



INTERNATIONAL CONFERENCE ON **BUILDING RESILIENCE IN TROPICAL AGRO-ECOSYSTEMS**

ICBRITAE-2023



CONFERENCE PROCEEDINGS

PROJECT PARTNERS

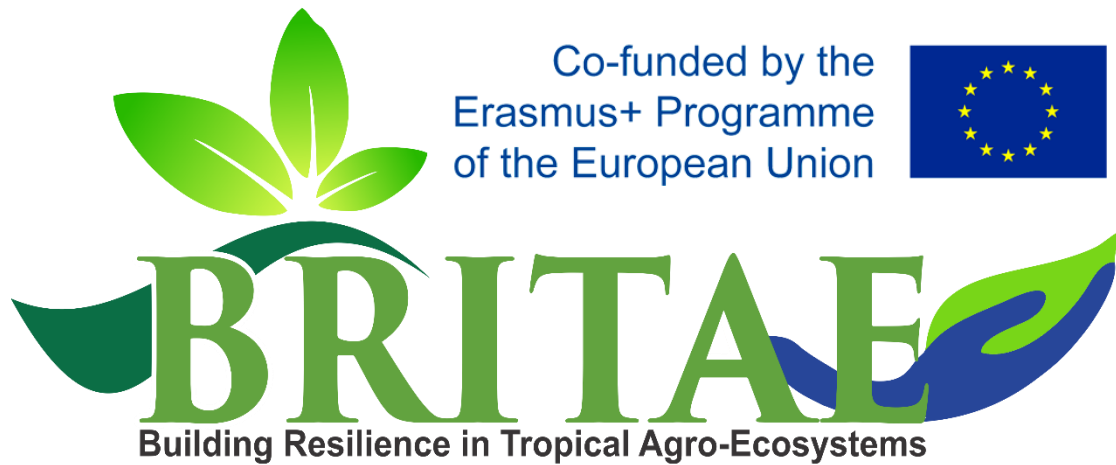


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International Conference on
Building Resilience
in Tropical
Agro-ecosystems

ICBRITAE-2023

CONFERENCE PROCEEDINGS

15th -16th, March 2023

Galle Face Hotel

Colombo

Sri Lanka

International Conference on Building Resilience in Tropical Agro-ecosystems

15th – 16th March 2023

CONFERENCE PROCEEDINGS

ISBN 978-624-5746-54-5

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respective authors.

Website www.britae.lk

Cover Design TIIKM Creative Division

Printers Print Hub, Borella

Table of Contents

Table of Contents	iii
Message from the Conference Co-chairs	iv
Preface	v
Conference Organisation	vii
Conference Partners	x
University of Ruhuna, Sri Lanka.....	x
University of Colombo, Sri Lanka	xii
University of Moratuwa, Sri Lanka.....	xiv
University of Sri Jayewardenepura, Sri Lanka	xvi
Sabaragamuwa University of Sri Lanka.....	xvii
University of Huddersfield, United Kingdom.....	xix
University of Central Lancashire, United Kingdom.....	xxi
Tallinn University of Technology, Estonia.....	xxiii
Vilnius Gediminas Technical University, Lithuania	xxiv
Keynote speakers	xxv
Senior Professor H.D.Karunaratne	xxv
Professor Mark Howden	xxvii
Professor Ayon Chakraborty.....	xxix
Professor Artūras Kaklauskas	xxxi
Eng. Bandula Wickramaarachchi	xxxii
Dr. Didier Lesueur	xxxiv
Professor Dr. Siegfried Zürn.....	xxxvi
Thematic Sessions.....	xxxviii
Conference Proceedings	1
Agro Ecosystems and Biodiversity Conservation	2
Ecosystem Management and Socio-ecological Resilience.....	14
Green Infrastructure and Urban Resilience.....	30
Indigenous Knowledge, Precision Agriculture and Agricultural Productivity	42
Global Food Safety and Security.....	67
Disasters and Agricultural Vulnerability	80
Life Cycle Assessment and Circular Economy.....	90
Agricultural Policies, Concepts and Strategies	100
Building Resilience in Tropical Agro-ecosystems (BRITAE) Project	111

Message from the Conference Co-chairs

Dear Authors and Esteemed Readers,

We take great pleasure in composing this Foreword for the proceedings of the ICBRITAE-2023 conference that will be held in Colombo, Sri Lanka on the 15th - 16th, March 2023. The BRITAE conference is an essential component of the European Union-funded initiative named 'Building Resilience in Tropical Agro-Ecosystems.' This project aims to enhance the resilience of vulnerable communities in the face of climate change-related risks. Therefore, it is crucial to establish a connection between the academic community, researchers, and intellectuals, who represent the vulnerable communities, to mitigate the adverse societal impacts. This connection will help us cope with the challenges that arise due to this issue in today's world. Therefore, the primary objective of this project was to equip scholars with a diverse range of knowledge and skills and disseminate that knowledge to enhance their ability to tackle real-world problems.

The conference promotes the exchange of ideas between young and mid-level academics and researchers and their more established counterparts in an informal setting. This interaction allows them to present and discuss their latest and ongoing research, making the conference more exceptional. The papers presented during the conference cover a wide range of topics, including Agro-Ecosystems and Biodiversity Conservation, Ecosystem Management and Socio-ecological Resilience, Green Infrastructure and Urban Resilience, Indigenous Knowledge, Precision Agriculture, Agricultural Productivity, Global Food Safety and Security, Disasters and Agricultural Vulnerability, Life Cycle Assessment, and Circular Economy Agricultural Policies.

We are privileged to have the participation of world-renowned keynote speakers who will shed light on various contemporary topics. We extend a warm welcome to Senior Professor H.D. Karunaratne, Vice Chancellor of the University of Colombo; Professor Mark Howden, Director of the Institute for Climate, Energy, and Disaster Solutions at the Australian National University; Professor Ayon Chakraborty, Associate Professor in Engineering Project Management at Federation University, Australia; Professor Artūras Kaklauskas from Vilnius Gediminas Technical University, Lithuania; Dr. Didier Lesueur, Associate Senior Researcher at CIAT Asia – International Center for Tropical Agriculture (CIAT) and Agricultural Genetics Institute, Vietnam; Eng. Bandula Wickramaarachchi Technical Specialist, Asian Disaster Preparedness Center, and Professor Dr. Siegfried Zürn, Director of the International Centre and Graduate School in Esslingen, Germany. We express our profound gratitude to all of them.

As conference co-chairs, we are delighted to announce that all major stakeholders, both local and international, in the field of building resilience in tropical agro-ecosystems, have come together to support this noble cause. These proceedings will serve as an excellent reference book for scientists worldwide. We are confident that it will inspire further research and studies in all these areas. We would like to thank all authors and participants for their valuable contributions.

Prof. S.B. Navarathne

University of Sri Jayewardenepura

Prof. Nishara Fernando

University of Colombo

Conference Co-Chairs - ICBRITAE 2023

Preface

The Editorial Board is thrilled to announce the publication of the Proceedings for the upcoming International Symposium on Building Resilience in Tropical Agroecosystems (ICBRITAE-2023) with great pleasure and enthusiasm. A hybrid event focusing on the resilience of contemporary agricultural ecosystems has garnered worldwide attention and is scheduled for March 15th -16th, 2023. The symposium is seen as a key driver of the global interest.

Tropical agroecosystems are complex and dynamic systems that support the livelihoods of millions of people around the world. These systems are characterized by high biological diversity, intense interactions between ecological and social processes, and vulnerability to various stressors such as climate change, soil degradation, pests and diseases, and socio-economic pressures. Building resilience in tropical agroecosystems is thus an urgent challenge that requires the integration of scientific, social, and cultural knowledge to design and implement sustainable and adaptive management practices. Resilience refers to the capacity of a system to absorb disturbances and maintain its structure, function, and identity. In the context of agroecosystems, resilience implies the ability of farmers and their ecosystems to cope with and recover from shocks and stresses, while preserving their productive and ecological functions and enhancing their adaptive capacities.

