown height and leaf area. The results also indicated that the carbon content of the leaves of four species in the early growth stage are in between 20% - 22% of leaf biomass. This study provides a measure by which the initial growth of plant leaves can be evaluated.

Keywords: Analog Forestry, Photosynthetic Biomass, Carbon Accumulation, Ecosystem Services

B5 **[10]**

IMPACT OF CONVERSION OF GRASSLAND TO PLANTATION FORESTS ON SOIL MICROORGANISMS AND SOIL ORGANIC CARBON

M.M.S.N. Premetilake [1], R.R. Ratnayake [2], S.A. Kulasooriya [2] and G.A.D. Perera [3]

[1] *Uva Wellassa University, Badulla, Sri Lanka*

[2] *National Institute of Fundamental Studies, Kandy, Sri Lanka*

[3] *University of Peradeniya, Peradeniya, Sri Lanka*

ABSTRACT

Changes in land use is a key factor that affects climate change. Nevertheless, the influence of some land-use changes on climate change is yet to be understood. In the present study we investigated the effect of conversion of Patana grassland to plantation forest on soil fertility and accretion of carbon in soil which strongly associates with climate change. The study was carried out in four *Eucalyptus grandis* plantation forests (stand ages of 4, 10, 19, 27 years) and in an adjacent Patana grassland (previous land-use before afforestation), belonging to same agro ecological zone in Passara, Sri Lanka. Six subplots (20 m × 20 m) were established within site and after which soil was sampled at depths of 0–15 cm (top soil) and 15–30 cm (sub soil). Soil Microbial Biomass Carbon (MBC) and Microbial Biomass Nitrogen (MBN) was measured using chloroform fumigation method. Walkley-Black method was used to quantify the Soil Organic Carbon (SOC). The results revealed that MBC: MBN ratios in top soil showed a substantial positive correlation with stand age (Pearson correlation, 0.680; $p = 0.000$). The MBC: MBN in top soil for Patana grassland was 1.8 and after 27 years of afforestation it has increased up to 27.8. The SOC has also increased significantly with the stand age (top soil: Pearson correlation, 0.738; $p = 0.000$; sub soil: Pearson correlation, 0.531; $p = 0.003$) which increased from 3.9 kg ha^{-1} to 15.7 kg ha^{-1} after 27 years. In conclusion soil microbiological properties and fertility has improved after the afforestation and the land-use change from Patana grassland to afforestation affects negatively on climate change in the long term.

Keywords: Afforestation, Microbial Biomass Carbon, Microbial Biomass Nitrogen, Soil Organic Carbon, Patana Grassland

B6 **[11]**

IMPACT OF THE ESTABLISHMENT OF A BOTANICAL GARDEN ON SOIL CARBON CONTENT IN DRY ZONE OF SRI LANKA

P.W.D. Chamari [2], R.P.S.K. Rajapaksha [1], K.L.W. Kumara [2] and R.R. Ratnayake [1]

[1]National Institute of Fundamental Studies, Hantana Road, Kandy, Sri Lanka

[2]Department of Agricultural Biology, Faculty of Agriculture, University of Ruhuna, Matara, Sri Lanka

ABSTRACT

Botanical gardens are established for the purpose of maintaining documented collections of living plants varieties used for conservation, display, education and scientific research. In addition, botanical gardens have a unique set of resources that are important in climate change mitigation and improving soil organic carbon content in urban soils. The major objective of this research was to study the potential of soil organic carbon content with the establishment of a botanical garden in the dry zone of Sri Lanka. This study investigates organic carbon storage capacity of different thematic areas of a dry zone botanical garden in Sri Lanka, 10 years after its establishment. The selected thematic collections in this garden were Arboretum part A (HARA), Arboratum part B (HARB), Ethanobotanical garden (HEBG), Herbal garden (HHG), Ornamental shrub garden (HOSG), Student garden (HSG), Valley path (HVP), and Natural shrub garden (NSG) which is the previous vegetation remaining inside the botanical garden. Soil moisture content, soil pH and electrical conductivity (EC), bulk density, total organic carbon (TOC), microbial biomass carbon (MBC), $KMnO_4$ oxidizable carbon (POC) and water soluble carbon (WSC) in all thematic collections were determined. The study concluded that the soil conditions in terms of organic carbon have been improved after 10 years of the establishment of the botanical garden in dry zone scrublands. All the Carbon fractions analysed were significantly higher than the NSG. Some management practices used in maintaining this botanical garden such as pruning techniques, organic fertilizer applications, and irrigation practices may have affected the soil organic carbon status in the dry soil. The study further showed that the establishment of botanical gardens is important to improve organic carbon contents in the tropical soils.

Keywords: Soil Organic Carbon, Botanical Gardens, Dry Zone

B7 **[12]**

ASSESSMENT OF PLANT STRUCTURE AND COMPOSITION IN DHAKA: A RAPIDLY DEVELOPED URBAN CITY OF BANGLADESH

Md. S. Jaman [1], I. Jahan [1], M. Jamil [2] and Md. F. Hossain[1]

[1]*Department of Agroforestry and Environmental Science, Sher-e-Bangla Agricultural University, Bangladesh*

[2]*Government of People's Republic of Bangladesh*

ABSTRACT

Plants are an important feature of urban ecosystems which provide numerous environmental and ecosystem benefits such as defenses against noise and air pollution and conservation of biodiversity. The aim of this study was to investigate the structure and composition of Plants in different urban habitats like roadsides, parks, gardens and playgrounds in Dhaka City area. Stratified random sampling method was used in this study. A total of 221 plant species belonging to 63 families were identified and recorded. Among all plant species *Swietenia macrophylla*, *Polyalthia longifolia*, *Cocos nucifera*, *Samanea saman*, and *Artocarpus heterophyllus* are recorded as the most dominant. Most of the tree and shrub population were found between 6-9 m and 1-3m height classes whereas most of tree and shrub population were found in between 10-15cm dbh classes. Highest IVI was found for *Swietenia macrophylla* (193.22%) followed by *Polyalthia longifolia* (184.59%), *Samanea saman* (138.37%), *Cocos nucifera* (79.9%) and *Delonix regia* (68.27%) respectively. Average frequency, density, dbh and basal area were found 46.82%, 138.28 tree ha^{-1}, 458.59 cm ha^{-1} and 12.33 m^2 ha^{-1} respectively. Findings of this study reveals that structural attributes of plant represent quite young and still developing vegetation. This research will help to plan for future green infrastructure which will maintain ecosystem function, therefore, providing longer term benefits for the city dwellers.

Keywords: Diameter at Breast Height, Basal Area, Frequency, Density, Important Value Index

B8 **[13]**

CONSERVATION OF FLOOD FLOW ZONE AND COMPACT TOWNSHIP DEVELOPMENT: A CASE STUDY OF TURAG RIVER AND ITS ADJOINING AREAS

Md. A. slam[1] and S.B.B. Amin[1]

[1]*Rajdhani Unnayan Kartripakkha, Bangladesh*

ABSTRACT

Protection of flood flow zone, wetlands and water retention areas from illegal encroachment is a challenging task because most of these areas belong to private ownership. A significant loss of flood flow zone and increase in sand filling along the adjoining areas of Turag River has been analyzed through satellite image from 2003 to 2017. Cheaper land price of these areas attracts private developers to buy lands for housing projects which increase vulnerability to flood. This paper illustrated that government initiative for a strategically designed compact township project can not only help to conserve low lying areas but also provide functional purposes to that area. About 9000 acres of land along the Turag River and its adjoining area has been selected as case study area in which 38 % of the area has been proposed to be preserved as rivers, canals, wetlands; 32 % of the area will be kept for agricultural land and water based recreational use and the rest are proposed to be developed as a block based compact township with roads, commercial and apartment buildings for recovery of land acquisition and other development expenditure. This paper also discussed that through this approach large functional open spaces can be secured which is very difficult to manage within densely built up city, flood risk will be reduced and initial investment cost can be recovered by selling residential and commercial apartments or plots.

Keywords: Compact Township, Flood Flow Zone, Conservation

B9 **[14]**

ASSESSMENT OF THE SUSTAINABILITY AND THE EFFECTIVENESS OF THE EXISTING SOLID WASTE MANAGEMENT REGULATIONS AND PRACTICES IN COLOMBO MUNICIPALITY WITH REFERENCE TO GREENHOUSE GAS (GHG) MITIGATION

K.M.S.R. Fernando and E. Lokupitiya

Department of Zoology and Environment Sciences, Faculty of Science, University of Colombo, Sri Lanka

ABSTRACT

Municipal Solid Waste Management (MSWM) has become a global scale problem especially in developing countries due to the insufficient collection of waste and lack of suitable lands for final disposal. As a result the unsustainable practices such as collection of only part from the total amount of waste generation and the usage of unoccupied lands as open dumps for the final disposal has taken place. Waste management activities contribute to GHG emissions approximately 4% mainly from waste landfills by releasing Methane and Carbon dioxide due to the breakdown of biodegradable carbon compounds by anaerobic and aerobic decomposition. Sri Lanka as a developing country has no exception, and faces an array of problems due to unsustainable waste management practices. The overall objective was to assess the sustainability of the current status of Solid Waste Management in the Colombo Municipality over Galgamuwa Pradeshiya Sabha (PS) as the reference site. Research approach was obtained by using functional elements which comes under five key aspects of sustainable solid waste management. Data collection was done through a questionnaire survey, interviews and by referring the necessary documents. The sustainability levels were illustrated through spider-web charts. A SWOT analysis was done in identifying the internal and external forces of municipal solid waste management in Colombo municipality. The highest sustainability value was obtained by the Galgamuwa PS due to the low level of urbanization compared to the Colombo municipality. The availability of well-established management hierarchy along with the trained personnel for waste management is the major strength of Colombo municipality while the lack of law enforcement has become the main weakness in effective management of Waste. The current sustainable management practices at the two sites have led to a reduction in the amount of solid waste that ends up in landfill sites, leading to a lowered contribution to global warming compared to the past.

Keywords: MSWM, Sustainable Practices, GHG Emissions, Landfills, SWOT Analysis, Spider-Web Charts

B10 **[15]**

CLIMATE CHANGE, CIVILIZATIONAL TRANSFORMATION, SUSTAINABLE DEVELOPMENT AND SRI LANKA

M.N.A. Dhas

The Foundation for Civilizational Transformation and Conscious Evolution, Sri Lanka

ABSTRACT

Sri Lanka is an island situated just offshore from the southernmost edge of the Indian Subcontinent. With a population of 20,000,000 and a national average IQ of just 79, the island has established beyond any doubt, its inability to successfully develop itself without extensive inputs in technology, structure, infrastructure and processes. These require a supportive nexus of specialized human resources and this in turn requires the generation of a socio cultural and ecological environment capable of attracting such skilled human resources. Climate change combined along with the growth model of development on which the currently global civilization of the human species is based and the rapid growth of its global population has begun to strengthen demand for biomass, protein, minerals, metals, manufactured goods and services. Delivering these in a constant never ending stream to meet the needs of a population already larger than 7 billion requires a virtualization of territorial borders and accelerated realization of all available potential which when resisted leads to conflict. Sri Lanka finds itself forced to align itself with these pressures while at the same time forging a developmental model that effectively responds to their challenges. This paper outlines such a developmental model which may serve as a pilot that can guide the island through the turbulent currents of civilizational transformation and towards a sustainable and resilient future.

Keywords: Sri Lanka, Civilization, Transformation, Conscious, Evolution

B11 **[16]**

CLIMATE CHANGE AND ITS IMPACT AS PERCEIVED BY PEOPLE OF SUNDARIJAL VDC

K.C. Ritika

Golden Gate International College

ABSTRACT

Climate change is now a scientifically established fact. Climate change and its impact on the livelihood of the people have become serious concern and common contemporary issue of 21st century. Climate change has direct impact on different livelihood resources like agriculture, water, forest, public health and settlement. This study was carried out in Sundarijal V.D.C. to explore the people's perception about climate change and the adaptation strategies. Questionnaire survey, key informant interview, focus group discussion and tree core samples were obtained as primary data. The average annual temperature was found increasing at the rate of 0.57°C per 3 decade time series while annual rainfall was found decreasing at the rate of -40.39 mm in 20 years. The respondents felt high intensity rainfall occurred for short duration. Erratic rainfall and drought have affected the agricultural productivity of the area. The use of inorganic fertilizer instead of organic fertilizer is highly prevalent in study area to increase the productivity different pest, insects as especially mosquitoes are increasing.Due to late onset of Monsoon, the germination, cropping and harvesting time of crops have changed. Adaptive capacity of the respondents was quit poor probably due to illiteracy and poverty. Knowingly or unknowingly some coping strategies like rotation of crops, intercropping etc were adopted within the community. There is an urgent need to formulate adaptive strategies for increasing food security and water source management.

Keywords: Climate Change, Livelihood, Temperature, Precipitation, Adaptation Strategies, Tree Core

B12 **[17]**

RATIO BETWEEN POTENTIAL EVAPOTRANSPIRATION AND PRECIPITATION AS A DROUGHT INDEX AND ITS IMPACTS ON RUBBER YIELD IN SRI LANKA

D.N. Wijayarathne[1], E. Lokupitiya[1] and T.U.K. Silva[2]

[1]*Department of Zoology and Environment Sciences, University of Colombo, Sri Lanka*

[2] *Rubber Research Institute, Dartonfield, Agalawatte, Sri Lanka*

ABSTRACT

The climate change may bring about an increase in the frequency of the extreme weather events like droughts. This study was undertaken to build up relationships between the rubber yield per tree per tapping with independent weather variables (i.e. temperature, precipitation) and a drought index incorporating the ratio between the potential evapotranspitation and precipitation. Meteorological and productivity data were obtained for the period 2002-2015 from six estates in Ratnapura, Kalutara districts representing the wet zone and Moneragala district representing the intermediate zone. Any autocorrelation in the residuals was checked before selecting the final predictors. Regression analyses between the rubber yield per tree per tapping and selected final predictors were carried out. According to the results, the drought index two months before the current month impacted negatively on the current month's rubber latex yield per tree per tapping in the wet zone. When the relationship of rubber latex yield per tree per tapping with the independent weather variables was considered, a negative correlation with the minimum temperature and a positive correlation with the precipitation two months before the current month resulted. In the Intermediate zone, the drought index seven months before the current month negatively impacted on each month’s rubber yield per tree per tapping. In considering the association of rubber latex yield per tree per tapping with the independent weather variables, a positive correlation with the average temperature resulted. The model relationships derived for each zone could be used to predict the rubber yield per tree per tapping. It would also facilitate decision making to mitigate the drought effects on rubber yield in the wet zone and intermediate zone and support policymakers to strengthen the rubber yield exports.

Keywords: Potential Evapotranspiration, Precipitation, Drought Index

B13 **[18]**

RESTORATION OF THE CASCADE SYSTEM AS A SOLUTION TO WATER SCARCITY IN DROUGHT PERIODS: A REVIEW OF THE POTENTIAL IN THE DRY ZONE OF SRI LANKA

H.U.K. Dilanjani [1], P.S.K. Rajapkshe [1] and A.K.R. Sameera [2]

[1]Department of Environmental Management, Rajarata University of Sri Lanka, Sri Lanka

[2]Mahawali Authority of Sri Lanka, Sri Lanka

ABSTRACT

There are some adverse impacts of global climate change such as drought. In most of dry zone areas of Sri Lanka have been struggling with the shortage of water scarcity particularly during the drought periods. Historically, small tanks were treated as an integral part of the rural landscape of the rural Dry Zone of Sri Lanka and these small tanks are connected to each other in those plains which are called "Cascades or Clusters of Tanks". The Small Tank Cascade System (STCS) was served as the essential components of ecological balance, water management and rural livelihoods. The main objective of this literature based study are to identify the benefits and to explore the potentials of restoration of STCS as a drought adaptation measure particularly as a solution for water scarcity during drought periods. This study found that the restoration of STCS may provide series of socio-economic and ecological benefits hence restoring the STCS is important to ensure the food security and for improving the rural livelihoods. Management of water and ecological practices within the STCS served for the dry zone areas to adapt climate induced impacts hence minimize the impacts of water scarcity. Study stressed the importance to develop the management structure not only covering villages on individual basis but also whole system of villages nested within a cascade system and re-adjustment of land use and land tenure to suit with current socio-economic realities based on holistic and participatory management principles.