The symposium on Building resilience in Tropical agroecosystems aims to bring together scientists, practitioners, policymakers, and stakeholders from different disciplines and regions to share their experiences, insights, and challenges in addressing the resilience of tropical agroecosystems. The symposium will cover various themes related to the resilience of tropical agroecosystems, such as:

- **Ecological and social resilience:** The interplay between ecological and social factors in shaping the resilience of agroecosystems, including the role of biodiversity, ecosystem services, land use and management practices, and local knowledge and institutions.
- **Climate change and resilience:** The impacts of climate change on tropical agroecosystems and their adaptive responses, including the use of climate-smart agriculture, agroforestry, and other sustainable practices to enhance resilience.
- **Pests and diseases and resilience:** The management of pests and diseases in agroecosystems and their impacts on the resilience of crops, livestock, and ecosystems, including the use of integrated pest management, genetic diversity, and agroecological practices to reduce vulnerability.
- **Socio-economic and cultural resilience:** The linkages between socio-economic and cultural factors and the resilience of agroecosystems, including the role of markets, policies, gender, and social equity in supporting or hindering adaptive capacity.
- **Monitoring and evaluation of resilience:** The development and application of indicators and methods to assess and monitor the resilience of agroecosystems, including the use of participatory and integrated approaches to engage stakeholders and enhance learning.

The symposium will provide a platform for participants to exchange knowledge, experiences, and perspectives on building resilience in tropical agroecosystems. The symposium will also aim to generate new insights, collaborations, and recommendations for future research and action to enhance the resilience of tropical agroecosystems.

The ICBRITAE 2023 Proceedings are a valuable repository of knowledge from esteemed scientists, policymakers, planners, technologists, and thinkers on the topic of building resilience in tropical agroecosystems. The Editorial Board affirms that maintaining high standards necessitates a rigorous review process for accepting papers. This year, a significant number of submissions were received, and each one underwent thorough evaluation by 2–5 program committee reviewers. The Editorial Board expresses deep appreciation to the authors whose technical expertise and dedication are showcased in these proceedings. Their exceptional contributions and hard work have made it possible to compile this valuable collection of knowledge.

A total of 101 papers will be presented across eight sub-themes, with each sub-theme consisting of eight parallel technical sessions. The sub-themes include: (1) Agro Ecosystems and Biodiversity Conservation (2) Ecosystem Management and Socio-ecological Resilience (3) Green Infrastructure and Urban Resilience (4) Indigenous Knowledge, Precision Agriculture and Agricultural Productivity (5) Global Food Safety and Security (6) Disasters and Agricultural Vulnerability (7) Life Cycle Assessment and Circular Economy and (8) Agricultural Policies, Concepts and Strategies.

We express our gratitude to our keynote speakers for dedicating their time and effort to curate the materials and share their diverse and insightful experiences, resulting in remarkable presentations. Our heartfelt congratulations also go out to all the oral and poster presenters, whose exceptional and dynamic presentations successfully fulfilled the learning objectives of students at all levels, including undergraduates, graduates, policy makers, and professionals. We extend our appreciation to the session chairs for their exemplary work in overseeing the paper reviews within their sessions and managing the assignment of other volunteer reviewers, conference technical program committee members, and designated reviewers.

In conclusion, the symposium on Building resilience in Tropical agroecosystems is a timely and important initiative that addresses a critical challenge facing global food systems and sustainable development. By fostering interdisciplinary and participatory approaches, the symposium aims to advance our understanding of the complex and dynamic nature of tropical agroecosystems and their potential for resilience, adaptation, and transformation. We hope that this symposium will contribute to building a more resilient, equitable, and sustainable world for all. The Editorial Board and Publication Committee would like to express our sincere gratitude to the chief guest, keynote speakers, and all authors for their valuable contributions and collaborative efforts in compiling the ICBRITAE 2023 proceedings. This substantial outcome is a result of the dedicated teamwork of the Publication Committee and Editorial Board, and we greatly appreciate their tireless efforts. As the editor-in-chief of ICBRITAE, I extend my best wishes to all participants for a productive and fulfilling experience at the conference.

Professor G.Y. Jayasinghe

Editor-in-Chief | Proceedings-ICBRITAE 2023

Conference Organisation

Organised by

University of Ruhuna, Sri Lanka

University of Colombo, Sri Lanka

University of Moratuwa, Sri Lanka

University of Sri Jayewardenepura, Sri Lanka

Sabaragamuwa University of Sri Lanka

University of Huddersfield, United Kingdom

University of Central Lancashire, United Kingdom

Tallinn University of Technology, Estonia

Vilnius Gediminas Technical University, Lithuania

In association with

Building Resilience in Tropical Agroecosystems (BRITAE)
*Erasmus + programme, Field of Higher Education: Strand 2 - Partnerships for
transformation in higher education*

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Head of the Department of Construction Management and Real Estate

Conference Partners

University of Ruhuna, Sri Lanka



The University of Ruhuna, Sri Lanka's sixth oldest institution of higher education, was established by a Special Presidential Decree in 1978 and became a fully-pledged university in 1984. It is the sole university located in the southern region of the country and boasts ten faculties situated in three prominent locations. The faculties of Science, Humanities and Social Sciences, Management and Finance, and Fisheries and Marine Sciences & Technology are situated in the central campus located in Wellamadama. The faculties of Agriculture and Technology are located in Kamburupitiya, and Engineering, Medicine, and Allied Health Science faculties are located in Galle. Over the past 43 years, the University of Ruhuna has made impressive strides in academic, research, and outreach activities, with significant enhancements in intellectual and infrastructure resources, cementing its position as a leader in Sri Lanka's higher education sector.

In previous years, the University of Ruhuna has actively engaged in various Erasmus Plus initiatives, encompassing student and staff mobility programs, strategic partnerships, and capacity-building projects. Through these endeavours, members of the University of Ruhuna community have been afforded the opportunity to pursue educational, teaching, and professional experiences abroad, in European nations and beyond. These programs have fostered the exchange of knowledge and exemplary practices among partner institutions and have played an integral role in enhancing the internationalization efforts of the University of Ruhuna.

The Faculty of Agriculture, University of Ruhuna, has been awarded an Erasmus Plus grant by the European Education and Culture Executive Agency (EACEA) for its proposal submitted under the call Capacity Building in the field of Higher Education: Strand 2 - Partnerships for transformation in higher education. The University of Ruhuna serves as the primary collaborator in the Building Resilience in Tropical Agro-ecosystems (BRITAE) project, which aims to enhance the capacity of higher education institutions in partner countries to address the challenges of tropical agro-ecosystems.

The primary objective of the BRITAE project is to foster innovative and interdisciplinary methods of teaching and learning within the realm of agriculture. The initiative is grounded in collaborative partnerships with universities and research institutions in Europe, Asia, and

Africa, with the ultimate goal of strengthening the capacity of higher education institutions to confront the complex and multifaceted challenges impacting the tropical agricultural sector.

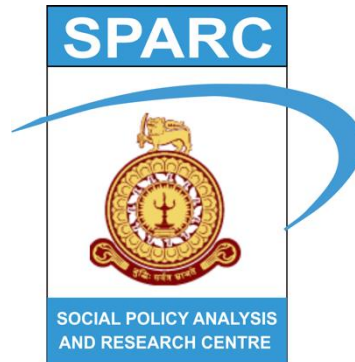
The BRITAE project concentrates on designing novel curricula and teaching approaches, encouraging research and innovation in the agricultural field, and elevating the expertise and understanding of students and faculty members in the domains of sustainable agriculture, adaptation to climate change, and the management of natural resources.

The University of Ruhuna will leverage its involvement in the BRITAE project to bolster its affiliations with prominent institutions in Europe and beyond, thereby elevating its standing as a preeminent center of excellence in agriculture and affiliated domains. Additionally, the initiative will extend valuable prospects for faculty and students at the University of Ruhuna to gain international exposure and cultivate familiarity with cutting-edge teaching and learning methodologies in the agricultural field.

For more information visit: <https://ruh.ac.lk>

University of Colombo, Sri Lanka

Social Policy Analysis and Research Centre (SPARC), Faculty of Arts, University of Colombo, Sri Lanka



Founded in 1921, University of Colombo is the oldest university in Sri Lanka, consisting of 9 faculties, 59 academic departments, a campus, a school, 7 institutes and over 20 centres and units. This renowned university provides unmatched knowledge, skills, and timely research exposure to its student population of more than 11,000 in number. The university also has a well-recognized team of academic experts with national and international experience and exposure in their respective fields. The university has a strong commitment towards research and academics in various disciplines engage in high quality research of local and international relevance.

The Faculty of Arts is the largest faculty in the university in terms of student enrolment. Its vision is to be a Centre of excellence in creative thinking, teaching, research and community outreach in the South Asian region while its mission is to promote collective scholarship, critical inquiry, competencies and skills in the social sciences and humanities, keeping in line with the highest academic and ethical standards of teaching, research, training and evaluation. The faculty has 13 academic departments and several teaching units which offer courses in the field of Social Sciences and Humanities. Apart from undergraduate BA courses, several departments offer courses for diplomas, MSc and PhD degrees.

The Social Policy Analysis and Research Centre (SPARC) is a research Centre of the Faculty of Arts, University of Colombo. It is a pioneering force in multi-disciplinary research. Professor M.T.M. Mahees is the director of the Centre. The establishment of SPARC is the culmination of a process set in motion at the university several years ago with the launch of the Improving Capacities for Poverty and Social Policy Research (IMCAP) in the late 2000s. IMCAP was a staff and student development programme which was implemented to strengthen the skills of younger academics from different social science backgrounds on poverty and social policy analysis and research.

The Centre conducts its research in diverse fields including disaster management, disaster resilience, built environment, climate change, disaster relocation, development induced relocation, vulnerable groups in post war situations, impact assessments, vulnerability assessments, youth studies, violence against children and women, and cyber violence. These

focal areas are reviewed from time to time, keeping with new experiences gained within the university and emerging critical issues that require expert attention.

For more information about SPARC visit: <https://sparc.cmb.ac.lk/>

University of Moratuwa, Sri Lanka



The University of Moratuwa (UoM) in Sri Lanka, considered to be the leading technological university in the country, comprises five faculties, including Architecture, Business, Engineering, Graduate Studies, and Information Technology. With 22 academic departments and 12 bachelor's degree programs, the university offers a wide range of undergraduate education to students chosen by the University Grants Commission (UGC). The university also offers 56 postgraduate programs, including MSc, MPhil, and PhD research-based degrees, catering to the higher education needs of over 12,000 students.

The university presently has an undergraduate student population of 9,916, in addition to 1,050 NDT diploma students of the Institute of Technology of University of Moratuwa (ITUM). The university has a well-qualified academic staff of 423 and an administrative staff of 31. The university has increased its annual intake of students by 75% overall and 200% in the IT faculty over the last ten years, meeting the growing demand for its degree programs and contributing to the human resource development of the nation.

As an internationally recognized university in Sri Lanka, UoM aims to provide transformative education in technological and related disciplines while carrying out nationally relevant and high-impact research to expand the boundaries of knowledge and enhance national technological capabilities. The university strives to provide expert services to the state, industry, and society while contributing to sustainable, scientific, technological, social, and economic development in Sri Lanka.

The University of Moratuwa is a centre for excellence in research and development in innovation and technology, with each faculty having its research unit. The Faculty of Engineering is the largest faculty, offering degree programs in civil, electrical, electronic, computer, mechanical, materials, and production engineering. The university collaborates with industries on various research and development work and has established research labs to promote University-Industry Partnerships (UIPs). The Disaster and Emergency Warning Network (DEWN), the only mobile app in Sri Lanka providing the public with disaster emergency warnings, is one such outcome of the university's research laboratories.

Improving research and innovation capacity remains a primary challenge for the University of Moratuwa, given the need to enhance this capacity for the rapid development of the country. The university has given high priority to developing a strong research and development capability in its Corporate Plan and Strategic Development Plan to contribute to national

development activities. The university believes that consulting with national stakeholders and international collaboration and sharing experiences and success stories will help achieve its goals.

The Department of Civil Engineering (DCE) at UoM is one of the largest Civil Engineering departments in Sri Lanka. The department operates under six divisions, all of which conduct postgraduate taught and research programs leading to Master's, MPhil and PhD qualifications. The department is highly active in teaching, research, and consultancy activities, making it one of the most active departments in the university.

The DCE has played a significant role in providing technical guidance with innovations and academics have chaired many national committees since the Indian Ocean Tsunami in 2004. The department was instrumental in setting up the International Institute for Infrastructure Renewal and Reconstruction (IIIRR) after the tsunami. The IIIRR is a multi-university international consortium that provides leadership in research, education, planning, design, and implementation for mitigating the impact of natural disasters and infrastructure renewal and reconstruction projects in tsunami-affected or underdeveloped regions.

The DCE has been involved in Disaster Risk Management related activities since the 2004 Indian Ocean Tsunami and has been heavily engaged in research on early warning systems, risk assessment, and mitigation. The department has provided leadership in developing many nationally important guidelines for building resilience. The DCE has experience in collaborating with many international universities and organizations, funded by ERASMUS+, EPSRC, GCRF, ADB, World Bank, among others.

Overall, the University of Moratuwa is a prestigious academic institution with a strong focus on engineering, architecture, and technology, and a commitment to research, innovation, and sustainability.

For more information visit: <https://uom.lk/>

University of Sri Jayewardenepura, Sri Lanka



The University of Sri Jayewardenepura situated in the Sri Jayewardenepura Kotte, the capital of Sri Lanka boasts of a long and glorious history, and it was established in 1959 at Gangodawila premises and its roots can be traced back to the Vidyodaya Pirivena established in 1873 by Hikkaduwe Sri Sumangala Thero at Maligakanda. Today the University pays homage to 60 years of history while paying tribute to journey of 145 years. Moreover, it is the second oldest University in Sri Lanka and the first University established in Independent Ceylon and the university was the essence of the revival of Sri Lankan Education.

Today the University stands strong with eleven (11) faculties, Faculty of Humanities and Social Sciences, Faculty of Applied Sciences, Faculty of Management Studies and Commerce, Faculty of Medical Sciences, Faculty of Graduate Studies, Faculty of Engineering, Faculty of Technology, Faculty of Allied Health Sciences, Faculty of Dental Science, Faculty of Urban and Aquatic Bio resources, and Faculty of Computing. The University is home to over 12,000 Undergraduates, and over 1000 postgraduate students. It is considered the largest University in terms of Student Population in Sri Lanka.

The University is also in the forefront of research and innovation with a research council of over 20 research centres and an Invention, Innovation and Venture Creation Council with over 50 Entrepreneurs and stakeholders with over 15 patents and recognized as the 2nd best university in Sri Lanka according to the Webometrics ranking in 2022. And the university has become the first Carbon neutral university in the South Asian region since 2023.

The University has also maintained cordial relationship with many international bodies of education and have signed over 60 MoUs with recognized internationally acclaimed universities; and over 60 MoUs with established international and local companies. Further the university strives to give its students an international experience, offering student exchange programmes and internships.

Throughout the years the University of Sri Jayewardenepura has managed to develop in many areas expanding its horizons and will continue this journey reaching many milestones that will no doubt ensure that the University will produce smart, efficient, skillful and professional individuals that will aid in the development of country.