Keywords: Drought, Dry Zone, Restoration, Tank Cascade System, Water Scarcity

B14 **[19]**

CARBON NEUTRAL ENERGY: PRODUCING ENERGY EFFICIENT BRIQUETTES WITH INVASIVE SPECIES WATER HYACINTH (*Eichornia crassipes*), WOOD RESIDUES AND COWDUNG TO REPLACE FOSSIL FUELS USED IN SMALL AND MEDIUM SCALE INDUSTRIES

W.A.R.T.W. Bandara and P. Kowshayini

Department of Zoology and Environmental Management, Faculty of Science, University of Kelaniya, Kelaniya, Sri Lanka

ABSTRACT

Conventional energy sources are depleting with increasing demand and also they greatly contribute for global warming. Sri Lanka has long been an import dependent consumer of fossil fuels and at present, national energy policy focuses on total replacement of fossil fuel by renewable energy sources by 2050.Water hyacinth is an aggressive invasive aquatic weed which contains considerable energy within and has been spreaded over 45% of fresh water bodies in Sri Lanka.This study aims to calculate the amount of electricity and fuel that could be replaced by the produced best performing saw dust: water hyacinth and cow dung: water hyacinth briquettes. Raw materials were prepared in 1-3mm particle range and saw dust: water hyacinth and cow dung: water hyacinth briquettes were produced in 25:75, 50:50 and 75:25 mixing ratios using screw type extruder briquetting machine, energy and mechanical properties of the produced briquettes were measured and the results was analyzed using one way ANOVA followed by Tukey's pair wise comparison. Both in saw dust - water hyacinth briquettes and cow dung - water hyacinth briquettes 50: 50 mixing ratios by weight perform better with calorific values of 19.17 kJ/g and 10.17 kJ/g respectively. 1kg of saw dust: water hyacinth (50:50) briquettes can replace 0.51 L diesel and 0.46 L of furnace oil and 1kg cow dung: water hyacinth (50:50) briquettes can replace 0.26 L of diesel and 0.25 L of furnace oil. Burning of 1kg saw dust: water hyacinth (50:50) briquettes can produce 5.33 Kwh and burning of 1kg cow dung: water hyacinth (50:50) briquettes can produce 2.83 Kwh units of electricity. Cow dung: water hyacinth (50:50) and saw dust: water hyacinth (50:50) briquettes can be recommended to partially fulfil energy demand of small and medium scale local industries as these are carbon neutral as well as these would help to control water hyacinth.

Keywords: Renewable Energy, Water Hyacinth, Biomass Briquettes

B15 **[20]**

FEASIBILITY STUDY ON USE OF COTTON APPAREL WASTE FOR THE BIOMASS BOILERS AS AN ENERGY SOURCE

W.M.C. Prasanga and W.M.P.S.B. Wahala

University of Moratuwa, Sri Lanka & University of Sabaragamuwa, Sri Lanka

ABSTRACT

Apparel manufacturing sector is a vital economic segment in Sri Lanka which consumes huge energy and also generates large amount of solid waste. The generated apparel waste has become a burden to apparel manufacturing industry and as a whole to the entire society. In order to fulfill the annual heat energy requirement , the industries are spending large amount of capital. As a solution some of the apparel industries are using the cotton apparel waste for the biomass boilers as an energy source without any prior investigation in detail. Thus, the research aims to conduct a study on social, environmental, financial and technical effect of the technique. The environmental impact of the technique has been identified in terms of carbon footprint calculations. Through an extensive literature synthesis, current apparel waste practices and their drawbacks along with suitability of cotton apparel waste as energy source for the biomass boiler was identified. Finally, a qualitative analysis was conducted from the data gathered through semi structured interviews, unstructured interviews and document survey. It was found that use of cotton apparel waste for biomass boilers is not environmentally and socially feasible. The study reveals that there is a reduction of carbon footprint 1053.6 $kgCO_{2e}yr^{-1}$. However due to the damage cause for the environment and the temperature of emission air is not within the minimum levels, study reveals that the technique is not environmentally feasible. Moreover the technique is more feasible in terms of technical, legal and financial aspects.

Keywords: Apparel Manufacturing Industry, Apparel Waste, Boiler, Feasibility, Carbon Footprint

B16 **[21]**

A STUDY ON THE ADAPTATION OF GLOBAL GREEN STANDARDS AND ISO14000 IN PAKISTAN AND THEIR IMPACT ON FIRM PERFORMANCE

S.R.U. Shah

Freelance Consultant, Auditor, Trainer and Writer in the Fields of Quality, Environment, Occupational Safety and Social Compliance, Pakistan

ABSTRACT

The Purpose of this research is to measures the impact of global green standards and ISO 14000 on the firm performance in Pakistan. The quantitative research method was adopted by the researcher to measure the impact of global green standards and ISO 14000 on the Pakistani industries. For this purpose a questionnaire was constructed to testify the generated hypothesis by the researcher Impact of these green standards have been studied by getting the information from the organizations related to their growth, profitability customer satisfaction, employees satisfaction and corporate social responsibility. The data was collected and analyzed through SPSS. The results indicate that although Global green standards and ISO 14000 improve the performance of the firms but still firms feel that adoption of these standards is a burden on them.

Keywords: Environmental Standards, ISO 14000, Green Standards, Productivity, Performance, Profit

B17 **[22]**

FINANCIAL AND ENVIRONMENTAL OVERVIEW ON SOLAR POWERED WATER PUMPING SYSTEM FOR AGRICULTURE IN SRI LANKA

B. Rotawewa[1] and E. Lokupitiya[2]

[1]Food and Agriculture Organization, Sri Lanka

[2]Department of Zoology and Environment Sciences, University of Colombo, Sri Lanka

ABSTRACT

Availability of affordable, low cost and long-life water pumping technology is a dream of every farmer. In Sri Lanka, there are thousands of hectares irrigated by kerosene, diesel or electricity powered water pumps to irrigate OFCs, Vegetables, fruits and when necessary to irrigate paddy as a supplement to surface water irrigation. The Hector KobbekaduwaAgrarian Research and Training Institute (HKARTI 2000), has found that there are 10,000 and 5,400 agro-wells in Anuradhapura and Kurunegala districts, respectively. The fuel cost is the biggest burden for the farmers, that result in higher cost of production. Further, use of electricity or burning fossil fuels contribution to global warming through CO_2 emission is highly significant. Use of solar energy for water pumping is a promising alternate to conventional electricity and diesel based water pumping systems. solar water pumping is based on photo voltaic (PV) technology that converts solar energy into electrical energy to run a DC or AC type water pump. This paper presents comparative analysis on carbon foot print associated with solar water pumping system against diesel water pumping system and economic cost benefit analysis (CBA) for 25-hectare land extent for the cultivation of export oriented OFCs by 100 members of Tempitiya Farmer Organization in Ampara District of Sri Lanka. Based on the required irrigation water demand, unit cost of different components and fuel were considered for the related cost benefit analysis and carbon foot print estimation. Its concluded that solar water pumping system is advantageous compared to diesel pump in terms of economic and environmental aspects.

Keywords: Water Pumping, Solar Energy, Diesel Fuel

C1 [23]

IMPACTS OF CLIMATE CHANGE ON CHANGING WATER RESOURCES AND AGRO-ECOLOGICAL ZONES IN THE COASTAL PLAIN OF THE MEKONG DELTA, VIET NAM

H.M. Hoang[1], T.T.N. Bich [1,3], V.P.D. Tri[2], Y. Chen[3], N.T. Quan[2] and N.D. Tai[2]

[1]*School of Agriculture and Aquaculture, Tra Vinh University, Viet Nam*

[2] *College of Environment and Natural Resource, Can Tho University, Viet Nam*

[3]*Department of Environmental Engineering, Da-Yeh University, Changhua, Taiwan*

ABSTRACT

Increasing populations and agricultural cultivation leading to highly rising water resources demands have led to water shortages worldwide, especially in the coastal areas undergone sea level rise (SLR) and climate change. Ensuring fresh water supply for agricultural cultivation is a major problem and need to be considered for sustainable socio-economic development and adapt to SLR and climate change in the coastal areas. The Vietnamese Mekong Delta (VMD) is the largest agricultural area of Viet Nam, which has also been significantly affected by the water resources changes, especially in the coastal areas. Tra Vinh, one of the coastal provinces of the VMD, has faced with changing farming systems and freshwater scarcity for agricultural cultivation affected by the SLR-induced saline water intrusion. The purpose of this study is to assess the relationships of SLR and climate change resulting in negative impacts to changes of freshwater resources and agro-ecological zones in Tra Vinh. The Geographic Information System and Driving – Pressures – State – Impact – Response (DPSIR) framework are used to develop a systematic framework assessment of the complex components of changing water resources and agro-ecological zones for the Tra Vinh province (from 2010 to 2017). The study identifies different agro-ecological zones and major factors impacting on changing hydrological conditions and agro-ecological zones in the VMD's coastal plain.

Keywords: Agro-Ecological Zones, Climate Change, DPSIR Framework, Sea Level Rise, Water Resources

C2 **[24]**

CARBON FOOTPRINT OF CANNED PINEAPPLE

M. Yuttitham[1] and J. Boonmark[1]

[1]*Faculty of Environment and Resource Studies, Mahidol University, Thailand*

ABSTRACT

This study is to evaluate the amount of Carbon footprint occurring from canned pineapple process in order to educative and suggest the best way to reduce the greenhouse gases effectively. This study followed Thailand Greenhouse Gas Management Organization guidelines. The result was calculated as equal Carbon dioxide (Carbon dioxide Equivalent, CO_2eq). The study was separated into two sections consisting agriculture section and pineapple manufacturing section. For agriculture section, the determination of scope of the study was considered from raw material production until 1 ton of pineapple process. When considered as each activity, the chemical fertilizer activity shared the largest releasing Carbon footprint. Totally, the releasing Carbon footprint amount was accounted for 0.109 kg CO_2/kg. For pineapple manufacturing section, the releasing Carbon footprint amount was accounted for 0.84 kgCO_2/kg. When considered in each activity, the raw material (fresh pineapple) shared the largest releasing Carbon footprint. Hence, the best way to reduce the effect is emphasizing at raw material (fresh pineapple). From the collecting data pineapple manufacturing plant, 95% of pineapple farmers contracted with the plant, and the plant supported by providing the agricultural expert to educate farmers to grow the pineapple productively. Moreover, to educate about using proper amount of fertilizer should be made available to support pineapple farmers as well.

Keywords: Carbon Footprint, Pineapple, Canned Pineapple, Agriculture

C3 **[25]**

IMPACTS OF CLIMATE CHANGE ON PADDY YIELDS AND FATE OF RICE RESIDUES IN DIFFERENT CLIMATIC ZONES

E.A.S.K. Somarathne and E. Lokupitiya

Department of Zoology and Environment Sciences, University of Colombo, Sri Lanka

ABSTRACT

The humanity will have to face various types of impact of climate change with far reaching consequences. Sri Lanka is one of the countries that is highly vulnerable to impacts of climate change. Food security of the nation can be adversely affected by the impacts of climate change. The impacts of climate change on paddy yields during *Yala* and *Maha* seasons and fate of rice residues in dry, semiarid, intermediate and wet zones in Sri Lanka were studied using district level data. From 1994 to 2016, the meteorological data and paddy yield data were analyzed using regression analyses to develop model relationships between weather parameters and paddy yields for *Yala and Maha* growing seasons. Farmer surveys were conducted to gather information on paddy residue disposal methods and fractions of paddy residues disposed by each disposal method different climatic zones. Greenhouse Gas (GHG) emissions were calculated for open burning of paddy residues in each climatic zone for *Yala* and *Maha* seasons separately. The results indicated that average minimum temperature, average maximum temperature and total rainfall were positively or negatively related with seasonal and total paddy yield to different degrees in the different climatic zones. There was no revealed statistically significant relationship between average daily mean temperature and paddy yield from any climatic zone. Open burning of paddy residues was recorded from dry, semiarid and wet zones. The highest total GHG emission was revealed from *Maha* season in the dry zone. The major key findings of this research were the impacts of changes of average minimum temperature, average maximum temperature and total rainfall on the paddy yield and the impact of open burning of paddy residues on GHG emissions in different climatic zones.

Keywords: Climate Change, Climatic Zones, Greenhouse Gas, Paddy Residues

C4 **[26]**

ASSESSMENT OF CLIMATIC VARIABILITY AND ITS PROBABLE IMPACTS ON MAJOR CROPS IN BANGLADESH

M.R.A. Hawladar[1], M.M.U. Miah[1], M.M. Rahman[1], M.A. Aziz[2], J.C. Biswas[3], S. Akter[2], A.K. Chowdhury[2], F. Ahmad[2], M. Maniruzzaman[3] and N. Kalra[4]

[1]Bangabandhu Sheikh Mujibur Rahman Agricultural University,Gazipur, Bangladesh

[2]Bangladesh Agricultural Research Institute, Bangladesh

[3]Bangladesh Rice Research Institute, Bangladesh

[4]Indian Agricultural research Institute, India

ABSTRACT

A study was undertaken to analyze the trends of climatic variability of Bangladesh during 1970 to 2013 as well as to measure the effects of temperature and humidity on major crops i.e. rice and wheat. Climate variability map and correlation graphs ware made using secondary data of climate variables and yield of crops. Geographic Information System (GIS) tool is used to show the spatial distribution of the climatic parameters of Bangladesh. The Climatic scenarios were developed based on three major crop growing seasons (kharif-1, kharif-2 and Rabi) and climatic data of all 34 weather stations in Bangladesh. The highest mean temperature of Kharif-1 season was found in Khulna and Satkhira district, whereas in Kharif-2 and Rabi season it was in Jessore and Coxs-Bazar district. The highest minimum temperature of Kharif-1, Kharif-2 and Rabi seasons was found in Patuakhali, Khulna and Coxs-Bazar district, correspondingly. Historical data of 34 weather stations of Bangladesh revealed that the maximum temperature of Kharif-1, Kharif-2 and Rabi season was recorded in Jessore, Chuadanga, and Teknaf district, respectively. Long-term weather data demonstrated that the average rainfall trend of Kharif-1 season showed slightly decreasing trend after 1977, whereas, rainfall intensity of Kharif-2 season shown somewhat decreasing trend though highest average rainfall was recorded in the year of 1987. Fascinatingly, rainfall intensity of Rabi season also showed increasing trend and highest amount of rainfall were found in the year of 1991.The overall findings revealed that the climatic parameters have substantial effect on the crop production of Bangladesh. Aus and Aman rice showed strong posative correlation to average temperature than boro rice. However, Boro rice showed strong correlation with the average humidity than Aus and Aman rice. On the other hand, wheat showed a strong negative correlation with average temperature but reverse phenomena was found with average humidity.

Keywords: Rice, Wheat, Temperature, Rainfall, Humidity, Bangladesh

C5 [27]

IMPACTS OF CLIMATE-RESILIENT AND ECO-FRIENDLY CROP MANAGEMENT PRACTICES ON YIELDS OF A REPRESENTATIVE RANGE OF CROPS GROWN ACROSS A NATURAL TEMPERATURE GRADIENT IN TROPICAL SOUTH-ASIA

W.A.J.M. De Costa [1], K.M.R.D. Abhayapala [1], M.A.P.W.K. Malaviarachchi [2], J.B.D.A.P. Kumara [3], R.M. Fonseka [1], L.D.B. Suriyagoda [1] and D.M. De Costa [1]

[1]*University of Peradeniya, Sri Lanka*

[2]*Field Crops Research & Development Institute, Sri Lanka*

[3]*Sabaragamuwa University of Sri Lanka, Sri Lanka*

ABSTRACT

Long-term temperature increases pose a major threat to tropical crops. Therefore, cropping systems, which are more resilient to increasing temperatures and less reliant on synthetic pesticides and inorganic fertilizer while producing yields on par with existing systems should be developed. We tested three modified crop management packages ($MCMP_1$, $MCMP_2$ and $MCMP_3$) that included measures to increase climate resilience and reduce external inputs on five representative crops (maize, mungbean, tomato, chilli, potato) in a series of multi-locational field experiments over four consecutive cropping seasons across a natural temperature gradient ranging from 15 to 31^oC in Sri Lanka. The control (C) was standard crop management with recommended doses of pesticides and inorganic fertilizer. All MCMPs included mulching with appropriate organic material at 8 t ha^{-1} and 30% reduced irrigation. In $MCMP_2$ and $MCMP_3$, standard crop protection was replaced with appropriate crop-specific integrated pest management packages. In $MCMP_3$, 25% of inorganic nitrogen fertilizer was replaced by an equivalent amount of organic manure. When averaged across locations and seasons, yields under $MCMP_1$ increased significantly above the respective control yields in tomato (12%), chilli (21%) and maize (16%) while in mungbean and potato, there was no significant difference. Maize and chilli yields under $MCMP_2$ (33-40%) and $MCMP_3$ (29-36%) were greater than the control while in tomato and mungbean there was no difference. In potato, $MCMP_2$ and $MCMP_3$ showed lower (22-23%) yields than the control. Temperature response functions of yield showed that the MCMPs increased the resilience of tomato, chilli and maize to increasing temperatures.

Keywords: Climate Resilience, Food Security, Eco-Friendly Crop Management

C6 **[28]**

EFFECT OF BIOCHAR ON CHILI PEPPER FINE ROOT AND CARBON STOCK IN HEAVY ACID SOIL

P. Hanpattanakit [1], P. Kerdsaeng [1], S. Vanitchung [1] and S. Saeng-Ngam [2,3]

[1]Department of Environment, Faculty of Environmental Culture and Ecotourism, Srinakharinwirot University, Bangkok, Thailand

[2] Department of Biology, Faculty of Science, Srinakharinwirot University, Bangkok, Thailand

[3] Center of Excellent in Animal, Plant, Parasite Biotechnology, Srinakharinwirot University, Bangkok, Thailand

ABSTRACT

Application of biochar to soil has been suggested as a potential way of enhancing soil carbon sequestration, plant production, and environment. However, we know little about its effects on belowground root growth in heavy acid soil. Since there is limited information on root growth implemented with biochar, Therefore, this study was conducted to monitor root growth of chili pepper (*Capsicum annuum* L.) under growth in 2 biochar conditions: B1 was added corncob biochar 6.25 ton/ha, and B2 was added corncob biochar 12.5 ton/ha. There were compared to the control in heavy acid soil (CF). Three replications for each treatment were used in this experiment. Root length growth in each treatment was studied by using minirhizotron technique. Aboveground and belowground biomass, fruit dry weight of chili, and carbon stock in soil were measured. The results showed that the average of aboveground and belowground biomass in CF, B1, and B2 were 2,033.33, 3,518.75 3,779.17 and 806.25, 1,418.75, 1,287.50 kg dry matter/ha, respectively. Chili yield in CF, B1-B2 were 1,496.85, 2,267.50, and 2,204.38 kg dry matter/ha, respectively. Total biomass and yield of B1-B2 and CF were significantly different ($p \leq 0.05$). According to root growth between B1-2 and CF was also significantly difference ($p \leq 0.05$). The average root growth length for the whole growing season of CF, B1, and B2 were 438.96, 497.29, and 477.48 m/tree, respectively. In addition, the soil carbon and pH in heavy acid soil were increased when applied with biochar. These results indicated that biochar can improve and stimulate plant growth and production in heavy acid soil.

Keywords: Biochar, Fine Root Growth, Carbon Stock, Chili Production, Heavy Acid Soil

C7 [29]

CONSERVATION AGRICULTURE ENHANCES CROP PRODUCTIVITY AND SOIL HEALTH IN A RICE ECOSYSTEM IN BANGLADESH

M.M.R. Jahangir [1] and M. Jahiruddin [1]

[1]*Department of Soil Science, Bangladesh Agricultural University, Mymensingh, Bangladesh*

ABSTRACT

When evaluating an agricultural management system for sustainability, the central focus should ensure that the system will not exhaust the resource base, will optimize soil conditions and will reduce food production vulnerability, while at the same time maintaining or enhancing productivity. Soil protection needs judicious and prudent use of conservation agriculture to prove its potential as a conservation effective technology, climate resilient agriculture, and a viable option for sustainable intensification of agroecosystems for advancing food security and for adaptation to/ mitigation of climate change. Conceptually conservation agriculture consists of four basic principles: i) retaining crop residues as surface mulch, ii) including cover crops in the rotation cycle, iii) improving soil fertility by integrated nutrient management for healthy crop growth and biochemical transformation of biomass carbon into soil organic matter or humus and iv) causing minimal or no soil manipulation. Two experiments with conservation agriculture practices were conducted in the field laboratory of Department of Soil Science at Bangladesh Agricultural University having a silt loam soil with low organic matter content. Experiment 1, being in practice since 2016, comprises two tillage (minimum soil disturbance with 20% crop residue retention and conventional tillage) and three cropping patterns (mustard – rice – green manure – rice, wheat – rice – rice, and lentil – rice – rice). Experiment 2, being in practice since 2012, comprised of two tillage (strip tillage and conventional tillage), two residue retention (20% and 60% of crop residue) and five nitrogen fertilizer doses in wheat – rice – rice pattern. Soil quality indicators e.g. bulk density, moisture content, aggregate formation and stability, easily oxidizable Carbon (C), Soil organic Carbon (SOC), potentially mineralizable C and Nitrogen (N), basal respiration rate and system productivity were examined. Conservation soil management practices significantly reduced ($p<0.05$) soil bulk density, enhanced soil aggregation and aggregate protected C and N, sequestered SOC without compromising crop production. Soil aggregation and aggregate protected C and N significantly responded to cropping patterns indicating that individual crop has significant impacts on soil quality. Different rates of N showed varying effects on crop productivity but not on soil health.

Keywords: Carbon Sequestration, Soil Health, System Productivity, Mineralization, Aggregation

C8 **[30]**

FARMERS' PERCEPTION OF CLIMATE CHANGE IN DISTRICT SWABI AND THE EFFECT OF TEMPERATURE ON GERMINATION AND INITIAL GROWTH OF PARTHENIUM WEED

H. Khan and I.A. Shah

Department of Weed Science, The University of Agriculture Peshawar, Pakistan

ABSTRACT

Climate change is the principal concern of present day agriculturists, environmental scientists and ecologists. Climate change and its negative impacts is still not fully understood and the concept is still criticized for its validity. Climate change was studied through farmers' perception using a formal survey and consequently a lab study based on the survey results to correlate farmers' perceptions with the scientific evidences during Jan-May, 2016 in Swabi, Northern Pakistan. Farmers were randomly interviewed through a questionnaire. 61 % of them believed in and had noticed climatic change for the last 20 years, in the form of changed rainfall pattern with earlier summer rainfalls (68%) and extended winter rainfalls (35%), severe floods (75%), storm (77%) and higher pests attack (68%). Climate change also favored the repaid spread of some invasive weed species like Parthenium hysterophorus and Silybum marianum. They noticed high weed frequency (69%) and aggressive growth (75%) thus outcompeting crops (82%). The field study proved Parthenium weed (82%) as the most responsive weed to climate change and was selected for lab experiment using Completely Randomized Design having 5 temperature regimes ranging from 15-35 °C. The results of laboratory experiment showed that high seed germination (34.50%) occurred at higher temperatures (30°C) than lower temperatures. Similarly growth remained (19.75%) high at higher temperatures than optimum (16.95%). So it is concluded that rise in temperature is favoring Parthenium weed spread, making it highly aggressive for the indigenous flora of the study area.

Keywords: farmer's perception, weeds, climate change impacts

C9 **[31]**

EFFECT OF BIOCHAR ON PHOTOSYNTHESIS AND SOME PHYSIOLOGICAL RESPONSES OF CHILI PEPPER IN STRONGLY ACID SOIL

S. Saeng-Ngam[1,2], P. Pearaksa[1,2], P. Hanpattanakit[3] and S. Vanitchung[3]

[1] *Department of Biology, Faculty of Science, Srinakharinwirot University, Bangkok, Thailand*

[2] *Center of Excellent in Animal, Plant, Parasite Biotechnology, Srinakharinwirot University, Bangkok, Thailand*

[3] *Department of Environment, Faculty of Environmental Culture and Ecotourism, Srinakharinwirot University, Bangkok, Thailand*

ABSTRACT

The strongly acid soil amendment biochar has been suggested as a potential way of enhancing soil quality. It affects plant growth and yields. However, little is known about practical aspects of applying biochar on farms. Therefore, this study was conducted to study shoot growth, some physiological responses and yield of chili pepper (*Capsicum annuum* L.) under three biochar conditions: CB1 was added corncob biochar 6.25 ton/ha, CB2 and CB3 were added corncob biochar 12.5 and 18.75 ton/ha, respectively. There were compared to the control in strongly acid soil (C). There were five replicates per treatment (25 plants/replicate). The shoots growth, photosynthetic pigments, hydrogen peroxide (H_2O_2) content and malondialdehyde (MDA) and yield were measured. The results found that the shoot biomass in C, CB1, CB2 and CB3 were 30.33, 77.57, 54.88 and 75.98 g dry matter/plant, respectively. Especially, the photosynthetic pigments and yield of chili treated with biochar treatments were significantly increased when compared with control ($p \leq 0.05$). In addition, biochar treatments were also decreased the hydrogen peroxide content and lipid peroxidation in plants. Moreover, soil pH was increased when amendment with biochar. These results revealed that soil amendment with corncob biochar can improve plant growth and decreased hydrogen peroxide accumulation under strongly acid soil.

Keywords: Biochar, Growth, Photosynthesis, Chili, Acid Soil

D1 **[32]**

COASTAL FLOOD OVER SRI LANKA: EXPLORING THE DISTRIBUTIONAL CHANGES IN EXTREME RAINFALL USING BAYESIAN NON-CROSSING QUANTILE REGRESSION

S.S.K. Chandrasekara, S. Uranchimeg and H-H. Kwon

Chonbuk National University, Republic of Korea

ABSTRACT

Recent flood disasters observed had caused severe damage to the coastal communities in Sri Lanka. Therefore, this study is focused on understanding distributional changes and return period in annual daily maximum rainfall (ADMRs) over time in coastal regions of Sri Lanka using Bayesian non-crossing quantile regression (BQR). Empirical probability density function of two years (i.e. the first year and the last year) were used to determine the distributional changes in the ADMRs. Generalized extreme value distribution was used to identify return period of the ADMRs. Daily rainfall series of 5 coastal regions in Sri Lanka were analyzed for the period of 1960-2015. All the regions (i.e. Colombo, Galle, Batticaloa and Trincomalee), except Hambanthota showed an overall decreasing trend in ADMRs. Hambanthota and Trincomalee regions have a high return period in the upper quantile of ADMRs. Colombo, Ratmalana and Galle stations showed a low return period in the upper quantile of ADMRs, which could leads a higher risk of flooding. This study confirmed that the proposed BQR could give comprehensive information on non-stationarity in hydrological extremes. Furthermore, this study discussed other factors which could influence the flood causing in the coastal regions of Sri Lanka.

Keywords: Coastal Flood, Quantile Regression, Sri Lanka

Acknowledgement: This research was supported by a grant [MPSS-NH-2015-78] through the Natural Hazard Mitigation Research Group funded by Ministry of Public Safety and Security of Korean government.

D2 **[33]**

IMPACTS OF FUTURE SEA LEVEL RISE ON INFRASTRUCTURE IN CHENNAI, INDIA

A. Akshaya, K. Masillamani, Bhavani, Rajan and S. Chella

Indo-German Centre for Sustainability, Indian Institute of Technology Madras, India

ABSTRACT

Climate change manifests itself on coasts through intense storms, coastal erosion and flooding and salt water intrusion leading to significant negative consequences on infrastructure, eco-systems and lives of people, especially those in developing countries. This paper estimated economic impacts of sea level rise (SLR) along the coast of Chennai in the time period leading up to 2050, assuming two inundation scenarios, A and B which represent 1m and 3m SLR, respectively. Specifically, the paper focused on estimating economic loss from critical economic infrastructure and land along the coastline in terms of 2016 prices. Economic loss was defined in terms of replacement cost by taking into account both stock and flow losses. Findings reveal that total economic loss of infrastructure from Scenario A is ₹7,91,790 Cr. and ₹ 10,68,009 Cr. from Scenario B. Flow losses from Scenarios A and B are likely to be around 50 percent and 55 percent respectively of Gross State Domestic Product (GSDP) for Tamil Nadu. Recognising that economic estimations do not capture social and socio-economic losses people will likely face, the authors will complement the existing findings by estimating these losses through the application of an index. This index will likely provide evidence on which areas of the city are most vulnerable to SLR and require immediate policy intervention.

Keywords: Climate Change, Sea Level Rise, Loss and Damage, Infrastructure, Economic and Socio-Economic Loss

D3 **[34]**

CONSTRUCTION OF SOUTHERN EXPRESSWAY AND FLOOD IMPACT IN MATARA MUNICIPAL AREA

H.C.M. Hewage, S.L.J. Fernando and N.M. Nishamani

Department of Geography, University of Ruhuna Matara, Sri Lanka

ABSTRACT

A flood is an inevitable natural phenomenon occurring from time to time in all rivers and natural drainage systems, which not only damages the lives, natural resources and the environment, but also causes the loss of economy and health. The amount of people affected by floods from 2000-2015 is reported to be approximately 1.76 billion. In the U.S. alone, there are 10 million people living in areas that could flood. Since the absence of successful feasibility study flooding has occurred annually after implementing the southern express way and resulted many adverse effects. This study is carried out to come across the impact of reliable and stable inundation extent of flooding inGodagama and Suthanagoda area located in the Southern Province in Sri Lanka. Primary and secondary data sources were used to collect required data and a questionnaire has been designed to survey the perspective and response of the society of the neighboring region. The findings indicate that 75.8 percent of respondents agreed that annual flood has brought a negative impact to the day to day activities and surrounding environment of them. Around 91 percent of respondents believed that the issues increased resulted after implementing the southern express way. The analyses lead to the concluded that social, economic and environmental issues are increasing due to the failure construction of southern expressway.

Keywords: Floods, Express Way, Environmental Issues, Respondents

D4 **[35]**

THE EFFECT OF URBAN EXPANSION ON URBAN SURFACE TEMPERATURE IN KANDY CITY SRI LANKA: AN ANALYSIS WITH LANDSAT IMAGERIES

R.J.M. Uduporuwa[1] and L. Manawadu[2]

[1]*Department of Geography and Environmental Management, Sabaragamuwa University of Sri Lanka, Sri Lanka*

[2] *Department of Geography, University of Colombo, Sri Lanka*

ABSTRACT

The most adverse impact of urban growth which has gained much global attention today is the rise of land surface temperature that come up with conversion of greener areas into urban type of characters. This paper attempts to examine whether there is such effect of urban growth on urban surface temperature in Kandy city, Sri Lanka with GIS and RS techniques. Measuring the built up area expansion, detecting changes of land surface temperature and identifying the correlation between urban growth and land surface temperature over time are the objectives of this paper. The paper uses Urban Index (UI), Land Surface Temperature (LST) and linear regression technique to achieve the above objectives. For this purpose, Landsat satellite images in 1980, 1994, 2003, 2007 and 2015 with moderate resolution were obtained from USGS server. Image processing and related mapping were done with Arc GIS 10.2 software. Microsoft Excel 2007 was used to perform regression analysis Results evidently prove that the Kandy also under the threat of rising temperature. According to the results there is a continuous increase of mean land surface temperature in the city. The mean temperature has risen from by 5 C^0 degree from 1994 (24 C^0) to 2015(29 C^0). The other important finding is that the strong spatial variations in the temperature in the city. Existence of very high temperature is always in the highly developed commercial areas (city core) where there is no vegetation cover while high and medium levels are in residential area. Correlation analysis indicates UI and LST are positively correlated each other. As Coefficient of correlation indicates there is a strong positive correlation in each year between UI and LST. Coefficient of determination which is around 50 percent and above it in each corresponding year indicates that increase in temperature in the city is strongly associated with urban growth.

Keywords: Kandy City, Urban Index, Land Surface Temperature, Correlation

D5 **[36]**

CARBON STRUCTURING AND DISSOLVED GREENHOUSE GAS CONCENTRATIONS: THE FATE OF A TROPICAL WETLAND (COCHIN ESTUARINE SYSTEM), INDIA

S. Bijoy Nandan*, Regina Hershey N.[1], Akhilesh Vijay and Neelima Vasu K.
[*]Dept. of Marine Biology, Microbiology and Biochemistry, School of Marine Sciences
Cochin University of Science and Technology, Cochin 682016, India
[1]PG and Research Dept. of Zoology, N.S.S Hindu College, Changanassery 686 102

ABSTRACT

Tropical wetlands are major sinks of carbon and source and sink of greenhouse gases (GHG) that are critically influencing global warming and climate change. Cochin backwater is an important estuarine complex on the south west of India that is experiencing intense pollution and anthropogenic interactions for several decades. In this view, extensive studies were carried out in Cochin estuary (76018'22.91"E, 9053'02.10"N to 76017'33.12"E, 10004'02.26"N) during monsoon 2013 and premonsoon 2014 from selected sixty stations to predict the effects of climate change and anthropogenic disturbances on the complex. Super saturation of carbon dioxide (18.79±3.45mgL-1 monsoon ; 8.27±1.97mgL-1 premonsoon) and methane (5.71±4.65nM monsoon; 5.50±3.27nM premonsoon) were observed in surface waters, while nitrous oxide concentrations (25.27±58.42nM monsoon; 29.25±41.13nM premonsoon) were higher in bottom waters indicating Carbon (C) diffusion through surface layers and Nitrogen (N) release from sediment to bottom waters, impacting the estuarine phyico- chemical characteristics. Increasing concentrations of dissolved greenhouse gas with high oxygen saturations against salinity gradient were observed. Salinity extremes were observed during the study with low salinities (0.63- 3.97ppt) during monsoon and mixo mesohaline salinities (2.13-37.92ppt) during premonsoon. pH was observed slightly acidic during monsoon. During monsoon the estuarine surface and bottom waters contributed higher inorganic carbon fractions (18.32±4.17mgL-1); dissolved carbon levels along with other nutrients that tend to affect the ecological balance leading to higher productivity patterns and thereby indicating increasing eutrophication. Significant correlations were observed among dissolved greenhouse gas concentrations to various physico chemical constraints and carbon forms. The present study also reveals that estuarine sediment holds a mammoth amount of organic carbon (25.14±9.86mg/g) which on a present scale of degradation and trophic changes, could act as significant source of C accelerating in global warming and climate change issues.