For more information visit: <https://www.sjp.ac.lk/>



Systematic education in Sabaragamuwa province dates back to the times of King Parakramabahu II of the Dambadeniya Period, under whose patronage the Deva Pathiraja Pirivena, a 13th century monastic university, was created in the Palabaddala area of the Ratnapura District. The Sabaragamuwa University of Sri Lanka (SUSL) now stands as the present-day link to such tradition of knowledge and wisdom, which is the 12th national university of contemporary Sri Lanka.

All the degree programmes offered by nine faculties of SUSL (Agricultural Sciences, Applied Sciences, Computing, Geomatics, Management Studies, Medicine, Social Science and Languages, Technology and Graduate Studies) have been designed in line with the Vision and Mission of the university and core values of the respective faculties. The teaching, learning and assessment methods have been designed to achieve the distinctly defined objectives. SUSL programmes adopt a combination of direct-delivery and student-centered teaching and learning methods which are adequately aided with ICT.

All degree programmes allow students to get practical knowledge through off campus field-classes, internships and research components which are now compulsory components of the programmes of study. The postgraduate and distance learning/external programmes have also been devised in conformity with SLQF to cater to the competitive demands from different levels of stakeholders. Apart from the academic activities, the university encourages its students to be involved in an array of extra-curricular activities in numerous ways. It should be noted that teaching, learning and assessment, and extra-curricular activities are carried out regardless of students' gender, race and ethnicity and the requirements of differently abled students are considered as much as possible, as conditions allow. The Main Library furnishes a number of services to students and teachers on their teaching and research activities through the Library Management System.

The university and respective faculties have made a host of publication avenues for researchers to present their work. At the institutional level, active researchers are appraised by holding the biannual International Conference of SUSL (ICSUSL), Annual Research Session and rewarding at the University Day. The members of the academic staff duly incorporate their research studies in teaching. SUSL is known for its award-winning academic research carrying national and international patents, high impact publications and innovations for commercialization. The university hopes to create more opportunities that will allow its students to gain more exposure to industry far more often and improve their research and career specific skills.

The Faculty of Agricultural Sciences, is one of the outstanding faculties of Sabaragamuwa University, stands strongly with its inherited teaching, research and community services. Faculty offers B.Sc. Agricultural Sciences and Management and B.Sc. Food Business Management four-year degree programs. Agricultural Sciences consists of three academic departments Agribusiness Management, Export Agriculture and Livestock Production, representing all possible disciplines related to Agriculture. Some centers and units established within the faculty are supported to academic and other activities and also helped to enhance soft skills of undergraduates. The faculty teaching farm provides a sound practical training on all kinds of crops and livestock species. The Journal of Agricultural Sciences, one of the great assets developed by the faculty, a peer reviewed journal indexed in Web of Science as an ESCI journal, Scopus, DOAJ and EBSCO. Teaching, learning, research and outreach activities are enriched with the services of audio-visual unit, faculty farm, research labs including the mobile lab. Research landscape of the faculty strengthen with cutting edge research, internationally recognized researchers along with funding support of both local and foreign grants.

For more information visit: <https://www.sab.ac.lk/>

University of Huddersfield, United Kingdom

Global Disaster Resilience Centre, University of Huddersfield, United Kingdom

University of
HUDDERSFIELD
Inspiring global professionals

A leader in inter-disciplinary research, education, and advocacy to improve the resilience of nations and communities.

What would it be like to live in a world in which government authorities, businesses, communities, and individuals work together to create a society that is able to withstand the effects of unforeseen events and threats? At the Global Centre for Disaster Resilience, we are working with stakeholders at the global, national and local level to make this happen.

The Global Disaster Resilience Centre (GDRC) is committed to excellence in research, education, and advocacy to improve the resilience of nations and communities to disasters. GDRC is part of the School of Applied Sciences at the University of Huddersfield in the UK. In November 2013, the University of Huddersfield was awarded the Times Higher Education University of the Year. The University excels in enterprise and innovation and in 2012, was named the Times Higher Education Entrepreneurial University of the Year.

At the Global Centre for Disaster Resilience, our vision is for a society that has the capacity to resist or change in order to reduce hazard vulnerability, and to continue functioning physically, economically and socially when subjected to a hazard event.

With growing population and infrastructures, the world's exposure to hazards is increasing. When disaster strikes, communities may need to be rebuilt physically economically and socially. At the same time, it is vital that any reconstruction activity pro-actively considers how to protect people and their environment and reduce a community's vulnerability.

We seek to achieve our vision by undertaking work that crosses the traditional boundaries between academic disciplines and schools of thought. We provide strategic advice and practical guidance based on rigorous, stakeholder informed research. We are also supported by a worldwide network of partners from policy, government, industry and academia.

Professor Dilanthi Amaratunga and Professor Richard Haigh together with their team have actively contributed towards establishing better informed and more socially inclusive public policy-making and implementation towards the development of a disaster resilient built environment in Sri Lanka, since 2004. This impact has occurred in Sri Lanka through their input to the capacity development of national and local stakeholders. In doing so, their research is contributing to a reduction in the vulnerability of communities to the threat posed by hazards of natural and human origin. If our research is to benefit both research users and society as a whole in Sri Lanka, it is essential that it not only has the potential to make a practical difference but is disseminated and effectively used. This is what we have been doing in Sri Lanka (We

started contributing to the disaster management domain since 2004 even though our wider involvement in Sri Lanka goes back to 1997):

- Producing excellent research outcomes that advance knowledge and understanding across all sectors of the economy and society.
- Exchanging knowledge and ideas with business and professional partners, especially through effective use of communications, to make sure as much of my best research as possible is translated into powerful services and products.
- Conducting research that underpins high-quality teaching and learning, equipping our students with the intellectual and practical skills they need in an increasingly competitive employment market.
- Carrying out research that has a focus on social, economic, cultural, scholarly or scientific impact, the value of which is recognized by the external community through support from funders and users of research.
- Producing research outcomes that have a major, visible impact and showcasing them through the media and our website to benefit regional, national, and international stakeholders, as well as society at large.

Key activities that have been carried out by the University of Huddersfield team in Sri Lanka can be categorised under the following themes:

- International Conferences
- International research collaborations
- Partners in the capacity building Making Cities Resilient campaign in Sri Lanka
- Working with the local authorities
- Engagement with industry
- Make risk knowledge, assessments, and risk reduction part of the university curricular
- PhD projects
- Keynote speeches and other sessions linked to Sri Lanka
- International Conference presentations

The 2022 Annual Report which has just been published highlights the current/recent DRR programs being implemented by University of Huddersfield, including in Sri Lanka, with academia, policy and practice. It also reflects the collective effort of over twenty team members and documents our wide-ranging contributions across a range of research themes and projects.

The report can be viewed at: <http://gdrc.buildresilience.org/gdrc-report-2022/>

University of Central Lancashire, United Kingdom



Founded in 1828 and granted University status in 1992, the University of Central Lancashire (UCLan) is a modern university based in Preston, UK. Today the University is one of the UK's largest with a student and staff community approaching 38,000 people. Internationally, the University has academic partners in all regions of the globe, and a first-class reputation for the quality of its education. In 2010, UCLan became the first UK modern Higher Education institution to appear in the QS World University Rankings and by 2018 was estimated to be in the top 3.7% worldwide by the Centre for World University Rankings. The University encourages and nurtures originality, from its ground-breaking energy management partnership with British Aerospace Marconi Electronic Systems (BAESystems) to its launch of the world's first International Fashion Institute and the UK's first MBA in Fashion. It has a proud record of student business start-ups – a sector-leading 60% of which can be found thriving after three years. As a result of its growing portfolio and research and innovation activities, UCLan has won at the Times Higher Education Awards in the categories of Excellence and Innovation in the Arts, International Collaboration of the year, and the most innovative contribution to Business-University Collaboration.