Keywords: greenhouse gas concentrations, carbon, climate change

D6 **[37]**

IMPACT OF URBANIZATION ON GROWTH OF WATER HYACINTH IN RIVER TAPI : A CASE STUDY

K.A. Chauhan and P. Tiwari

Sardar Vallabhbhai National Institute of Technology, Surat, Gujarat, India

ABSTRACT

Globalization and Industrialization have been the two major climate change drivers. The discharge of toxic effluents from various industries adversely affects water resources, soil fertility, aquatic organisms and ecosystem integrity. These effluents serve as a food for the growth of Worlds most noxious weed Water Hyacinth. This fresh water aquatic plant grows very fast depleting the nutrients and oxygen from water bodies. It changes the nutrient concentration as well the rate of carbon exchange in the atmosphere. It adversely affects the growth of both aquatic plants and animals. The present work focuses on the effect caused by *Eichhornia crassipes* on the River Tapi, Surat. Various important physical and chemical properties are determined using experimental approach in reference to APHA (American Public Health Association).Various Parameters such as the concentration of P, N, S and Dissolved oxygen are studied. Based on the results, Analysis of the values was also done. A Comparative is made between the desired properties and the obtained values. In addition, an attempt was made to study the possible reasons for the deviation in these values. The dissolved oxygen content was found to be significantly lower. These studies enabled us to conclude that high levels of N & P are indicators of aquatic pollution and a simultaneous threat to the water bodies. Experimental Results also established the unsuitability of water for the Population residing in Surat city region which is about 7.5 million The paper also reviews various control methods and enables us to conclude that the only way to get rid of this proliferative weed is to start exploring its potential as fuel and biosorbents which would not just transform it from waste to resource but would also boost the economic development of the country and lead to sustainable development.

Keywords: Industrialization, Water Hyacinth, Aquatic Life, Sustainable Development

D7 [38]

SEMI QUANTITATIVE ANALYSIS OF LAND USE HOMOGENEITY AND SPATIAL DISTRIBUTION OF INDIVIDUAL ECOLOGICAL FOOTPRINT

S. Banerji

Presidency University, India

ABSTRACT

Land use change is a part and parcel of urbanisation. Land-use change primarily occurs as a result of urban growth and urban planning systems conforming to the available technological development. Therefore, the largest change in land utilization implies rapid urbanisation and in the context of the present study, land-use mix has been considered for analysing the land use change. The present study analyses the change in land use mix in the eastern fringes of Kolkata, India over a span of 27 years and compares it to the present individual ecological footprint of residents of that area. The major objectives of the study are i) to calculate and represent the land use mix index using Landsat Imageries of 1989 and 2016, ii) to evaluate the changes in heterogeneity and homogeneity of land use between 1989 and 2016, iii) to analyse the current individual ecological footprint of the area and, iv) to analyse the relationship between Land Use Mix (LUM) Index and individual Ecological Footprints. The quantitative data in this research work comprise of Landsat imagery processing and assessment of the LUM index and data on individual ecological footprint of residents was collected with the help of questionnaire schedules. The values which were retrieved from the respondents were ranked so as to understand the per person impact on the study area due to consumption of resources. Results suggest, homogeneity of land-use types is associated with increase in individual ecological footprint and vice versa, with some aberrations.

Keywords: Urbanisation, Land-Use Mix Index, Ecological Footprint, Landsat Imageries, Homogeneity of Land Use, Resource Consumption

E1 **[39]**

THE IMPACT OF CELL-PHONE TOWERS ON THE CLIMATE CHANGE: A LEGAL AND POLICY ANALYSIS OF BANGLADESH, INDIA AND PAKISTAN

A.R. Shah

Department of Law, East West University, Bangladesh

ABSTRACT

Global Warming, the most significant effect of the climate change, has impacted on the South-Asian region more than any other parts of the world. The alarming rise in temperature has already had disastrous effects on this part, like heat-waves and the sea-level rise that triggered the unprecedented floods causing adverse damage to the overall environmental sustainability. One of the crucial factors which need to be addressed to overcome the situation is the effect of electromagnetic radio-frequency in this region. The electromagnetic radio-frequency is scientifically proved to have a strong link with global warming and is emitted particularly from the wireless communication system and most notably from cell phone towers. On this backdrop, it is noteworthy to mention that Bangladesh, India and Pakistan, which share a big coastal area of the South-Asian region, are among the top ten listed countries that have the highest number of cell-phone users. This fact indicates the escalated number of cell phone tower establishment into the environmental infrastructure which is driving the change in temperature and effecting human health, plants and animals as well. This paper aims to analyze the existing legal and policy frameworks of Bangladesh, India and Pakistan regulating the telecommunication network system along with their compatibility with internationally accepted standards and their affectivity to combat this regional crisis. It also endeavors to suggest measures to develop a comprehensive mechanism to deal with the growing threat by the telecommunication infrastructures to the changing climate of South-Asia and to ensure a sustainable environmental development.

Keywords: Cell-Phone, Global Warming, Climate Change, South-Asia, Environmental Sustainability

E2 **[40]**

VEHICLE EMISSION TRACKER: A MOBILE-SOCIAL APPLICATION MODAL TO SPOT VEHICLE EMISSION USING RINGELMANN SMOKE CHART

S.M.D.J.T. Jayatilake [1] and A.G.T. Sugathapala [2]

[1]*Vehicle Emission Test Trust Fund, Department of Motor Traffic, Sri Lanka*

[2]*Department of Mechanical Engineering, Faculty of Engineering, University of Moratuwa, Sri Lanka*

ABSTRACT

Vehicular emission control is the one of main strategy to improve the urban air quality in Sri Lanka. The advancements of the smartphones and the usage of the social media have aided in enhancing the social awareness among the communities on environmental concerns like air pollution. This mobile-social application modal is designed to enable individuals to spot the high smoke emitting vehicles and evaluate using the spotted vehicle based on Ringelmann Smoke Chart and share them on social networks. Collected literature on mobile-social applications with related to emission tracking and user feedback on using such applications were considered to develop this modal. Technologies of current smartphones offer advanced sensing, processing and storage capability with always-on internet connectivity with GPS location tracking and also most smartphone platforms provide an environment for diverse of application development. This concept can be used to monitor in-use vehicles with heavy smoke, evaluate and get user responsiveness on air quality management in Sri Lanka. It can be used as guidelines to evaluate existing designs and platforms, guide the design process and educate application designers to integrate new monitoring systems to measure air quality considering the new technologies which evolved among the social communities. It is intended to not only raise social awareness of vehicular emission, but also serve as a research platform for data collection for research in vehicular traffic and emission management, and user behavior analysis in social network based applications in order to use in policy formulation.

Keywords: Vehicular Emission, Mobile-Social Technology, Air Quality Monitoring

E3 **[41]**

FOOD PRESERVATION VIA IRRADIATION TECHNOLOGY TO COMBAT WITH CLIMATE CHANGE RELATED FOOD SECURITY

I.G.N. Hewajulige[1] , R.C. Pitipanaarachchi [1], D. Priyangani [1], D. Jayawardhana [1], K.V.T. Gunewardena[1], A.A.G. Madurakanthi [2] and P. Rathnayake [2]

[1]Food Technology Section, Industrial Technology Institute, Colombo 07, Sri Lanka

[2]Sri Lanka Gamma Centre, Biyagama Export Processing Zone, Biyagama, Sri Lanka

ABSTRACT

Sri Lanka is vulnerable to all identified impacts of climate change such as rising atmospheric temperature, changing patterns of precipitation, increased incidence and severity of extreme events, sea level rise, increased oceanic temperature and ocean acidification etc. Due to the key projected climate changes, agricultural production is likely to be impacted in several ways, posing serious challenges to food security and safety of the country. Sudden outbreaks, emergence of new strains and epidemics of pest and disease, increase the volume of postharvest losses could be anticipated as an impact of adverse climate change issues. As preparedness for adverse climatic issues such as floods and drought, it is necessary to have a stock of emergency food for calamity victims. Food irradiation is an environmentally safe processing technology where food is exposed to ionizing energy in order to reduce post-harvest losses or to make them safe from foodborne illnesses. Current study attempts to develop ready to eat, shelf stable, high energy food such as cereal bars, rice, flat bread and chicken curry as emergency food rations for calamity victims using irradiation technology. Formulation of high energy food and selection of suitable irradiation dosage to extend the storage life were done following a series of experiments. Irradiation dose up to 10 kGay was identified as the suitable condition to prepare the emergency food with extended shelf life.

Keywords: Irradiation, Sanitary, Phytoanitary, Emergency Food, Calamity Victims

E4 **[42]**

STATISTICAL DOWNSACALING OF GRACE DERIVED TERRESTRIAL WATER STORAGE (TWS) PRODUCT : CASE STUDY FOR SRI LANKA

M.B.M.R.D.H.B. Marapana and R. Bandara

Faculty of Geomatics, Sabaragamuwa University of Sri Lanka, Sri Lanka

ABSTRACT

Water is a vital and finite resource for all living beings on earth, with only 3% of the total water budget coming from fresh water sources. Groundwater accounts for about 98% of the total freshwater budget on Earth. To support all living beings, it is very important to harness, conserve, and manage this resource effectively, especially in arid and semi-arid regions, where water is scarce. For a better adaptation to the climate change, water resources should be monitored and managed with a higher importance. With the arrival of technology, humans have discovered new methods to detect, analyse and harness this vital resource. The conventional way (on-site measurements) which is both expensive, consuming and completely inefficient in larger areas. With the advent of remote sensing technologies, this can be monitored efficiently and inexpensively. Although detection of the underground water storage change is unsuccessful because of the indirect methods and deviation in penetration of microwave pulses. But, gravity variations can answer the question by monitoring the terrestrial water storage change effectively. Gravity Recovery and Climate Experiment (GRACE) provides gravity variation data and products like Terrestrial Water Storage (TWS) change over a period of time which can be used ton detect and analyse the terrestrial water storage change effectively. However, the very coarse spatial resolution (110 km by 110 km) in GRACE is not sensitive enough to cater to the demand of hydrological researches at smaller scales. Hence the objective of this research was to downscale the GRACE derived TWS product. The study area was North Central province of Sri Lanka. Shallow wells data were considered as ground validations. The regression equations were built using the water balance equation with precipitation from TRMM satellite data, evapotranspiration from MODIS satellite data, and the surface runoff from GLDAS model output. A correlation coefficient of 0.5277 was obtained for the fitted second order polynomial through regression analysis. The validation of the downscaled GRACE TWS had a correlation of 0.8877 with the groundwater level from gauged data. As such, it can be concluded that statistical regression can be used effectively to downscale the GRACE TWS product.

Keywords: Grace, Gravity, Groundwater, Downscaling, Sri Lanka, MODIS

E5 **[43]**

IN WHAT WAYS DOES CONTEXTUALISATION MATTER IN CLIMATE CHANGE COMMUNICATION?

C. Tobias

Wee Kim Wee School of Communication and Information, Nanyang Technological University, Singapore

ABSTRACT

Humans are hard-wired for certain kinds of behaviour. This also structures aspects of how they think, perceive, and communicate. These predispositions can make communicating a complex issue like climate change difficult, as many historic efforts have shown. However, contextualisation of climate change communications to resonate with the public's circumstances can prove fruitful and overcome typical barriers. This narrative literature review explores in what ways contextualisation matters when communicating climate change, as well as its limitations in the larger space climate action. Scientific and communications professionals should be cognisant of the 18 approaches that were identified in literature in order to better contextualise their work for various circumstances they might encounter. Broadly speaking, to do so can help overcome some of the typical blocks that arise with the public, help create personal meaning and resonance for the audience members, increase the issue's relevance in a variety of circumstances, and help inform people about the importance of climate change in a number of ways. Beyond the specific approaches identified here, professionals are also challenged to think more deeply about the communication strategies they employ.

Keywords: Climate Change, Communication, Contextualisation

F1 **[44]**

FUTURE WARMING SHIFTS CLIMATIC SUITABILITY OF NATIVE HIMALAYAN TREE SPECIES

P. Lamsal[1], L. Kumar[1], F. Shabani[1] and K. Atreya[2]

[1]University of New England, School of Environmental and Rural Science, Australia

[2]Asia Network for Sustainable Agriculture and Bioresources (ANSAB), Kathmandu, Nepal

ABSTRACT

Climate change (CC) impacts are forecasted to disrupt most of the global ecosystems, with high altitude mountain regions to become a worst sufferer due to having unsuitable climate. As a result, native mountain vegetation will shift into areas having climate they can fully tolerate to maintain their growth and survival. The purpose of this study is to model nine native highland plants viz. *Abies spectabilis*, *Betula utilis*, *Quercus semecarpifolia*, *Juniperus indica*, *Tsuga dumosa*, *Acer campbellii*, *Rohododendron campanulatum*, *Ephedra gerardiana*, *cassiope fastigiata* so as to visualize the likely landscape of the Himalaya under future warming climate. Analysis was done using CLIMEX niche modeling technique. Two global climate models, CSIRO-MK 3.0 (CS) and MIROCH-H (MR) were used under IPCC A1B and A2 emission scenarios for the year 2050 and 2100. Climatic suitability of the nine species contracts in areas that are currently suitable while expands in areas that are currently unsuitable. Currently around 1.09 million sq. km. area is climatically suitable. An addition of 0.68 and 0.35 million sq. km. will become suitable by 2050 and 2100 respectively. Cold stress is the main limiting factor for overall expansion of climatic suitability in the region. Existing climatic suitability of the nine high land native species will substantially shift towards north in the Tibetan Plateau. Such climatic suitability shift could impacts existing nature conservation activities and availability of water and food security in the region. Formulation and implementation of suitable adaptation strategies is necessary to offset such negative implications.

Keywords: Climate Change, CLIMEX, the Himalayas and Tibetan Plateau, Cold Stress

F2 **[45]**

ASSESSMENT OF SOIL CARBON OF THE MANGROVES IN SHWETHAUNGYAN AREA OF THE AYEYARWADY REGION IN MYANMAR

S.A. Vanniarachchy[1], H. Aung [2] and J. Kontny[3]

[1] *Prime Carbon Co Ltd, 20/217 B.Huakhuar, M.Saysettha, Vientiane Capital, Lao PDR*

[2] *Department of Marine Science, Pathein University, Pathein, Myanmar*

[3] *Worldview International Foundation, Dagon Township, Yangon, Myanmar*

ABSTRACT

Climate change has direct and indirect impacts on biodiversity and ecosystems. Mangroves have the potential to store blue carbon and mitigate climate change. They also play a role in climate change adaptation, especially against cyclones and tsunami. Despite their wide range of benefits, mangroves are one of the most threatened ecosystems on earth. Objective of this study was to assess the soil organic carbon (SOC) in mangrove forests in Shwethaungyan area in the Ayeyarwady region in Myanmar where a forest carbon project is being developed. Secondary objective was to develop country specific/ area specific SOC values that can be used for forest carbon projects and national inventories such as National Communications to the UNFCCC. Samples were collected using a soil core sampler along the Magyi and U-To channels where the project is being developed to restore degraded mangroves. A soil depth probe was used to measure the soil depth. In each location, three (3) samples were collected at every 30 centimeter depth giving 9 soil samples from each plot. The organic carbon content of the soil samples were measured using the Loss on Ignition (LOI) method. Laboratory tests were done at the Yangon University. The average soil organic carbon content in the studied soil was 732.26 t/ha. Results indicate that soil in mangrove forests are capable of storing carbon that are higher than IPCC default values and that restoring degraded mangroves and protecting existing mangroves is one of the best mitigation and adaptation measures against climate change.

Keywords: Mangrove, Soil Organic Carbon, Blue Carbon, Myanmar

F3 **[46]**

PHYSIOLOGICAL RESPONSE OF TWO FRESHWATER FISH SPECIES (*Rasbora daniconius* AND *Dawkinsia filementosa*) IN SRI LANKA TO SELECTED FACTORS OF CLIMATE CHANGE

W.A.M.T. Weerathunga[1], A.M.G.K. Athapaththu[1] and W.A.K.S.Shanaka[2]

[1]*Department of Zoology and Environmental Conservation, University of Kelaniya, Sri Lanka*

[2]*Department of Marketing and Management, University of Kelaniya, Sri Lanka*

ABSTRACT

Rising temperature is a major feature of climate change leading to direct impacts on biodiversity, while causing sea level rise and salt water intrusion into inland fresh water bodies, thus elevating their salinity. We investigated the physiological response of two freshwater fish species to elevated temperature and salinity. Fish from each species were sampled from the wild. For the temperature treatment, each fish was individually placed in a tank and the temperature was increased @ 1^{o}C per 5 minutes from 30^{o}C to 34^{o}C. The rates of operculum movement (ROM) and responses to tactile and visual stimuli were measured. The same procedure was repeated for salinity by increasing the salinity from 0.04 ppt to 35 ppt @ 5 ppt per 5 minutes. Loss of balance was taken as the definitive end point for determining thermal tolerance and salinity tolerance. Time taken by each fish for recovering balance after returning to ambient conditions was determined. In both species, ROM decreased with increasing temperature and salinity. In *D.filementosa*, ROM reduction reached a minimum of 169 min^{-1} at 32.7^{o}C and remained approximately constant thereafter. In contrast, in *R.daniconicus*, ROM decreased continuously throughout whole temperature range. ROM of both species were equally sensitive to increasing salinity and decreased linearly (@ -7.2 – -7.5 min^{-1} ppt^{-1}) with increasing salinity. Both species showed loss of balance with increasing salinity but not with increasing temperature. However, the tactile response was affected by both factors. The recovery time was longer for *R.daniconicus*, but the difference was not significant at p=0.05.

Keywords: Elevated Temperature, Increased Salinity, Freshwater Fish, Sri Lanka, Climate Change

F4 **[47]**

FOREST CONSERVATION AS A STRATEGY TO REDUCE CLIMATE VULNERABILITY IN SRI LANKA: WHAT TO PROTECT WHERE?

E.D. Wikramanayake

Environmental Foundation, Ltd., Colombo, Sri Lanka

ABSTRACT

Global climate change has now emerged as a significant driver of ecological and social change. The interactive impacts of climate change on ecological and social systems can have cascading effects on biodiversity, livelihoods, lives, human wellbeing, and economic development targets. Forest conservation is widely recognized and accepted as a strategy to build resilience against climate change. Forests remove and sequester atmospheric carbon, stabilizes slopes, regulates water supplies, and ameliorates local temperatures. Intact forests with their full complement of biodiversity are also more resilient to climate change. Thus, when Sri Lanka became a signatory to the Paris Agreement at the 21st Conference of Parties in December 2015 and pledged to increase forest cover to 32% by 2030, conservation of the existing forests should have become the first priority. Sustainability of Sri Lanka's ecosystems, community livelihoods, and the economy is largely dependent on two relatively predictable monsoons and the dynamics of consequent rainfall capture and release of environmental flows. The rivers that originate from the central mountains and radiate out are important conduits of these environmental flows. Forested watersheds are crucial for regulated release of water for use throughout the island. Thus, maintaining—and even increasing—forest cover as pledged should not be a mere promise, but an essential strategy for survival, economic growth, and good governance. Here, we present the results of a spatial analysis to identify forest conservation priorities as a guiding framework to reduce vulnerabilities from climate change, and keeping the promises of the Paris Agreement.

Keywords: Sri Lanka, Forests, Climate Change, Biodiversity, Conservation

F5 [48]

LAND USE LAND COVER CHANGE MAPPING AND ANALYSIS USING REMOTE SENSING AND GIS: A CASE STUDY OF CHILIKA-PURI COAST, INDIA

P.M. Khristodas, K. Palanivelu and A. Ramachandran

Center for Climate Change and Adaptation Research, Anna University, Chennai, India

ABSTRACT

Natural coastal vulnerabilities and foremost land-use/land-cover (LULC) change can have significant impacts on human life and their livelihood around the world. Remote sensing and GIS have become important tools to study, understand and develop the land use land cover changes, patterns and interactions between human activities and natural phenomenon. LULC change study is very important to have proper planning and utilizing of natural resources, their management and decision improvement. The Chilka-Puri Coastal area Odisha attracts the Global attention and matter of concern because Chilika is full of ecological importance as it is the largest brackish water wetland complex in Asia and declared as a Ramsar site under the ‘‘Convention on Wetlands of International Importance’’. The satellite images for the year 1997 and 2007 were downloaded from USGS Earth Explorer and for 2016 the Resourcesat1-LISS-III images were downloaded from NRSC Bhuvan website (bhuvannuis.nrsc.gov.in). The downloaded tiff files were imported and the referenced image used for the supervised classification and accuracy assessment using the ArcGIS 10.3 Erdas Imagine 2014. The result of the research illustrate that the built up areas have been constant positive from 1997 to 2016. On the other hand vegetation including cultivated and uncultivated agricultural lands has been steady decline from 1997 to 2016. The study recommended that appropriate management, secure land possession and integrated environmental rehabilitation program is the need of the hour or else these resources will momentarily be lost and no longer be able to play their role in socio-economic improvement of the region.

Keywords: Land Use Land Cover Change, Coastal Vulnerability, Livelihoods, GIS, Socio-economy

F6 **[49]**

SAN DIEGO COUNTY: THE ECOLOGICAL IMPACTS OF CLIMATE CHANGE ON A BIODIVERSITY HOTSPOT

D. Cayan[1], M. Jennings[2], J. Kalansky[1], A. Pairis[3], U. Abeysekera[3], S. Gershenov[1], K. Guirguis[1], S. Vanderplank[2], A. Syphard[4], E. Stein[5], D. Lawson[6], R. Clemesha[1], J. Randal[7], S. Gaughen[8] and R. Roy[9]

[1]*Scripps Institution of Oceanography, USA*

[2]*San Diego State University, USA*

[3]*Climate Science Alliance South Coast, USA*

[4]*Conservation Biology Institute, USA*

[5]*Southern California Coastal Water Research Project, USA*

[6]*Space and Naval Warfare Systems Command, USA*

[7]*The Nature Conservancy, USA*

[8]*Pala Band of Mission Indians, USA*

[9]*La Jolla Band of Luiseño Indians, USA*

ABSTRACT

The Mediterranean ecosystems of southern California, characterized by warm, dry summers and cool wet winters, are some of the most ecologically diverse systems outside of the tropics. The richness and diversity of plants and animals, as well as high rates of endemism make this area a biodiversity hotspot. While home to a major metropolitan area, San Diego County and areas north continue to host expanses of native and conserved habitats. While the region's species and ecosystems have adapted to a precipitation regime whose variability from year to year is greater than nearly anywhere else in the United States, they will be challenged as this variability is propelled into an increasingly warmer climate. In the near term, ecosystems in the region are most threatened by landscape changes due development and fire. In the long term, climate variability will add additional stressors including significantly warmer temperature, more variable precipitation regimes resulting in high intensity flooding, more destructive fires due to prolonged droughts and increased fuel availability; all of which highlight the importance of fog and low clouds as a buffer against the warmer and drier conditions. In this assessment, researchers have not limited themselves to the role of producing knowledge but instead are intent on working hand-in-hand with other disciplines and professions, and within communities. These efforts will result in a regional conference that brings together environmental leaders and community members to get an in-depth look at the assessment's findings and explore ways to integrate findings into conservation planning and community outreach.

Keywords: San Diego, Biodiversity, Conservation, Climate, Communication

F7 **[50]**

SOIL ORGANIC CARBON CONTENT AND ITS' EFFECT ON AVAILABLE SOIL NUTRIENTS IN KNUCKLES CONSERVATION FOREST OF SRI LANKA

R.P.S.K. Rajapaksha[1], H.M.S.P. Madawala[2], S.K. Gunathilake[3] and R.R. Ratnayake[1]

[1]National Institute of Fundamental Studies, Hantana Road, Kandy, Sri Lanka

[2]Department of Botany, Faculty of Science, University of Peradeniya, Peradeniya, Sri Lanka

[3]Department of Natural Resources, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka, Belihuloya, Sri Lanka

ABSTRACT

Estimation of soil organic carbon (SOC) contents and soil available nutrients in tropical forest ecosystems is important to understand the function of soil in the conservation of ecosystems. This study aimed at estimating the soil organic carbon (SOC) contents among major vegetation types in the Knuckles Conservation Forest (KCF) and correlating SOC contents with soil available nutrients. KCF is located in the north-west to south-east alignment in the central massif of Sri Lanka. Sampling was carried out (0-15 and 15-30 cm) in each vegetation type; montane forest (MF), sub-montane forest (SMF), moist monsoon forest (MMF), open and sparse forest (OSF), grassland (GL) and forest plantation (FP). The estimated total organic C (TOC), microbial biomass C (MBC), $KMnO_4$ oxidizable C (POC) and water soluble C (WSC), soil available macro (N, P, K, Ca, Mg) and micro (Fe, Mn, Cu, Zn) nutrients were analyzed using ANOVA-GLM in Minitab 16. Correlation between carbon fractions and soil available macro nutrients were also done using Minitab 16. MF recorded the highest TOC content of 4.52% with the lowest MBC of 0.035%. The highest POC and WSC were also estimated in MF soils (0.071%, 0.047%, respectively), while the lowest were recorded in FP (0.062%, 0.014% respectively) within the 0-15 cm layer. FP contained the lowest TOC content of 2.70% and relatively higher MBC content of 0.049%. Available N showed a significant and positively correlated relationship with TOC content and similarly available Mg was also positively correlated with WSC content. Results concluded that MF contained higher carbon fractions compared to other vegetation types in KFR, indicating its importance to a better function of the forest ecosystem. Available nutrients of N and Ca showed positive correlations with organic compounds due to the consumption of organic C as energy source. This information will address the dearth of data on soil carbon sequestration potentials and its' contribution to the available nutrients in forest ecosystems of the tropics, hence useful in tropical forest ecosystem conservation programs.

Keywords: Soil Organic Carbon, Soil Available Nutrients, Tropical Forest Ecosystems

F8 **[51]**

MEIOFAUNAL RESPONSE TO CLIMATE CHANGE AND OTHER ENVIRONMENTAL PERTURBATIONS IN THE ARCTIC FJORD

S.B. Nandan[1], M. Jima [1], P.R. Jayachandran [1], P.P. Krishnapriya [1], N.K. Aswathy [1], A.T. Athira [1], A. Vijay[1] and K.P. Krishnan[2]

[1] *Dept. of Marine Biology, Microbiology & Biochemistry, School of Marine Sciences, Cochin University of Science &Technology, India*

[2] *National Centre for Antarctic and Ocean Research, Ministry of Earth Sciences, Government of India, India*

ABSTRACT

One of the most constraining challenges faced by the scientific communities is about understanding how ecological communities react to these global changes. Benthic meiofaunal communities in the Arctic fjords in response to climate change and anthropogenic impacts offer several advantages in studying marine benthic ecosystems. The Kongsfjord is an open glacial fjord located on the west coast of Svalbard archipelago, which is influenced by the West Spitzbergen currents meliorating the effects of high latitude (79°N). This study is part of the Indian Arctic Expedition (Summer Phase group 1, 27June-28 July 2015). Eight study stations representing four inner and outer fjord stations were compared and contrasted. The meiofaunal communities in the fjord depicted relatively higher density of nematodes, followed by foraminiferans, copepods and ostracods, which are more sensitive and are valuable for understanding and predicting the climate change and related ecosystem perturbations. This was reflected in the benthic biomass /standing crop on an average that decreased during in 2015 (3865Â±1662 ind.10cm^2) as compared to 2011 (5925Â±2303 ind.10 cm^2), arctic field stations. The dominant nematode species, like, *Rhabdodemania* sp.were able to survivein the inner fjord where glacial inputs prevailed to support their distribution.The dominance of the agglutinated species of foraminiferans, *Adercotrym aglomerata* and *Spiroplectammina biformis* were prevalent in the inner fjord regions, in spite of the dynamic nature of the fjord influenced by the Atlantic water mass and glacial inputs. The fjord is being affected by meltwater from glacial discharges and other varying environmental gradients in the fjord sediments; from the glaciers to the mouth of fjord which includes deposition of sediment and organic matter. Thus, our understanding on the keystone species of meiofauna, the crucial drivers of the carbon chain in the ecosystem, is relevant in the context of various anthropogenic and climate related issues in the dynamic fjord systems.

Keywords: Climate Change, Meiofauna, Arctic, Kongsfjord, Nematode

F9 **[52]**

SHORELINE CHANGE A THREAT TO COASTAL ZONE: A CASE STUDY OF KARWAR, WEST COST OF INDIA

A. Yadav, B.M. Dodamani and G.S. Dwarakish

Dept of Applied Mechanics and Hydraulics National Institute of Technology Karnataka, Surathkal, Karnataka, India

ABSTRACT

Shoreline is a wet and dry boundary between land and sea. It is key geo-indicator of coastal environmental resource threats within the coastal zone. Shoreline change leads to causes for change in natural habitats, infrastructure change in coastal zone and so on. These changes which raise to serious issues those are related to coastal zone. The present study is carried out for the Karwar Coast, West Coast of India, using remote sensing and GIS Techniques. LANDSAT -8 remote sensing data which is available from 2013, coupled with GIS techniques were used for the shoreline analysis. The acquired image were undergone for layer stacking to remove errors from raw image data using, ERDAS IMAGINE 2014 tool and analyzed by ArcGIS 10.3 tool. For extraction of shoreline the High Water Line (HWL) is considered and visual interpretation of satellite imageries has been carried out to segregate the HWL. Digital Shoreline Analysis System (DSAS) an extension for Arc GIS were used to find rates of change of shoreline such as End Point Rate (EPR), Net Shoreline Movement (NSM). Results were concentrated on EPR as analyses were carried for each every two years from 2013 to 2017 of post monsoon period to find out erosion and accretion. Obtained results were compared with rainfall of the particular year to link between shoreline change and rainfall. It was found that rainfall pattern also contribute for shoreline change.

Keywords: Shoreline, HWL, EPR, NSM

G1 **[53]**

A STUDY OF EFFECT OF CLIMATE CHANGE ON RESILIENCE AND HUMAN HEALTH USING BIO-CLIMATOLOGICAL INDICATORS

H.P. Mohsen and G. Siroos

University of Sistan and Baluchestan, Iran

ABSTRACT

Nowadays, climate change has been accepted as a rapidly changing phenomenon. With the help of documents, these changes would implicitly or explicitly influence human health. The purpose of this study is to examine the effect of important climatic factors on bioclimatic indicators for the human livability in Chabahar, Iran. In this regard, four climatic models and three scenarios are taken into account. In addition, the average uncertainty of minimum and maximum temperature and precipitation variations is calculated based on the weighted method. According to the hybrid model, taken from the model and scenario, Chabahar temperature is on the rise between 0.52 and 2.38. Accordingly, bioclimatic factors would experience alteration. Eventually, it would lead to reduced resilience. The results of comfort-thermal indicators (bioclimatic) showed that the conditions are optimal and natural from October to March for individuals residing in Chabahar, Iran. However, the conditions are changing due to the future temperature increase. Such changes would significantly reduce the number of inhabitants in Chabahar and villages nearby.

Keywords: Climate Change, Resilience, Comfortable, Emission Scenarios, Chabahar

G2 **[54]**

THE ACCESS TO AND USE OF HEALTHCARE SERVICES AND VULNERABILITIES OF CLIMATE-DISPLACED PEOPLE IN MAINLAND BANGLADESH

M.R. Haque [1,2], N. Parr [2] and S. Muhidin [2]

[1]*Department of Population Sciences, University of Dhaka, Bangladesh*

[2]*Macquarie University, NSW, Australia*

ABSTRACT

This paper identifies and analyzes the experiences, vulnerabilities, access to and use of healthcare and coping strategies of climate-induced internally displaced people in mainland Bangladesh, one of the World's most climate-vulnerable countries. The research uses data from a representative survey of 1,200 households drawn equally from displacement-susceptible areas and areas without substantial climate-induced displacement. Changes over time are considered, and comparisons drawn between those displaced suddenly and those displaced gradually, by the frequency of past displacement, and between the displaced and the non-displaced. The findings reveal that displaced people experience considerable socio-economic disadvantage. The impoverishment and vulnerability of the displaced are intensified by the experience of sudden and multiple displacement. The results also show the increased time and cost of accessing healthcare and the greater disadvantage of the displaced following displacement, including lack of land ownership, access to electricity, sanitary toilets and healthcare service utilization. Relatives and neighbors are the predominant sources of support for coping with the displacement vulnerability processes. The vulnerability of the climate-displaced, thus, is a function of interactions between natural disasters, socioeconomic attributes and the geographic location of support services. Policy aimed at reducing displacement vulnerability should therefore address the socioeconomic disadvantage and inadequate access to health services of the displaced.

Keywords: Climate Change, Access to Healthcare, Use of Healthcare, Vulnerabilities, Displaced People, Bangladesh

G3 **[55]**

MODELLING WATER QUALITY FOR INFORMED POLICY MAKING IN LONG-TERM SCENARIOS UNDER CLIMATE CHANGE – PROSPECTS FOR SRI LANKA

C. Wickramaratne [1,2], A. Rigosi [2], L. van der Linden [3] and J. Brookes [2]

[1]*Environmental Foundation (Guarantee) Limited, Colombo, Sri Lanka*

[2]*Water Research Centre, University of Adelaide, Australia*

[3]*South Australian Water Corporation, Adelaide, Australia*

ABSTRACT

Eutrophication affects many water bodies globally and lead to excessive growth of phytoplankton, especially toxic cyanobacteria. Climate change has the potential to intensify the effects of increasing nutrients and degrade water quality further. Scenario analysis with water quality assessment models can support land use planning and policy. This study will introduce one such model, an open-source, 1-dimensional hydrodynamic model coupled with a biogeochemical model (GLM-FABM) that can be used to study impacts of increasing temperatures and nutrient loads on freshwater bodies. Purpose of the model, data requirements, and performance criteria are assessed and scenario analysis is carried out for two different lakes as case studies. A combination of 25 scenarios, with varying nutrient loads, and temperatures increases were used to evaluate and compare the responses of the water quality between the two lakes. Nutrients were decreased and increased by 10-20 folds to cause a shift in the nutrient status and temperatures were increased by 1-4 °C based on the future climate projections in the IPCC 5th Assessment report. Applicability of the model to evaluate impacts of high temperatures and likely land use modifications on rapidly-degrading urban lakes in Colombo, Sri Lanka is discussed. Modelled output can be used to inform effective land use policy changes and lake restoration measures that will ensure urban resilience under climate change. Additionally, effects of paucity of data and the subsequent uncertainties in model predictions are also emphasized in the study.

Keywords: Climate Change, Water Quality, Cyanobacteria, Policy, Urban Resilience

G4 **[56]**

DOES SEA LEVEL RISING DUE TO CLIMATE CHANGE HAVE ANY IMPACT ON THE CENTRAL COASTAL ZONE OF BANGLADESH?