UCLan has held the European HR Excellence in Research award since 2011 and been a full member of the Athena SWAN Charter since 2005. The [Athena Swan Charter](#) is a framework which is used across the globe to support and transform gender equality within higher education and the School of Engineering was conferred with a Bronze Athena SWAN award in 2021 in recognition of its commitment to this work.

As the first female professor in the School of Engineering, Professor Champika Liyanage led the submission for the Athena SWAN award. Undertaking many key roles in the institution, Champika is Research Degree Tutor within Civil Engineering and Construction (CCE), MSc Dissertation Coordinator, and the Research Excellence Framework (REF) lead for Unit of

Assessment (UoA) 13 on Architecture and Built Environment. She combines these and other duties with her position as Co-director of UCLan's Centre for Sustainable Transitions.

The Centre for Sustainable Transitions (CST) was established in 2019, as part of UCLan's strategic investment in research excellence. The CST brings together Engineers, Social Scientists, Architects and Psychologists to work on the systemic challenges presented by climate change. The Centre undertakes research across different disciplines to create new conceptual, theoretical and methodological innovations that integrate and move beyond discipline-specific approaches towards the transdisciplinary. The centre uses the United Nations Sustainable Development Goals (SDGs) to frame the ongoing radical socio-technical transformation for pursuit of a sustainable society. Consequently, Champika is actively involved in a wide array of research relating to sustainability; facilities and infrastructure management; and capacity building in disaster resilience. She has published over 150 peer-reviewed publications (journal and conferences papers) to-date and secured funding from, among others, Horizon 2020 and EU Erasmus+, towards internationally renowned research projects.

For more information visit: <https://www.uclan.ac.uk/>

Tallinn University of Technology, Estonia



Creators of digital innovations, Tallinn University of Technology (TalTech) is leading Estonia and the world towards a sustainable digital future. Founded in 1918, TalTech is the only university of technology and the most international university in Estonia - of the nearly 10,000 enrolled students, approximately 16% are international students, coming from more than 100 different countries.

The university is made up of 5 schools of: Engineering, Information Technologies, Science, Business and Governance, and the Estonian Maritime Academy offering research and Bachelor's, Master's and Doctoral programs in technology, applied science, IT, business and maritime studies. TalTech is currently ranked 701-750 in the QS World University Rankings.

The Building Lifecycle Research Group (BLRG) forms part of the Department of Civil Engineering and Architecture within the School of Engineering. TalTech's BLRG has been actively engaged in capacity building and curriculum development for nearly two decades with partners in Europe and Asia. Currently, it is collaborating with universities from the UK, EU, Sri Lanka, Thailand and the Philippines on a number of disaster resilience-related, capacity development initiatives co-funded by the EU's Erasmus+ program.

The BLRG approaches the building lifecycle holistically, integrating the construction process and its outcomes with management strategies, technologies, building materials, economics, and facilities management. In addition to disaster resilience in the built environment, the BLRG's areas of research include:

- The application of multicriteria decision-making methods for the assessment of different management strategies.
- Developing and providing BIM-related know-how.
- Energy saving and the renovation of buildings.
- Surveys on the building life cycle and technical conditions of housing.
- Engineering education,
- Regulation of construction activities and creation of normative materials and standards for the Estonian construction industry.
- Utilization of oil shale ash and mining waste materials in the production of building materials.
- All aspects of construction economics and management including project delivery strategies, etc.

Professor Irene Lill is the Head of the BLRG and is TalTech's Main Coordinator for the BRITAE project.

For more information visit: <https://taltech.ee/en>

Vilnius Gediminas Technical University, Lithuania



VG TU is one of the largest universities in Lithuania. VG TU is a member of over 50 international organisations and has over 200 partners consolidated by international projects. The Department of Construction Management and Real Estate (CMRE) at VG TU is well known for its achievements in e-learning. With that expertise in e-learning, intelligent library, computer learning and tutoring systems, which have been identified as one of the potential mechanisms to be developed to support LL strategies, CMRE will substantially contribute to support the implementation of LL strategies. Department is an active group in terms of R&D projects, participating in more than twenty different EU, Africa, Asia and national projects (COST, FP-5, FP-6, FP-7, H2020, TEMPUS, LLP, Intelligent Energy Europe programme). Deriving these projects, the Department has contributed to the scientific community by publishing scientific articles in the Clarivate Analytics Web of Science journals.

For more information visit: <https://vilniustech.lt/>

Keynote speakers

Senior Professor H.D.Karunaratne

Professor Karunaratne earned his PhD in Economics from the Graduate School of International Development (GSID) of Nagoya University, Japan in 2000. He also holds MA in Economic Policy from Nagoya City University, Japan (1997), MA in Economics from the Department of Economics from the University of Colombo (1992), and BA (with specialization in Economics) with First Class honours from the University of Sri Jayewardenepura, Sri Lanka (1990). His academic research focuses chiefly on Entrepreneurship, International Business, International Migration, Labour Markets, Income Inequality and International Trade. According to Research Gate, Prof. H.D. Karunaratne has more than 126 research items and over 246 Google scholar citations.



On international front, he is a recipient of Japanese Government Postgraduate Research (Monbusho) Scholarship for Seven Years (1993-2000). He was an Invited Professor in the Faculty of Economics of Hosei University, Tokyo in 2006-2008 and 2016/2017. The Japan Foundation in Tokyo awarded him a Senior Researcher Fellowship to conduct research at the University of Tokyo in 2016-2017. In recognition of overall academic and socio-cultural exposure to Japan, he was appointed as the Director of The University of Tokyo Sri Lanka Office by the University of Tokyo in October 2019. He was awarded the Foreign Ministers' Commendation by the government of Japan in August 2021.

Senior Professor Hettige Don Karunaratne is the Chair Professor of Business Economics in the Faculty of Management and Finance, University of Colombo, Sri Lanka. He completed 31 years' of service in academia and professional career by September 2021. Additionally, he serves as the Director, Institute of Human Resource Advancement, University of Colombo (IHRA-UOC) and Chairman of the Governing Council of the Institute of Policy Studies (IPS), the Vice President of Sri Lanka Economic Association (2018 – to date), President of Japanese Graduates' Alumni Association of Sri Lanka (2012-2014 and 2018 – to date). At the University of Colombo, Professor Karunaratne has held many academic positions during his 30-year stint there to date. They include Senior Professor (2017-to date), Professor (2009-2017), Associate Professor (2007-2009), all in the Department of Business Economics, Associate Professor (2003-2007) and Senior Lecturer (2000-2003) in the Department of Commerce of Faculty of Management and Finance and Lecturer (1990-2000) in the Department of Commerce and Management Studies of the Faculty of Arts. Professor Karunaratne has also held multiple administrative positions at the University of Colombo; as the Dean of the Faculty of Management and Finance (2011-2014), Acting Vice-Chancellor (April 2014), Acting Director of the Institute of Human Resource Advancement (January-May 2015), Acting Dean of the Faculty of Graduate Studies (December 2013), Chairman of the Sports Board (2011-2014), Head of the Department of Commerce (2005-2006), Head of the Department of Business

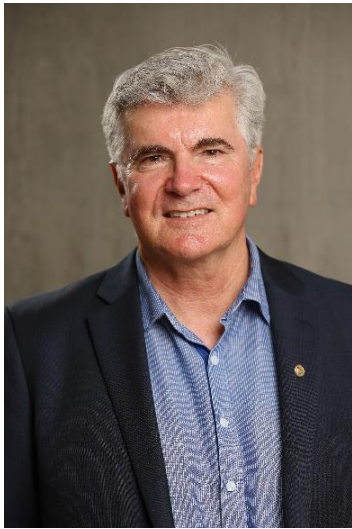
Economics (2010-2011, 2014-2016), Acting Director of Studies in the Faculty of Graduate Studies in 2009. Also, he carried out roles as the Chairman of Summit Finance PLC (2016).