A. Ahmed[1], P. Rashid[2] and S. Hoque[3]

[1]*Ecology and Environment Laboratory, Department of Botany, University of Dhaka, Bangladesh*

[2]*Physiology and Anatomy Laboratory, Department of Botany, University of Dhaka, Bangladesh*

[3]*Department of Soil, Water and Environment, University of Dhaka, Bangladesh*

ABSTRACT

A segment of the central coastal zone of Bangladesh at Rangabali, Patuakhali district (21°53'10" - 22°00' N and 90°27' - 90°30'30"E) was studied since 2003 in relation to water quality to assess the effect of the sea level rising. Water sample were collected from three locations since December 2003 to May 2017 (in eight sampling occasions). The result showed that waters of the Buragauranga estuary were slightly alkaline and pH decrease from February 2005 till December 2016. Conductivity showed a gradual decrease in Location 1 but in the other two locations, bell shaped patterns were observed where Location 2 showed extremely low values in May 2015. Salinity showed spatio-temporal variations among the locations. The salinity of Location 1 was zero since May 2005 whereas Location 2 showed temporal variation and was found to be zero in May 2017. Temporal variations were also observed in Location 3 (very close to sea) with lowest value (0.62‰) in May 2017. Dissolved oxygen also showed similar patterns of spatio-temporal variations where the values were below pollution level (5.0 mg/l) from 2005 to 2016 except in Location 1 in 2016. BOD_5 showed a gradual decrease till 2005. The Pb, Mn and Fe contents of the study areas were below detection level indicating that the areas are free from these metals pollution. Slight acidifications of the estuarine waters till 2016 might be attributed to the rise in atmospheric CO_2 content due to climate changes. The results (level of salinity and very low amount of Na) also indicated that till now the sea level rise does not have any impact in this area.

Keywords: Central Coastal Zone, Acidification, Salinity, Metals Pollution

G5 [57]

LOCAL PEOPLE'S PERCEPTION OF CLIMATE CHANGE AND RELATED HAZARDS IN DRY AND WET ZONES OF SRI LANKA

C.S. Patabendige [1] and S. Kazama [2]

[1]*University of Moratuwa, Sri Lanka*

[2]*Tohoku Universities, Japan*

ABSTRACT

Most studies address the potential climate change and its impact based on the modelling technologies integrating available observed climatic data. This study provides insights into local people's perception of climate change and its impacts in two river basins, "Kalu" and "Walawe" representing wet and dry climatic zones of the Sri Lanka. A simple random-sampling technique was used while choosing the households. The questionnaire was designed with three sections, and 58 open- and close-ended questions based on earlier studies. Surveyed data were analyzed using IBM SPSS Statistics software and compared with the analyzed observed and simulated meteorological and hydrological data. Local people have perceived remarkable changes in rainfall, mainly decreasing amount of rainfall and number of rainy days in Walawe river basin and short term heavy rainfall increase in Kalu river basin during last two decades. Most disastrous impacts experienced and remembered by locals were from the past fifteen years. Extremely less rainfall and severe dryness in 2004 and 2013 shaped the perception of drought among the respondents in the Walawe river basin. 90% of household's perceived heavy rainfall in the upstream of the river raise water level in the downstream and its backflow causes the flood to the lower plain along the Kalu river. Their perception and climate and hydrological data analyses are very similar and complementary, that demonstrates a good level of knowledge and understanding of climate change. The people's perception on local climate change unaddressed by global climate change models is an important basis for implementing adaptation measures.

Keywords: Climatic Zones, Hydrological, Adaptation, Flood, Drought, Rainfall

G6 **[58]**

LONG-TERM MONITORING OF WETLANDS VIA REMOTE SENSING AND GIS: A CASE STUDY FROM TURKEY

N. Musaoglu [1], A. Tanik[1] , M.U. Gumusay [2], A. Dervisoglu [1], B. Bilgilioglu [1] , T. Bakirman [2], N. Yagmur [1], D. Baran [1] and M.F. Gokdag [2]

[1]*Istanbul Technical University, Turkey*

[2]*Yildiz Technical University, Turkey*

ABSTRACT

Ecological functions of wetlands are numerous and valuable; however, natural and anthropogenic activities in the long-term usually spoil the well-being of such vulnerable and sensitive areas making their management a crucial business. Spatial-temporal change detection by utilizing remotely sensed imagery has therefore become a useful tool in gathering information on the status of the wetlands for the decision makers and local authorities. By utilizing the remotely sensed data, one can generate wetland maps which may give rise to the estimation of its functions and services as well to further assessment of the gains and losses within years. Turkey houses almost 303 natural lakes among which Akgol, internationally recognized wetland located in the Central Anatolia, has significantly lost its water covered surface within years due to climatic conditions, to construction of dams and to withdrawal of high amounts of water for agricultural irrigation. In this study, temporal land use/cover and land surface temperature change of Akgol was examined via Landsat satellite images obtained from 1984 to 2017. According to the results gained from the satellite images, the total water surface area of the wetland is found to be reduced by 93.4% in approximately 30 years. Long-term meteorological data including precipitation, temperature and evaporation values were considered in the evaluation of the results obtained from the satellite images. Relationship between climate data and wetland change is evaluated chronologically based on the images belonging to different years. All the conducted studies were compiled and integrated in a GIS environment; a convenient system that will be able to make further queries.

Keywords: Wetland, Akgol, Turkey, Remote Sensing, Geographic Information System, Landsat Satellite

G7 **[59]**

PROCESS OF RIVER BED CONFIGURATION AND ITS IMPACT ON RIVERINE HAZARD- A CONTEMPORARY STUDY OF RIVER JAYANTI, WEST BENGAL, INDIA

M. Biswas and A. Paul

Department of Geography, Presidency University, India

ABSTRACT

The study of River bed configuration is a major fundamental part of fluvial morphology as it explains the process of water-sediment interaction in terms of river bed terrain evolution. In fact, the terrain of the river bed is highly depended on the nature of river transported sediments, its distribution and physio-chemical nature of deposited particles. It has been observed that discharged water volume gives rise to numerable complex relationships between the river bed and flowing channel. The area chosen for our study purpose has experienced a unique change in its riverbed morphology in recent past.The graph of the river bed and various bed features also depend on systematic sequence of the river aggradation and transportation of sediments. The paper deals with the process of Jayanti River bed elevation which is accompanied by the nature of deposited sediment particles of the bed and it has an impact on riverine hazards such as flood. It also has a characteristic of channel shifting between both bank side and in bed resulting the dynamic nature of channel planform surface which is also accompanied by huge sediment aggradation over time thus increasing the river bed elevation and flood probability. Scanning Electron Microscope (SEM) and X-ray Diffraction (XRD) of the sediment samples has been done to identify its chemical composition initiating cementation. It is observed that in the year of 1916, the elevation of the bed was nearly 18.28m lower than now and the continuous rise in its elevation has a drastic impact on riverine hazards.

Keywords: Bed Elevation, Processes, Flood, Environment

G8 **[60]**

FARMERS' PERCEPTIONS OF CLIMATIC IMPACTS AND ADAPTATION RESPONSES: AN EVIDENCE FROM COASTAL ODISHA, INDIA

D. Sahoo [1] and G. Sridevi [1]

[1]*School of Economics, University of Hyderabad, Hyderabad, India*

ABSTRACT

The study attempted to understand farmers' perception of environmental and socio-economic impacts of climate change and variability, and adaptation strategies in the coastal district of Ganjam, Odisha. Primary data were collected using structured household interview schedule from a random sample of 310 male headed farm households across four categories of farmers- such as marginal (**Error! Reference source not found.**2.50 acres of land), small (2.51-5.00 acres), medium (5.01-10.00 acres) and large (>10.00 acres) farmers. The study used five-point Likert scaling technique, ANOVA, and post-hoc analysis to analyze the survey data. A majority of farmers noticed the rising temperature during summer, rainy, autumn and winter seasons, changing rainfall pattern (timing and distribution), reduction in crop productivity and farm income, and loss of employment among others. The perception of climatic variables (rainfall and temperature) are quite consistent with the observed scientific data collected from Indian Meteorological Department. Analysis of Variance (ANOVA) and Post-hoc results reveal that medium and large farmers are mainly dependent on agricultural adaptation strategies - such as using HYV seeds of different crops or early maturing varieties of crops, changing crop planting dates, planting vegetables, livestock rearing, and homestead gardening among the others. Whereas the marginal and small farmers worked out non-agricultural adaptation strategies like migration, petty business, non-farm work (for example, auto or van driving). This study provides the micro-level evidence of how impact perception is the most decisive factor in devising the adaptation strategies to mitigate the severity of the climatic risk.

Keywords: Climate Change, Perception, Adaptation, Primary Data

POSTER PRESENTATIONS

P1 **[61]**

TEMPERATURE TREND ANALYSIS OF BHUBANESWAR CITY, INDIA

P.M. Khristodas, K. Palanivelu and A. Ramachandran

Center for Climate Change and Adaptation Research, Anna University, Chennai, India

ABSTRACT

Climate change poses the major environmental threat ever known by humankind. India has observed significant irregularity in natural inconsistency of temperature and rainfall patterns and has experienced more frequent and lethal catastrophes in recent decades. As the majority of the world's population is living in urban environments, there is rising interest in studying local urban climates. This paper effort to study temporal variation in temperature over Bhubaneswar city, India during the period of 1953 to 2015. The long-term change in temperature has been estimated by Mann-Kendall rank statistics and linear regression trend. From the population trends Less Urbanized Period (LUP) and More Urbanized Period (MUP) were identified. The analysis reveals significant increase in mean maximum temperature (MMaxT), mean minimum temperature (MMinT) and mean annual temperature (MAT). This increase in temperature is more noticeable during the summer season which can be ascribed to a significant decrease in the amount of suspended particulate matter (SPM) in the ambient air during the last decade.

Keywords: Climate Change, Catastrophes, Urban Climate, Mann-Kendal, SPM

P2 **[62]**

IMPORTANCE OF BIODIVERSITY AND ECOSYSTEMS IN CURRENT AND FUTURE ADAPTATION PLANS AND STRATEGIES OF SRI LANKA

S.A. Vanniarachchy

Prime Carbon Co Ltd, 20/217 B.Huakhuar, M.Saysettha, Vientiane Capital, Lao PDR, Sri Lanka

ABSTRACT

As a developing county, Sri Lanka is vulnerable to climate change. Despite being a relatively small island the country is rich in biodiversity. Sri Lanka's biodiversity gives multiple ecosystems services including nutrient recycling, clean air, fresh water, food, carbon sequestration, climate regulation, reducing soil erosion, regulating surface runoff and provides resources for domestic and international markets. Maintaining a healthy ecosystem is vital to meet the consumptive and economic needs. Since climate change is in inevitable, it is important to incorporate adaptation strategies in current and future actions. This paper is a review of past vulnerability assessments and adaptation strategies with special focus on biodiversity and ecosystems. The Ministry of Mahaweli Development and Environment together with the National Experts Committee on Climate Change Adaptation (NECCCA) has taken initiatives in preparing National Adaptation Plans (NAPs) and the Third National Communication to be submitted to UNFCCC. National Climate Change Policy provides guidance against adverse effects of climate change and highlights the need to enhance climate change resilience of natural ecosystems and its diversity. Diverse ecosystems are more resilient to climate change and have stronger survival capacities. Species with high genetic diversity may be resistant to climate change. Hence proper actions should be considered to maintain healthy ecosystems in current and future decision making processes. Strategies such as maintaining biodiversity corridors, control of invasive species is important. The country should explore multilateral and bilateral climate funds available for financing adaptation activities such as the Adaptation Fund, Green Climate Fund and International Climate Initiative.

Keywords: Biodiversity, Adaptation, Climate Change, Ecosystem, Funding

P3 **[63]**

GREENHOUSE GAS EXCHANGE IN RELATION TO SOIL C AND N INTENSITY FROM A TROPICAL RICE PADDY DIFFERING SOIL AMENDMENTS

A. Vijay and S.B. Nandan

Department of Marine Biology, Microbiology & Biochemistry, School of Marine Sciences

Cochin University of Science and Technology, India

ABSTRACT

Tropical paddy fields represent a significant source of GHG (greenhouse gas) to the atmosphere. The emerging shift in agricultural management practices to organic farming owing to its environmental benefits have made it increasingly important to understand how organic (ORG) and conventional mineral fertilizers (CMF) substantially modify in regulating the retention of SOC (soil organic carbon), dynamics of soil carbon (C) to nitrogen (N) ratios, and GHG emissions. Static chamber based investigation was carried out on GHG emissions and soil C and N fractions from paddy fields following ORG manures and CMF treatments. Soil treatments with ORG and CMF had enhanced the CO_2-C (-0.84 to 28.9 g $m^{-2}d^{-1}$), CH_4-C (-19.35 to 14.97 mg m^{-2} d^{-1}) and N_2O-N (-0.61 to 17.4 N_2O-N g m^{-2} d^{-1}) emission compared to the untreated control attributed to greater C inputs, directly *via* organic and indirectly *via* mineral fertilizers. Among treatments cumulative emissions, global warming potential (GWP) (87.13 to 94.07 Kg h^{-1}) and carbon equivalent emission (CEE) (25655.3 to 23762.4 Kg h^{-1}) lack significant variation. The relatively low and insignificant difference in the C:N ratio between treatments (6.4 to 3.4 and 6.1 to 2.9) interfering with the retention of soil C and N could be the reason for similar GHG emission pattern. Thus, ORG manures and CMF with adequate nitrogen input will limit the mineralization of native soil SOC favoring the increase of soil carbon reserve pool and reducing GHG, could be a viable option to mitigate global warming and to sustaining soil health.

Keywords: Carbon Dioxide, Methane, Nitrous Oxide, C/N Ratio, Global Warming Potential (GWP), Organic And Non-Organic Amendments

P4 **[64]**

INFLUENCE OF SEASONS ON EXTREME TEMPERATURE AND RAINFALL IN THE WET ZONE OF SRI LANKA

G. Naveendrakumar[1,2], M. Vithanage[3], S. Meneripitiya[4], J. Obeysekera[5], M.C.M. Iqbal[6] and S. Pathmarajah[7]

[1]*Faculty of Applied Science, Vavuniya Campus of The University of Jaffna, Sri Lanka*

[2]*Postgraduate Institute of Science (PGIS), University of Peradeniya, Sri Lanka*

[3]*Faculty of Applied Science, University of Sri Jayewardenepura, Sri Lanka*

[4]*National Science Foundation (NSF), Maitland Place, Colombo 7, Sri Lanka*

[5]*South Florida Water Management District (SFWMD), West Palm Beach, Florida, USA*

[6]*National Institute of Fundamental Studies (NIFS), Kandy, Sri Lanka*

[7]*Department of Agricultural Engineering, Faculty of Agriculture, University of Peradeniya, Sri Lanka*

ABSTRACT

Because of the departures from the normal rainfall and extreme ambient temperatures, Sri Lanka is vulnerable to the extreme climate. This paper analyzes the consistency in trends of extreme rainfall and temperature events in wet zone of Sri Lanka with special emphasis on the influence of four monsoonal seasons. The data analyzed consists of the daily temperature and rainfall records (1961-2015) at 7 stations distributed throughout the wet zone of Sri Lanka. The non-parametric Mann-Kendall and Sen-Theil statistical methods were used for the investigation which is appropriate for the non-normal data with missing or censored records. To test the data with seasons, modified seasonal Mann-Kendall trend test was used. The pre-whitening method was applied to remove autocorrelation from the time series. Though, the results show a decreasing rainfall in general, the number of wet days during the Second Inter-Monsoon has increased. It is noteworthy that during the month of May, the rainfall reduced drastically with time in which South West Monsoon is in control. In contrast, an overall increasing trend in temperature of wet zone in Sri Lanka was detected. In terms of maximum temperature (T_{max}), at least five stations with significantly increasing statistical trend was observed during the consecutive months of MJJA (May-Aug) in which South West Monsoon is at its most influence in the wet zone of Sri Lanka. At least two stations were detected with significantly increasing extreme T_{max} during South West Monsoon, First Inter-Monsoon and Second Inter-Monsoon. The findings of extremes in temperature and rainfall of wet zone are helpful in speculating the big picture of weather departures during monsoonal seasons in Sri Lanka.

Keywords: Extreme Analysis, Mann-Kendall, Monsoon Rainfall, Non-Normal, Trend Analysis

P5 **[65]**

SIGNATURES OF ENVIRONMENTAL FACTORS IN RELATION TO CLIMATE CHANGE IN A MODEL TROPICAL ESTUARINE SYSTEM ON THE SOUTH WEST COAST OF INDIA

S.B. Nandan, N.R. Hershey [1] and K.N. Vasu

Dept. of Marine Biology, Microbiology and Biochemistry, School of Marine Sciences, Cochin University of Science and Technology, India

[1]PG and Research Dept. of Zoology, N.S.S Hindu College, India

ABSTRACT

Cochin estuarine system on the South West coast of Indiarepresents an interface between marine, freshwater and terrestrial environment is experiencing intense pollution and anthropogenic interactions since few decades leading to environmental modifications. The estuary marks the northern extension of Vemband backwater, a notedRamsar site of India. Continuous monitoring has been carried outin the estuarine complex to collect monthly deviations in various physico-chemical constraints and productivity patterns with thrust on carbon measurements (June 2013 to May 2015) to understand the effect of increasing pollution with changing climatic conditions. The estuarine depth has abridged (1.89±0.99m), water appeared turbid and pH was 7.14±0.24in several study locations with acidic conditions. Salinity was mixo-mesohaline, exhibiting an inverse relationship to dissolved oxygen,however very low saline zones were also observed with low dissolved oxygen concentrations. Trophic index (TRIX),confirms the estuary is highly productive indicating the availability of nutrients and solar radiation promoting organic load. Carbon concentrations in bottom waters were higherin surface waters and highest in monsoon season (30±2.68mgL^{-1}) and declined towards post monsoon(25.14±7.25mgL^{-1}) followed by pre-monsoon (22.92±5.54mgL^{-1}), while a reverse condition was observed in sediment (highest in premonsoon). High inorganic carbon content along with other nutrients in water layers especially during monsoon promoted higher productivity therebyhigh chlorophyll ‘a’ content (9.90±9.19mgm^{-3})and phytoplankton carbon (495.17±459.50mgCm^{-3}).The study revealed that high carbon content, organic matter and organic carbon storage of estuarine sediment indicates that the estuary can trap or holds significant amount of carbon favouring sequestration.But the entire study concludes that the physicochemical constraints, productivity patterns and carbon load has been disturbed greatly due to anthropogenic disturbances,variability in monsoon pattern and changing climate which could soon upset the sequestration capacity of the estuary and transform it to a significant source of carbon.