Keynote:

Agricultural sector productivity and farmer's literacy in Sri Lanka

According to official statistics, over 30% of Sri Lankans are employed in the agricultural sector. However, the agricultural sector contributes only 7 % to the national GDP, out of which the fisheries sector contributes around 1.3 %, and the livestock sector accounts for 0.9%. Productivity in the agricultural sector has been continuously decreasing in Sri Lanka due to various reasons. Traditionally, Sri Lanka increased agricultural production by adopting land intensive techniques. Forest coverage and arable lands were used to expand plantation agriculture as well as domestic food production for a long period. Subsequently, majority of farmers gradually accustomed themselves to the use of more imported seeds, pesticides, weedicides and chemical fertilizer to increase agricultural production. In the recent past, Sri Lanka had to close the country from the rest of the world due to the Easter attack and the Covid 19 health crisis and thereafter the country was driven to a foreign currency earning crisis. As a result, the government had to limit importation of seeds, pesticides, weedicides and chemical fertilizer. Even importation of animal feed was restricted and the country faced a severe food crisis. The country is still in the midst of a multi-dimensional crisis compounded by ongoing, and in some instances deteriorating food security, livelihoods and protection concerns. Shortages of vital and essential medicines also persists. According to the OCHA situation Report No. 12, published on 15th February 2023, the European Union (EU) will provide approximately \$US4.3 million in grants to the FAO, which will be used primarily to purchase fertilizers, seeds, and to provide training to the most vulnerable farmers in Sri Lanka. Sri Lanka has over 1.4 million state/semi-state sector employment including over 14,000 village/urban divisional government officers (gramaniladhari) and a similar number of agricultural officers (waganiladhari). It is assumed that there are over 3 million farmers in Sri Lanka. However, the interaction between these state sector employees and farmers are severely limited. Decision-making in the agricultural sector occurs through personal involvement without the adoption of scientific methods. Therefore, strengthening of information collection and the use of information in decision making is essential to improve production levels of the agricultural sector in Sri Lanka. In addition, there is a decline in training and development programs for state sector employees in agriculture and farmers in Sri Lanka. Furthermore, it is essential to incorporate, financial literacy, technical literacy, networking abilities, value addition and innovative approaches to training programs designing and conducting for agricultural officers and farmers in Sri Lanka.

Professor Mark Howden



Prof Mark Howden is Director of the ANU Institute for Climate, Energy and Disaster Solutions, an Honorary Professor at Melbourne University, a Vice Chair of the Intergovernmental Panel on Climate Change (IPCC), Chair of the ACT Climate Change Council and contributes to several major national and international science and policy advisory bodies. His work has focussed on climate impacts and adaptation for systems we value: agriculture and food security, the natural resource base, ecosystems and biodiversity, energy, water and urban systems. He helped develop the national and international greenhouse gas inventories and has assessed sustainable ways to reduce emissions. Mark has partnered with many industry, community and policy groups via both research and science-policy roles and

has over 450 publications. He has been a major contributor to the IPCC since 1991 now being a Vice Chair of IPCC Working Group 2.

Keynote:

'Adapting Tropical Agro-Ecosystems to climate change'

Tropical agriculture historically has been heavily affected by climate factors (for example the El Nino/La Nina system, the various monsoons, different categories of extreme events as well as via temperature and rainfall averages). Tropical agriculture has generally adapted to these past, variable climatic conditions so as to deliver to the goals and values of the individuals, communities and enterprises involved. However, this past dependence on climate makes it clear that if the climate changes, then tropical agriculture will need to change too.

This process of change is called climate adaptation. There exist many different theoretical frameworks around adaptation. A pragmatic approach to adaptation is to ask a series of questions. What is it you are trying to achieve and what values does your current agricultural activity support? What climate changes are likely and how may they affect achievement of those values and goals? What decisions can you take to better achieve your values and goals? Who takes action? What action is best to take? How has that adaptation worked, and do you need to change that or change your goals? How can climate adaptation contribute to the paired goal of reducing greenhouse gas emissions and to overall sustainable development.

Tropical agriculture is hugely diverse, responding to different environments, cultural precepts, technologies, and capacity. One possible framing of commonality is that across the different systems there is often a concern about both risks and returns and how to balance trade-offs between these to meet the underlying goals and values of the individuals, communities and enterprises involved. This presentation will illustrate how both risks and returns are fundamentally affected by climate changes. The presentation will briefly address the driving factors for climate change and how they are likely to evolve, projections for climate changes that are particularly relevant for tropical agriculture and how climate changes are already affecting agricultural productivity. This establishes a strong rationale for increasing the focus

on climate change adaptation. The presentation will then outline the importance of both immediate, incremental adaptations as well as for more transformational ones. It will demonstrate the critical importance of developing the capacity for effective and equitable adaptation responses and the underlying factors that can assist with this. Finally, it will raise the prospect that we will sometimes need to re-think our values and goals in the face of climate change and the leadership needed to navigate possible forthcoming changes.

Professor Ayon Chakraborty

Ayon Chakraborty is an Associate Professor in Project Management within the Institute of Innovation, Science, and Sustainability at *Federation University, Ballarat, Australia*. He is also *Program Coordinator* for Maste s in Engineering Project Management program. Prior to joining the university, he worked as an Associate Professor in Operations Management and Decision Sciences area at *Indian Institute of Management Tiruchirappalli, India*. Ayon also worked as Post-Doctoral Research Fellow, Services Science Discipline, Information Systems School at the *Queensland University of Technology, Brisbane, Australia*. He received his Ph. D degree from *National University of Singapore* in the area of Service Quality. He has more



than eleven years of experience in teaching and consulting business students and executives at various institutes such as Queensland University of Technology, James Cook University Australia (Singapore Campus). His main research interests are in the areas of sustainable development and circular economy, specifically in Micro, Small and Medium Enterprises (MSMEs) and Operational Excellence such as on Lean, Six Sigma, TQM, and other tools and techniques.

Keynote:

Understanding Circular Economy Landscape in Small and Medium Enterprises

Institute of Innovation, Science, and Sustainability, Federation University, Mount Helen, Australia

Circular Economy (CE) has emerged as a new alternative to linear economy of take, make, and dispose. CE as a concept provides a model of production and consumption which includes recycle, reuse, remanufacturing, refurbish, redesign, repair of existing products or materials. The objective is to prolong the lifecycle of the products as much as possible and thus minimize the waste reaching to landfill. In ideal scenario, CE should lead to zero waste. While China and European Union are at the forefront of CE initiative, the concept is also gaining momentum in other countries. CE as a phenomenon is also garnering much attention in Australia and India. The studies on CE so far focused on industry set-up, more so in SMEs (Small and Medium Enterprises). Major discussion on CE adoption in SMEs is around drivers, barriers, business models and actions. Most of these studies are based on reviews with limited findings from empirical research. Understanding this void, the focus of this study is to look not only at enablers, and challenges, but also on strategies, resource and energy efficiency, practices and actions. The study will report on empirical findings from a survey conducted in Australia and India. The survey in Australia was conducted through Qualtrics and in India through a third-party service provider who has SME representatives on their panel. Response rate form Australia and India were 350, 220 respectively. In case of Indian responses at the end only 157

were usable. Respondents of survey in Australia consisted of employees with the following roles, managerial level (36%), executive manager (28%), administrative (18%), and technical (11%). The Indian sample was composed of the following positions, director (69%), manager (16%), CEO (9%), owner (3%) and chief managing director (2%). Major barrier of CE adoption from Australian data observed was "do not have clearly defined business processes to support change for environmental management" since it had the third highest average of agreement and indicates a lack of support for the implementation of CE. The Indian SMEs response shows that "lack of customer awareness to reduce the impact on the environment" is a major barrier with 77% of the respondents agreeing with the existence of this barrier.