Keywords: Nutrient, Productivity, Carbon, Climate

P6 **[66]**

OPTIMIZING THE EFFECTIVE USE OF TRADITIONAL METHODS OVER THE CURRENT PRACTICE OF WASTE MANAGEMENT AND ITS IMPACT ON CLIMATE CHANGE

A. Jayanthan

Resilient Environment Youth Network, Sri Lanka

ABSTRACT

Climate change is one of the major problem that the world is facing now. The main Greenhouse gasses that is responsible for Climate Change are CO_2, $CH_4$and NO_2. Apart from the Developed countries most of the Developing country use the Land filling and dumping yard for the Waste Disposal and from them CH_4 and CO_2 released to the atmosphere. My case study is about the waste disposal units in Sri Lanka. It covers about 10000 acres of filling and Dumping yards. About 3750 tons of Degradable waste was collected each day. Per each ton about $40m^3$ of CH_4 and $20m^3CO_2$ release in each day. The effect of $CH_4$is much greater than CO_2.There are some traditional practices to overcome waste disposal. In past days they have their own waste management unit in their own house. The best and quick compost producer that was used in their home is the cow. It will take about 45 days to turn the organic waste into Fertilizer by the Bactria but Cows will take about 8 hours for this process. The degradable animal waste can be recycled through the Pigs and Ducks. The very next method that was used to turn other degradable waste such as tree barks, coconut husks etc. is to turn them into Activated Carbon So that they can be used as purifiers. In addition to improve the waste management Traditional system we can add the Bio gas plant in it.

P7 **[67]**

MILITARY THREAT PERCEPTION IN PERSPECTIVE OF CLIMATE CHANGE REFERRED PAKISTAN

M. Jabeen [1], I. Khattak [2] and H. Suhail [3]

[1]*International Relations, Faculty Contemporary Studies, National Defense University, Islamabad, Pakistan*

[2]*National Defense University, Islamabad, Pakistan*

[3]*Internee Prime Minister Program, National Defense University, Islamabad, Pakistan*

ABSTRACT

Pakistan is identified the top 5th in the climate vulnerability index. "The geopolitical consequences of climate change are determined by local political, social, and economic factors as much as by the magnitude of the climatic shift itself. As a rule, wealthier countries and individuals will be better able to adapt to the impacts of climate change, whereas the disadvantaged will suffer the most. An increase in rainfall, for example, can be a blessing for a country that has the ability to capture, store, and distribute the additional water. It is a deadly source of soil erosion for a country that does not have adequate land management practices or infrastructure." "Climatic shift can trigger or exacerbate food shortages, water scarcity, destructive weather events, and spread of disease, human migration, and natural resource competition." Out of all these water qualifies as weapon because it is visible, it is quantifiable, it is manipulative by states to maneuver conflict. This scenario triggers the thought to highlight the climate change as indicator of danger and threat multiplier magnifying the economic deprivation and peace destruction. This paper paradigms the situational analysis of military threat perception and climate change referred Pakistan. The paper deals with four topics; military threat perception and climate change, climate change characteristics of Pakistan, climate change policy of Pakistan, and the assessment of climatic literacy among the military officers of Pakistan.

Keywords: Military Threat Perception, Climate Change, Climate Change Policy of Pakistan, Climatic Literacy

P8 **[68]**

PERFORMANCE OF EXISTING GREEN FACADES AS URBAN HEAT ISLAND ADAPTATION STRATEGY IN HOT HUMID COLOMBO

C. Udawattha and R. Halwatura

University of Moratuwa Sri Lanka, Sri Lanka

ABSTRACT

Colombo (6°54'N, 79°52'E)), is capital city of Sri Lanka, which has approximately 0.8 million inhabitants. The CMR is a lowland region with a typical warm-humid tropical climate which is affected by the seasonal wind. Temperatures and humidity are high throughout the year creating an uncomfortable thermal environment. A cross section of city of Colombo derived by considering local climatic classification for city of Colombo was considered as case study for the research and Green Cover Ratio (GCR) and Green facade ratio (GFR) were considered as primary urban planning indicator for the research. The Actual Data taken onsite climatic measuring system from seven receptor points and the regression analysis method used to understand the correlation between climatic considerations, GFR and GSR. Regression analysis of Green urban variables and climatic elements (Temperature & Humidity) shows that GCR can correlate only 14.4% of Temperature, 16% of Relative Humidity and 21.6% of Temperature Humidity Index. In comparison GSR shows that there are 19.6% of Temperature 56% of Humidity and 46.6% of Temperature Humidity Index. To be more precise Green surfaces such as grass cover, water bodies and small plants have more impact on city climate than Green cover(GCR).

Keywords: Urban Heat Island, Green Façade, Green Cover, Tropical Climate and Adaptation Strategy

P9 **[69]**

MANGROVE TREE PLANTING: MALAYSIAN EXPERIENCE

M.N. Pandithan

Malaysian Red Crescent

ABSTRACT

Mangroves are the most threatened and has been rapidly disappearing since the last few decades. This natural occurring environment has been converted into many uses ranging from aquaculture farms to urban development purposes. Malaysia harbours around 11.7% Southeast Asia's mangroves. There was a considerable loss of mangrove in Malaysia between 1980 and 1990 has impacts on coastal areas around Malaysia. The Matang Mangrove Forest in Peninsular Malaysia has been the most sustainably managed forest in the world since 1902, yet sustainability is not implemented in mangrove areas all over Malaysia. Among the largest mangroves include; Matang Mangrove Forest, Setiu Mangrove Forest, Kuala Selangor Nature Park, PulauKukup State Park including much larger areas in Sabah and Sarawak in West Malaysia and even more. Constant, pressure of anthropogenic activity is responsible for rapid declination rate of these species. Though, little is known about the effects that lost mangroves can bring upon a population. Worldwide, mangroves are found in high intertidal waters and in estuarine zones, which are adapted to brackish waters. Due to the mangroves being cut down primarily for the development of aquaculture mainly for cockles, oysters, shrimps and other sorts of bivalves, there are some unseen long term impacts that may occur. With continuous destruction, economic downfall will be faced as well as some environmental consequences. If measures are not enforced then the risk of loss for several mangroves species is prominent within the next few decades.

P10 **[70]**

DESIGN OF REUSABLE, BIODEGRADABLE, HYDROPHOBIC AND TRANSPARENT PACKING MATERIAL FROM NATURAL PLANT CELLULOSE FIBERS

S. Sivanujan

Faculty of Science, University of Jaffna, Sri Lanka

ABSTRACT

Consumption and improper disposal of polythene packing material become a major threat to natural environment of Sri Lanka. This can be overcome by promoting production and usage of eco-friendly packing material. Common cellulose paper packing material is not in a preferable approach within consumers due to its hydrophilic nature and opaqueness. In this work, a reusable, biodegradable, hydrophobic and transparent packing material model was designed using natural plant cellulose fibers. Cellulose fiber mass was initially treated with Sodium Hydroxide solution and was processed to reach pulp consistency. Molten beeswax was added. Gelatin content was incorporated into the pulp. The pulp was molded into a thin sheet (6 x 6 cm_2). Results showed surface of the model of packing material designed acquired hydrophobic character, repelling water drops laid over the surface and light transparency as well. This, in large scale production will reduce agricultural waste of plant fibrous parts, which can be utilized in manufacturing of plant fiber based packing material. This model can be used in packaging industry and can minimize solid waste management issues arising due to polythene consumption.

Keywords: Packing Material, Biodegradable, Hydrophobic, Cellulose Fiber, Beeswax, Gelatin

P11 **[71]**

DETERMINING THE BEST AGRICULTURAL MANAGEMENT PRACTICES FOR SALT-AFFECTED COASTAL PADDY SOILS IN SRI LANKA CONSIDERING NET GREENHOUSE GAS EMISSION ALONG WITH OTHER SOCIOECONOMIC BENEFITS

A.S. Archana[1], E. Lokupitiya[1], D.N. Sirisena[2] and G. Seneviratne[3]

[1]*Faculty of Science, University of Colombo, Sri Lanka*

[2]*Rice Research and Development Institute, Sri Lanka*

[3]*National Institute of Fundamental Studies, Sri Lanka*

ABSTRACT

Sea level rise is a major impact of climate change. Sea level rise and various anthropogenic activities leading to salt water intrusion have affected law-laying agricultural areas. Salinity intrusion could significantly affect the food security. Rice is a stable food in Sri Lanka and occupying 1.05million ha of cultivated area. This study was initiated to assess best agricultural management practices for salt-affected soils considering net greenhouse gas emission along with other socioeconomic benefits. The research is being carried out in Madampe in Puttlam District (soil pH is 3-4 and EC- Sat. 2-4 dS/m) in Maha season. Newly improved salinity tolerance variety BG 310 was planted in this particular salinity effected geographical location to study the change in greenhouse gas emission. The following management options were applied in the different plots along with control plot; a) Broad casting seeds, addition of organic matter and maintaining the water level 2-3cm until milking stage. b) Transplanting of seedlings, addition of organic matter and maintaining the water level 2-3cm until milking stage. c) Transplanting of seedlings, addition of organic matter and intermittent irrigation. d) Control - Broad casting seeds, without addition of organic matter and intermittent irrigation. Greenhouse gases emitted from each plot at time intervals of 0 minute, 30 minute and 60 minute were collected using closed chambers at weekly intervals and analyzed by using gas chromatography (for N_2O, CH_4, and CO_2). It has been noted that flooded (with an irrigation water level of 2-3cm) soil with high organic matter content has significant contribution to CH_4 emission. N_2O emission was observed in dried and re-wetted irrigated land plots.

Keywords: Sea Level Rise, Salinity Intrusion, Greenhouse Gas, Paddy, Management

P12 **[72]**

IMPACT OF UNIVERSITY WASTE MANAGEMENT PRACTICES ON GREENHOUSE GAS EMISSIONS AT LANDFILL SITES

M. Kariyawasam and E. Lokupitiya

Center for Environmental Initiatives, University of Colombo, Sri Lanka

ABSTRACT

The amount and the variety of waste material generated in the country is increasing fast making a considerable damage to the natural environment. The waste generated at various institutions makes a significant, but typically ignored, contribution to GHG emissions. Landfills are the predominant type of solid waste disposal sites in the Sri Lanka which have a significant contribution to the climate change due to production of methane (CH_4). The waste disposed in a landfill site undergoes biological transformation to produce carbon dioxide (CO_2) under aerobic conditions and a mixture of CH_4 and CO_2 under anaerobic conditions. The estimation of GHG emissions at the landfill sites will be key in finding solutions to climate change as the landfills plays an important role by emitting large quantities of CH_4 which has a higher global warming potential compared to CO_2. This study was an attempt to evaluate the greenhouse gas (GHG) emissions at landfill sites against the recent waste management practices adopted at University of Colombo, Sri Lanka. A waste survey was conducted and different waste types were weighed separately during week days and weekends, and the impact was evaluated for the time before and after making the university a polythene-free zone. GHG emissions from waste categories and disposal methods were also examined. Calculations were made using IPCC revised guidelines (2006) in estimating emissions. Results show that the contribution of university waste towards landfill GHG emissions is moderate at the moment. But proper waste management strategies could help further mitigate the GHG emissions. Waste minimization and sustainable waste management at institutional level could play a key role in minimizing GHG emissions at landfill sites.

P13 **[73]**

ESTIMATING CARBON FOOTPRINT OF RUBBER INDUSTRY IN MONARAGALA DISTRICT

W.S.S.L. Abeyrathna[1], S.P Nissanka[2], V. H. L Rodrigo[3], E. S Munasinghe[3]

[1]*Post Graduate Institute of Science , University of Colombo, Sri Lanka*

[2]*University of Peradeniya*

[3]*Rubber Research Institute, Agalawatta, Sri lanksa*

ABSTRACT

Sri Lanka is one of the natural rubber producers in South East Asian region. To fulfill the growing demand for natural rubber, Sri Lankan government has planned to expand the rubber cultivations to the drier non-traditional areas of the country. In this exercise more emphasis has been given to the Monaragala district, intermediate agro-ecological zone IL1. Although rubber plantations are considered as terrestrial carbon sinks, detailed carbon footprints along with the rubber production line is to be considered. Therefore, the objective of this study was to develop carbon foot prints of mature rubber fields of both plantation and smallholder sectors. Data required for the study were collected from mature fields of commercial rubber estates and smallholdings in Monaragala district. Emissions of Green House Gases (GHGs) associated with the production of fresh latex and primary rubber products and annual increment of CO_2 stock only for smallholder sector were estimated (not included the emission related to fertilizer production, land preparation, pest and disease control, stimulant application). The overall emissions from the production of Fresh latex, Crape Rubber, Ammoniated Latex and Ribbed Smoked Sheet (RSS) were 0.1242, 0.1320, 0.1246 and 1.3093 ton CO_2-eq/ton product, respectively in the estate sector for the year 2012. The emission values for the production of Fresh latex, Ammoniated Latex and Ribbed Smoked Sheet (RSS) were 0.0924, 0.0931 and 0.8720 ton CO_2-eq/ton product, respectively in the smallholder sector. Accordingly, average annual GHGs emission and CO_2 fixation in rubber vegetation was 5.0328 CO_2-eq ton /yr and 13.9893 CO_2 ton/yr respectively, for smallholder sector. Overall results indicated that rubber plantations act as net carbon sinks and considered as a viable mitigatory measure where carbon trading opportunities could be developed at national level for GHG emission reduction.

Keywords: Ghgs, Non-Traditional Areas, Smallholders, Estate Sector, Primary Rubber Products

P14 **[74]**

FORECASTING THE MONTHLY ELECTRICITY CONSUMPTION IN SRI LANKA USING MODELS INCORPORATING WEATHER RELATED FACTORS

A.D.A.D. Priyadarshana [1], R.S. Lokupitiya [1] and D. Kuruppuarachchi [2]

[1]*Department of Statistics, Faculty of Applied Sciences, University of Sri Jayewardenepura, Sri Lanka*

[2] *Department of Decision Science, Faculty of Management Studies and Commerce, University of Sri Jayewardenepura, Sri Lanka*

ABSTRACT

Sri Lanka as a developing country, over 98% households have been electrified and it is crucial to plan for future electricity demand in order to match the demand with supply. This study aims at forecasting monthly electricity consumption in Sri Lanka and explores the weather influence on the electricity consumption. Due to higher living standards, weather has a considerable impact on the short-term electricity demand due to the use of fans, air conditioners and refrigerators, etc. There are three main weather related factors that could affect the demand. They are Rainfall, Humidity and Temperature, the patterns of which are also affected by climate change. In this study, four forecasting approaches (Classical Decomposition Method, Exponential Smoothing Method, Probabilistic Modeling in Time Series, Autoregressive Distributed Lag (ARDL) model Approach) were employed in forecasting monthly electricity consumption in Sri Lanka. Additionally, Artificial Neural Network (ANN) was used in order to investigate the applicability on forecasting monthly electricity in Sri Lanka as an advanced method. Arc-map software was used for longitude latitude conversion and to find the centroids of the districts. Twenty meteorology stations were considered to spatially interpolate the weather data by using the Inverse Distance Weighted (IDW) interpolation method. Under this study, it was revealed that ARDL and ANN model approachesin which the weather influence was incorporated perform better in monthly electricity consumption forecasting.

Keywords: Electricity Consumption Forecasting, Weather Impact, Inverse Distance Weighted Interpolation, Autoregressive Distributed Lag, Artificial Neural Network

P15 **[75]**

GENERAL CONSIDERATIONS FOR TIDAL ENERGY EXTRACTION

V. Mendi[1], S. Rao[1] and J.K. Seelam[2]

[1]*National Institute of Technology Karnataka, Surathkal, India*

[2]*National Institute of Oceanography, Goa, India*

ABSTRACT

Renewable energy has been one of the most focused areas of research in the recent past. It has proven worthwhile to study and invest in renewable energy sources. Increasing carbon emissions, exhaust of fossil fuels have been the issues of major concern and have forced to look for alternative energy sources. Of all the available renewable energy sources, tidal energy is considered as one of the most reliable source in the literature. The energy from the tides can be extracted in two methods; potential energy and kinetic energy. There are no codal provisions available for the tidal energy extraction. However, there are some tidal power plants established around the world which are currently operating and serving the purpose of energy extraction. Countries like UK, have set targets to achieve 20% of their total energy consumption from renewable energy sources by the year 2020. To establish a tidal power plant, there are some general considerations made in the literature with respect to the parameters like minimum tidal range, minimum tidal current speeds etc. In this paper, the general considerations made for tidal energy extraction will be reviewed from the literature and criteria to be adapted for the tidal energy extraction in particular to the Indian coast will be suggested.

Keywords: Tides, Renewable Energy, General Considerations

P16 **[76]**

CIRCULAR ECONOMY APPROACH FOR SOLID WASTE MANAGEMENT IN SRI LANKA

G.V.H.M. Pathmasiri

Free Lance Researcher, Sri Lanka

ABSTRACT

Rapid urban development, industrialisation, new technological innovations have increase generation of solid waste around the world. Sustainable Solid Waste Management (SWM) is a considerable problem for both developed and developing countries around the world. Generation of solid waste is a natural consequence of human activities .Sustainable SWM is very important activity in a country as it is an integrated with community health, impact on environment and economic factors. As a developing country Sri Lanka provides high level of health care and free education from grade one to university level. However, there is no systemised waste management system around the country. It is required to realistically assess SWM system in Sri Lanka. Circular Economy (CE) has been identified as one of the latest concepts for efficient resource management and some countries mainly in western countries use this method for sustainable waste management. The level of education, skills and knowledge are major components of implementation of new systems in a continual manner. Therefore, this study analyse in terms of level of education, skills and knowledge with regards to implementation of sustainable SWM system by using concept of CE. Mixed Methods were used for this study. Data was collected from waste generation sources of Residential, commercial, Institutional and Municipal services in Western province of Sri Lanka.

Keywords: Solid Waste, Circular Economy, Sustainability

P17 **[77]**

DETERMINATION OF RELATIONSHIPS AMONG CHILLI LEAF CURL VIRUS DISEASE INCIDENCE, POPULATION OF BENEFICIAL INSECTS AND CLIMATIC PARAMETERS PRESENT IN CHILLI GROWING AREAS OF DIFFERENT AGROECOLOGICAL REGIONS OF SRI LANKA

K. Prasannath[1], D.M. De Costa[2] and K.N.P. Dharmadasa[3]

[1]*Department of Agricultural Biology, Faculty of Agriculture, Eastern University, Sri Lanka*

[2]*Department of Agricultural Biology, Faculty of Agriculture, University of Peradeniya, Sri Lanka*

[3]*Postgraduate Institute of Agriculture, University of Peradeniya, Sri Lanka*

ABSTRACT

The present study was conducted to determine the effects of climatic parameters on population of beneficial insects towards management of chilli leaf curl virus disease. Chilli variety MI Green was grown under two crop management systems *viz.* pesticide-based management system and an IPM-based management system at five different locations of Sri Lanka, namely Kilinochchi, Mahailluppallama, Kundasale, Peradeniya and Rahangala which represent gradients of two key environmental factors, temperature and rainfall during *maha* 2012/2013 and *yala* 2013 seasons. At each location, two crop management systems were tested in a nested treatment structure using a randomized complete block design with six replicates. Incidence of chilli leaf curl virus disease and abundance of different types of beneficial insects were recorded over four crop growth stages, namely initial, crop development, midseason and late season. Data on mean day temperature and daily rainfall were collected from each experimental site during the two cropping seasons. Relationships among chilli leaf curl virus disease incidence, population of beneficial insects and climatic parameters were tested by regression analysis. Results revealed that there was no significant relationship ($p=0.05$) of chilli leaf curl virus disease incidence with mean temperature of the locations or total rainfall of the locations. A significant polynomial relationship ($p<0.05$) was observed between beneficial insect population and the mean temperature of location showing that maximum beneficial insect population in the chilli fields was at 24.3 °C during *maha* and 24.4 °C during *yala*. Furthermore, there was a significant polynomial relationship ($p<0.05$) between beneficial insect population and total rainfall indicating the maximum beneficial insect population at 987.7 mm rainfall during *maha* and 513 mm during *yala*. No significant relationship ($p=0.05$) was found between the beneficial insect population studied and chilli leaf curl virus disease incidence.

Keywords: Abundance of Beneficial Insects, Incidence of Chilli Leaf Curl Virus Disease, Rainfall, Temperature

P18 **[78]**

MEASURING FLOOD RISK IN RATNAPURA TOWN AREA IN SRI LANKA

H.W.Y.J. Hettiwaththa and R.A.B. Abeygunawardana

Department of Statistics, University of Colombo, Sri Lanka

ABSTRACT

Flood is a common chaotic natural problem frequently occurs in Ratnapura district. Recent chain of flood events that occurred in Ratnapura district have raised the question regarding the capability of defending civilian lives and property from this natural disaster. Ratnapura town area mainly face floods due to the over flow of Kalu river during the South West monsoon season. So forecasting the water level of Kalu River at Ratnapura town area is a very important component of a flood forecasting system in Ratnapura. This study is focused on forecasting water level of Kalu River using the rainfall data and the water discharge rate. Secondary data were collected from Department of Meteorology, Sri Lanka and Department of Irrigation over the period of 2007-2016. Data were collected from meteorological stations at Ratnapura, Galabada, Guruluwana and Lellopitiya which are located in upper catchment area of Kalu River. By accurately forecasting water level, the risk of flood can be measured. ARIMAX-GARCH model was fitted to forecast water level using the rainfall and the water discharge rate. The accuracy of the fitted model to forecast water level was high when comparing the estimated values with the actual values. The Mean Absolute Percentage Error of the fitted model is 5.0%. Therefore the ARIMAX-GARCH model can be used to measure the flood risk in Ratnapura.

Keywords: Flood, Rainfall, Forecasting, Risk, ARIMAX-GARCH

VIRTUAL PRESENTATIONS

[79]

AN ANALYSIS OF FARMERS` CROP CHOICE IN RELATION TO CLIMATE CHANGE AND FARM LEVEL ECONOMIC POTENTIAL IN MAJOR AND MINOR IRRIGATION SCHEMES OF SRI LANKA

G. Sharunya[1] and S. Suthrashan[2]

[1]*Department of Agricultural Economics and Business Management, Faculty of Agriculture University of Peradeniya, Sri Lanka*

[2]*National Building Research Organization, Sri Lanka*

ABSTRACT

This study endeavors to assess how the crop selection is changing with climate change and economic potential of farmers in Major and Minor irrigation schemes of Sri Lanka. Research area includes 30 Grama Niladhari Divisions in 9 districts of the dry zone of Sri Lanka, across the major and minor irrigation schemes. Multinomial Logistic Model (MNL) was employed to appraise the probability for varying crop choices of farmers in major and minor irrigation schemes, by considering the environmental and economic factors such as changes in precipitation and temperature, income level of farmers, agricultural revenue, cost benefit ratio of the crop and the ratio between farm and non-farm income. The results indicate that the crop selection of farmers regarding to the factors mentioned above follows the same pattern regardless of the irrigation schemes. With increasing rainfall paddy cultivation is preferred and Other Field Crop (OFC) cultivation is preferred when the temperature is increased. The income level is not influencing the farmers` crop choice to a greater extent. Farmers prefer OFC than paddy with increasing agricultural revenue and cost benefit ratio. It is observed that the preference for paddy is lower, higher the non-farm income is. The results gained in this study can be used as a tool for deciding the economic perspective of farmers in selection of crops and to identify the impact of climatic change in selection of crops. The findings will be helpful to farmers to elevate the economic status of their livelihood which is vulnerable to climate change.

Keywords: Crop Choice, Irrigation Scheme, Multinomial Logit, Economic Potential, Climate Change

[80]

IMPACT OF THE CLIMATE CHANGE ON THE ANCIENT CIVILIZATION IN PAKISTAN AND PROTECTIVE RESPONSIBILITIES OF THE GOVERNMENT AGENCIES

F.Z. Syed

University of the Punjab Lahore, Pakistan

Government College Women University Sialkot, Pakistan

ABSTRACT

The large and small changes in climate are partly destroying the ancient civilization in the worldwide. The issues of land degradation, pollution, natural disasters, and smog are badly hitting the ancient ruins of the civilization. Pakistan is considered a highly rich and famous country by her old civilization in the world. The destruction and the threat of the collapse of the ancient civilization are now attention seeking problem in Pakistan. This paper aims to elaborate the climate change impacts on the vanishing ancient civilization and the protective responsibilities of the government and related agencies in Pakistan. A qualitative research method with secondary data was used to investigate the problem. The available research of government agencies fail to highlight the government agencies protective responsibilities towards the climate change and aftereffects on ancient civilization in Pakistan. It is found that more serious steps have to be taken on an emergency basis with the collaboration of international organization under UNO agreement for the preservation of the ruins of ancient civilization and impacts of climate change on these sites in Pakistan.

Keywords: Climate, Climate Change, Ancient Civilization, UNFCCC, Environment

[81]

UNDERSTANDING THE DIFFERENCE BETWEEN OVERSEAS DEVELOPMENT ASSISTANCE (ODA) AND CLIMATE FINANCE (CF): THE CASE OF BANGLADESH

M.R Khan[1], R. Bashar[1], S. Munira[1] and T.H. Easher[1]

[1] *Environmental Science and Management Department, North South University, Bangladesh*

ABSTRACT

Although Bangladesh is a developing country, with almost negligent contribution to climate change, it is amongst the most vulnerable to feel its consequences; often termed 'innocent victim'. As most of the climate change has been brought about by the emission practices of the richer (developed) countries, it is a right of the poorer (developing) countries to claim Climate Finance (CF) as a source of fund to combat the consequences of Climate Change. However, many-a-times, the qualitative differences between CF and Overseas Development Assistance (ODA) get blurred and one is used for the purposes of the other. Hence, an understanding of this phenomena and how the distribution of CF, as well as ODA, has been occurring within Bangladesh and among the developing countries from 2006-2015 is important and must be performed as soon as possible. However, it is a challenge to differentiate between CF and ODA. This study will focus on explicating the difference between CF and ODA in the context of Bangladesh, i.e. how much Bangladesh has been getting external support in the name of CF and ODA during the last decade, and to what extent the two categories are mixed, and whether they can be differentiated. To efficiently achieve this goal, data from databases available in the websites of national and international, governmental and non-governmental and bilateral and multilateral organizations like ERD, TIB, OECD DAC, UNFCCC, IATI, USAID, DFID, GIZ, JICA, SIDA, DANIDA, WB, ADB, UNDP, Oxfam, CARE, Concern Worldwide, BRAC, NGO Affairs Bureau of GoB and so on must be collected and later, analyzed using statistical software like Microsoft Excel and SPSS. Only through the use of numbers and information technology i.e. digitalization, can this issue of 'mix-up' be mitigated which will greatly benefit policy makers and fund-receivers alike in Bangladesh.

Keywords: Climate Change, Climate Finance, Overseas Development Assistance, Least Developed Countries

[82]

INDIGENOUS SCENARIOS ON CLIMATE CHANGE AND ADAPTATION OPTIONS

A. Lammel

Prof. University Paris 8, France

ABSTRACT

The importance of traditional indigenous knowledge systems in climate change adaptation is now integrated into the climate change negotiations and they are recognized by the scientific community (e.g. IPCC). However few studies are interested in indigenous scenarios predicting impacts in function of systemic variables. The presentation will focus on indigenous climate change scenarios and local evaluation of adaptive capacities in contrasted environments, based on longitudinal research: New Caledonia (Kanak people), Golfe of Mexico (Totonac people), and Baffin Island (Inuit people). Data analyses highlight the inclusion into the scenarios the following components: the system of natural forces (including climate system), global economic and political background and precise, experiential local micro-observations. Adaptation options will be discussed in light of the indigenous scenarios.

[83]

WATER AND SUSTAINABILITY IN CITIES: ANALYSIS OF THE SUPPLY - DEMAND RELATIONSHIP IN A MEXICAN BORDER CITY

M. Gil-Samaniego

Universidad Autónoma de Baja California, México

ABSTRACT

The state of Baja California, Mexico, is located at the west coast of the country and is conformed by 5 municipalities: Mexicali (the capital city), Ensenada, Tijuana, Tecate and Rosarito. They are located in a dry, semiarid zone close to the border with the United States. In this region, water and energy are the scarcest resources. The annual precipitation is of 169 mm, compared to the national mean of 760 mm. In this paper, an assessment was made of the supply and demand of drinking water in the city of Mexicali, Baja California, with a focus on sustainability and its three main impacts: economic, social and environmental. Indicators were implemented to measure and evaluate the efficiency and the water-energy relationship of the water distribution system for the supply analysis, and the water consumption habits of the population for the diagnosis of the demand. The results show acceptable efficiency in the water supply system, but a great waste of water by the domestic user. Recommendations were made to establish public policies that could impact in the reduction of such consumption, and consequently in the GHG emissions generated that could help to cut down on the climate change risks.

Keywords: Water Distribution Systems, Pump Efficiency, Residential Water Use

[84]

PANCHESHWAR DAM - THREAT TO HIMALAYAN CLIMATE AND SUSTAINABLE DEVELOPMENT

M. Chaudhary

Delhi Public School, Sonepat, India

ABSTRACT

The 5040 MW Pancheshwar multipurpose project on the Mahakali river along the India-Nepal border is a disaster in the making, according to my research findings. It involves the construction of a mega dam in an area that is seismically more active. Seismic energy has been building up along this Indo-Nepal border area for several decades, without any release, and seismologists have been predicting that the built up energy can lead to a quake of magnitude 8 or even 8.5 on Richter scale. This dam would mean destruction of 4 National Parks in India and 2 National Parks in Nepal, thereby, causing permanent damage to thousands of flora and fauna species. Almora, Pithpragarh and Champawat, the three districts of Uttarakhand, are in danger of being submerged. The project is expected to submerge 11,600 hectares of mountain area in five seismic zones. A total of 134 villages are going to submerged along with their rich biodiversity, culture and specific river valley civilization. Cloud bursts, land slides, man-wildlife conflict, new borne diseases and severe climate change due to methane released by dam lakes are some of issues, which are going to create a great threat to the lives of locals. This will bring about social, economical, environmental and climate change effects. Through my study I stand to propose alternative methods of energy generation which can ensure our future consumption of electricity, employment opportunities and safe living environment for coming generation.

[85]

RETHINKING THE URBAN WATER SUPPLY IN AN EMERGING SATELLITE TOWNSHIP: NEW TOWN, KOLKATA, INDIA

D. Mitra

Department of Geography, Presidency University, India

ABSTRACT

Climate change coupled with wasteful consumption of water resources plagues the developing world which is still in the phase of urbanisation. The city of Kolkata in West Bengal is plagued with continuous in-migration and eastward expansion, the product of which has been the establishment of the new satellite township of New Town. This township in spite of being situated far away from a perpetual water source draws 100MGD of water from river Hooghly and purifies it before supplying 135lpcd to the residents. This is expensive since it has to be accessed from a great distance. As a result there are locales in the three Action Areas which pump out groundwater to meet their water demands thus adversely affecting the piezometric water level. Hence, the central focus of the paper is promoting self-sufficiency in water availability. In this respect, at first secondary data such as the water supply network schemes were collected for the three Action Areas. These were analysed in ArcGIS Software to identify the places without access to water. Using the present rates of payment, the cost of water treatment has been equated. Further, the secondary piezometric data was assessed using the Surfer software to establish the depleting nature of groundwater resources. Lastly, a step towards sustainability has been suggested wherein a prospective water distribution model has been designed in such a way, that equitable distribution might be enhanced. Combining the collected rainwater and partly treated grey-water generated from the households, this model aims to provide a sustainable water supply network to the township.

[86]

CLIMATE CHANGE INDUCED DISPLACEMENT AND MIGRATION IN INDIA: ISSUES AND CHALLENGES

S. Mrutuyanjaya

Birla Institute of Technology & Science, Pilani, Dubai Campus, Dubai International Academic City, UAE

ABSTRACT

Climate change pose severe threat to many countries, territories and cultural heritage of humanity on earth in the 21st century. India is no exception to the increasing impacts of climate change. The geographically diverse Indian subcontinent is particularly vulnerable to a wide variety of natural disasters. Every year thousands of people are affected and displaced at least temporarily by the impact of weather and natural disasters such as droughts, floods, cyclones and riverbank erosion. Moreover, the vulnerability of populations to climate change-related disasters goes beyond physical relocation risk. There are also economic, social and cultural fallouts from such disasters and the displacement has propelled deeper into poverty and marginalisation. Besides disrupting the family life of the displaced and the social fabric of communities, it has also led to further geographical and social exclusion by denying their right to the opportunity to live with dignity as given by the Indian Constitution.However, the influence of environmental change on population displacement has largely been ignored by the standard theories of forced migration and the empirical basis of the research remains weak at the national level. This paper highlights the processes of climate change induced displacement and migration of local population in India in general and specifically focuses on the effects of Phailin cyclone storm 2013 in Odisha state. It examines the post disaster rehabilitation and reconstruction measures taken by the state government to mitigate the effects and enable communitiesto be better prepared to deal with future climate change-related events. Finally this paper draws conclusions and reflects on policy implications for research and practice.

Keywords: Climate Change, Displacement, Migration, Resettlement, Reconstruction