In case of energy usage and measuring resource efficiency, it is observed that SMEs in Australia primarily use electricity from grid, followed by diesel and natural gas, though some SMEs mentioned about using renewable sources, but the proportion is very less. In case of SMEs in India, primary energy source is natural gas, followed by electricity. The Australian SMEs demonstrated a more advanced environmental performance improvement than social and economic. The performance in the social dimension also showed advances according to the perception of the respondents. Mainly in terms of social wellbeing, and health and safety standards due to circular economy initiatives. The results show that Indian SMEs perform better from an environmental perspective, followed by economic and social performance. Overall, the findings show that SMEs in both Australia and India are active in CE adoption. SMEs from both countries have different challenges and focus on energy and resource efficiency is also varied. In case of sustainable performance, SMEs in Australia are more focused on enhancing social performance indicators whereas for India the priority is more on improving environmental factors. Finally, energy and resource efficiency measures show limited applicability of renewable energy sources but there is growing focus now towards conservation of water resources and emission reduction.

Professor Artūras Kaklauskas



Chair, Construction Management and Real Estate Department, Vilnius Gediminas Technical University.

Member, Research Council of Lithuania Member, European Open Science Cloud Steering Board, European Commission.

Expert, Intergovernmental meeting on Draft Recommendation, UNESCO Ethics of AI.

Member, Lithuanian Academy of Science.

Editor in Chief, Civil Engineering and Management Journal.

Editor, Engineering Applications of Artificial Intelligence Associate Editor, Ecological Indicators.

Participant, 5 Horizon 2020 programme projects and over 30 other projects in the EU, US, Africa and Asia.

Author, 193 papers in Web of Science Journals, with a 33 Web of Science H-Index, and 3917 citations in Web of Science Journals.

Keynote:

Application of ground-breaking technologies in students' education

Universities applied various ground-breaking technologies to students' learning processes. According to our research, the following development in educational research, recent developments, policy, and practice need to be reflected through the education curriculum: big data analytics, artificial intelligence, micro-learning mobile learning, gamification, AR/VR/Immersive reality, IoT, blockchain, robots. A few examples are briefly presented below. Video Neuroanalytics performs real-time analytics of affective, emotional and physiological (AFFECT) states during courses. Video Neuroanalytics analyses can rate the learning process according to the student's AFFECT states. Based on these ratings, Video Neuroanalytics give recommendations for improving the learning process for different stakeholders. Video Neuroanalytics can perform the real-time mapping of students' AFFECT states during the learning process. The maps are then used as a reference to offer stakeholder groups personalised tips on ways to make the learning process more efficient. Web Text Mining automatically detects in real-time opinions about the learning process expressed in blogs, online forums, Facebook, Twitter and other social media channels, comments, ideas, notices, surveys, studies, papers, research, articles, and reviews, thereby allowing visualisation of threats held towards the issues learning process. By applying Web Text Mining is possible to understand and monitor students' opinions, thoughts, sentiments, attitudes, emotions, and preferences and allow stakeholders to make superior decisions.

Eng. Bandula Wickramaarachchi



Bandula Wickramaarachchi works as a Technical Specialist at Asian Disaster Preparedness Center since 2019. He was the Secretary to the Ministry of Primary Industries and Social Welfare. He chaired the Board of Directors of the Agriculture Sector Modernization Project funded by World Bank, International Pepper Community, an intergovernmental organization based in Indonesia, the National Council for Elders, and the Board of Directors for Visually Handicapped Trust Fund. He was also a member of Board of Directors of Export Development Board.

Bandula received B.Sc. Civil Engineering degree and P.G. Dip in Environment from University of Moratuwa. He is a Corporate Member of the Institute of Engineers Sri Lanka and graduated to a Chartered Engineer. He has also followed P.G. Dip in Geoinformatics. Bandula is an ISO (ISO 22301:2012) certified practitioner for Business Continuity Management and a master trainer on Incident Command System.

Bandula commenced his carrier as a Construction Project Manager. Completing 20 years in Sri Lanka Engineering Service, attached to Coast Conservation Department, he has extensive exposure to coastal sciences, coastal disasters and coastal economy. He is well-informed of the risk induced by Climate Change. He was consulted by Geo-informatics & Space Technology Development Agency to evaluate Conceptual Satellite Models for Thailand Earth Observation System Phase 2 on environment, disaster and water. Conducting joint research on environmental, he worked closely with Japanese Aerospace Exploration Agency, Tokyo University, and Asian Institute of Technology. Having worked with Asian Disaster Preparedness Center in Bangkok as a Senior Technical Specialist has led him to explore the disaster environments in Cambodia, Vietnam, Lao PDR, Myanmar, Nepal, Pakistan, Thailand and Sri Lanka.

Keynote:

Agroecosystem Resilience; A Matter of Administration and Technology

The agroecosystems are complex systems that interact with and are induced by the elements of the natural environment, while humans tailored those with socioeconomic and cultural elements for their consumption and production. Being sensitive elements of or exposed to nature, they are most susceptible to biological and climatic stresses. As these ecosystems produce are linked to local and global markets, eventually, there are exposed to market stresses. These stresses could be short-term, or long-term some appeared suddenly while others are predictable, and some are more severe while others slowly erode the production capacities and economic benefits. Agroecosystem resilience implies the capacity to sustain production, and economic benefits in the face of shocks or stresses, either by resisting or adapting to change. The proper agroecosystem administration and technological transformation of the practices built on the agroecosystem intelligence enhance the resisting or adaptive capacities of the

agroecosystems and then lessen the impacts of stresses. There are enough administrative instruments and technologies developed globally that enhance the resilience of agroecosystems which can be carefully adapted to local environments. Due to poor resistance or adaptation, smallholders are more vulnerable to these stresses. Hence, the resilient value chain approach should be promoted for benefiting all nodes of the value chain and at large the entire agroecosystem.

Dr. Didier Lesueur

Didier Lesueur received a PhD in Plant-Soil-Microorganism interaction from the University of Paris I (Pierre & Marie Curie) in 1992. He has been getting a position in CIRAD for working in France at the BST laboratory, in Senegal for 8 years, in Kenya for 6 years, in Thailand for 5 years and currently at CIAT-Hanoi. For all these positions, he was leading soil microbiology research. His main areas of research have been biological nitrogen fixation and the utilization of beneficial microorganisms for inoculating legumes and other crops within agro ecological systems in relation with nutrient cycles. He is currently coordinating the CMBP Asia-Pacific network on microbial biotechnologies aiming to develop soil biological indicators for improving soil health management by farmers. His field experiences are mainly in Africa and Southeast Asia. He has co-authored over 70 referred journal articles or book chapters and has trained 10 PhD students and 35 M.Sc. students from North and South. He is Editor board of 2 International journals.



Keynote:

“Why soil health is crucial for sustaining soil biodiversity and enhancing crop yields in tropical agroecosystems?”

Laetitia Herrmann^{a,b}, Viet San Le^{a,b,c}, Lambert Bräu^a, Long Van Nguyen^{a,c,d}, Phuong Nhat Thi Bui^{b,e}, Duy Quang Nguyen^{a,b,f}, Ngo Phuong Anh^{b,g} and Didier Lesueur^{a,b,h,i,j}

^a School of Life and Environmental Sciences, Faculty of Science, Engineering and Built Environment–Deakin University, Melbourne, VIC 3125, Australia

^b Alliance of Bioversity International and International Center for Tropical Agriculture (CIAT), Asia hub, Common Microbial Biotechnology Platform (CMBP), Hanoi, Vietnam

^c The Northern Mountainous Agriculture and Forestry Science Institute (NOMAFSI), Phu Tho, Vietnam

^d The Pepper Research and Development Center, Pleiku, Vietnam

^e Faculty of Biology, University of Science, Vietnam National University, Hanoi, Vietnam

^f Faculty of Chemical and Food Technology, Ho Chi Minh City University of Technology and Education, Ho Chi Minh City, Vietnam

^g School of Biology and Food Technology, Hanoi University of Science and Technology, Hanoi, Vietnam

^h Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), UMR Eco&Sols, Hanoi, Vietnam

ⁱ Eco&Sols, Université de Montpellier (UMR), CIRAD, Institut National de Recherche pour l’Agriculture, l’Alimentation et l’Environnement (INRAE), Institut de Recherche pour le Développement (IRD), Montpellier SupAgro, 34060 Montpellier, France

^j Chinese Academy of Tropical Agricultural Sciences, Rubber Research Institute, Haikou, China

Farmers across the world are concerned about the impact of chemical inputs on food safety and their own health. Obviously, it is time to reduce as much as possible the utilization of chemical fertilizers and/or pesticides and to promote sustainable alternatives taking into account soil health such as agroecology. Surprisingly soils have been neglected for decades until recently with the creation of the Soil World Day on December 5th every year since 2015 with huge negative consequences on their health and sustainability.

People had been talking about soil quality only. Soil quality is usually defined as “the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation”. But now the concept of soil health is promoted as it is directly related to a sustainable management, not only about yields. Soil health is defined as « the continued capacity of soil to function as a vital living system, within ecosystem and land-use boundaries, to sustain biological productivity, maintain the quality of air and water environments, and promote plant, animal, and human health.

Thus, obviously several specificities characterize a healthy soil. Among them we find: soil stability, rich biological diversity, stress resilience, important level of nutrients, nutrients are reused in the ecosystem internal cycling. A healthy soil provides important functions for plants, such as anchorage, physical structure suitable for root growth, the capacity to infiltrate and absorb water, the storage and release of nutrients and the suppression of pests and diseases. Actually, improving soil health makes the whole plant-soil system more resilient and then plants can be more stress-tolerant.

Although many existing soil abiotic and biotic parameters describe soil health, there is a deficiency of well-identified, reliable and consistent indicators to detect changes due to soil management, affecting soil health. There is a need to develop a minimum set of relevant soil health indicators that are linked to soil functions and that facilitate the monitoring of soil health restoration.

Through the ASIA-Pacific Common Microbial Biotechnologies Platform network (<https://www.cmbp-network.org/>) created in 2019, scientists from universities, research institutes and private companies interact and collaborate to promote agroecology in order to restore and sustain soil health and plant productivity at no cost for the environment. We will make a focus on ongoing studies carried out in Vietnam (Northern Vietnam on tea and Central Highlands on coffee and black pepper) to illustrate how agroecological practices can enhance soil health in a sustainable way.

Professor Dr. Siegfried Zürn

Prof. Dr. rer. nat. Siegfried G. Zuern, MBC
Director International Centre and Graduate School
Professor of Operations Management
Esslingen University of Applied Sciences, Germany



Dr Zuern is Professor of Operations Management and Director of the International Centre and Graduate School at Esslingen University of Applied Sciences. He holds a PhD in Natural Sciences from the University of Munich and a Master's degree in Management Consulting from the University of Wismar.

Before his academic career, he filled senior international management positions in multinational chemical companies for more than 20 years, e.g. as plant manager (France) or R&D director. Dr Zuern's core scientific competencies are in the areas of industrial project and quality management, sustainability and R&D management with a strong focus on systems thinking modelling. He develops business games and simulations on the above-mentioned topics, which are used in corporate education and training.

Keynote:

**Systems Thinking Simulation Modeling of the 17 SDGs as a basis for CSR reporting:
Example of a large international fruits and vegetables company.**

Global warming, soil degradation, water scarcity, inequality and poverty are just some of the many problems the world is currently facing. For this reason, the area of social responsibility and sustainability has gained importance in all sectors of the economy. Against this background, many large companies, but also more and more SMEs, practice Corporate Social Responsibility (CSR) as a self-regulating business model. The concept enables them to demonstrate their social responsibility to their stakeholders and the public. By adopting clear CSR strategies and best assessment practices, companies take responsibility for their impact on society across all economic, social and environmental dimensions.

One of the most widely used methodology for addressing CSR are the 17 Sustainable Development Goals (SDGs) contained in the United Nations (UN) 2030 Agenda for Sustainable Development. This global document calls on governments, businesses, academia and people to mobilise their efforts through targeted action to create long-term value that is socially, economically and environmentally balanced. It is widely recognised that the 17 SDGs cannot be considered as independent values but are highly interlinked. In this sense, actions taken to change one SDG will inevitably influence others either in the same direction or vice versa. With this in mind, a System Thinking Model (STM) is an adequate tool for the analysis of the relevant interactions within a given system (here: 17 SDGs) and allows for the comparison of alternative courses of action using simulations.

The example presented shows a STM from the perspective of the food industry (fruit and vegetables) and its supply chain, built with the elements associated with achieving the SDGs. The model development including its characteristics, external influences, activities and the derivation of scenarios can contribute to shape the vision of CSR in the mentioned industry.

The scenarios were built on varying requirements and restrictions a supply chain is facing by considering several internal and external conditions that might determine its successful execution. The results of these simulations helped the case company to define the future of its sustainable actions considering a holistic view of its positive or negative impact on the SDGs and provide valuable basic information for the CSR. The analysis of the information clearly showed that to reach positive impacts on the SDGs, companies need to develop additional organizational practices that are preceded by internal competencies and new structures including actions across their complete supply chain, without forgetting the integrated nature of these goals. In addition, there is growing evidence that the success in planning and implementing CSR initiatives hinges on engaging the right set of stakeholders and partners.

The STM was primarily designed for application to the case company in the food supply chain. The configuration has been reviewed and validated by academics and practitioners who have experience of incorporating the SDGs into supply chains and business strategies. It is important to recognise that the case company is a global company operating in different countries and cultures, with a broad portfolio of suppliers and producers. As such, the STM represents a comprehensive model that can be applied to other companies in the same industry to assess their sustainable development. However, an STM should be adapted with regard to the specific resources, events, measures and scenarios for each new company or organisation.

Thematic Sessions

Session One – Agro-Ecosystems and Biodiversity Conservation

Agro-Ecosystems and Biodiversity Conservation	
Chair and Co-Chairs	Prof KL Wasantha Kumara Prof. Emlyn David Qivitoq Witt
Short Description	<p>Agroecosystems provide humans with food, fiber, and other goods, while biodiversity conservation aims to protect and manage the diversity of life forms in ecosystems. The central focus is on managing agroecosystems in a way that supports biodiversity conservation by implementing agricultural practices that promote the health and diversity of plant and animal species and sustain ecological processes and services that underpin them.</p> <p>However, there are several challenges in achieving this objective, including the need to balance food production demands with the need to preserve natural habitats and ecosystems. Nevertheless, there are numerous opportunities for collaboration and innovation among farmers, policymakers, scientists, and other stakeholders to build more sustainable and biodiverse agroecosystems.</p> <p>The overall theme examines the intricate interplay between agriculture and biodiversity conservation, and serves as a platform for sharing knowledge, best practices, and solutions for creating more resilient and ecologically sound food systems.</p>
Session Format and Programme	Agenda item
<i>Oral Presentations</i>	<p>A Systematic Review of SWAT Model Applications, Performance, Challenges, and Future Need for Simulation in Tropical Watersheds in Asian Context. <i>P.B. Ranasinghe, T.A.N.T. Perera and G.Y. Jayasinghe</i></p> <hr/> <p>Impact of Land Use and Land Cover Changes on the Mangrove Diversity of the Negombo Lagoon, Sri Lanka <i>C.M.K.N.K. Chandrasekara, K.D.N. Weerasinghe, S. Pathirana and R.U.K. Piyadasa</i></p> <hr/> <p>Roles of Small-scale Seed Companies for Agrobiodiversity Conservation and Social Mechanisms Behind the Seed Industry in Japan <i>Ayako Kawai</i></p> <hr/> <p>Seed System Governance for Sustainable Agriculture - Management of Bio-cultural Diversity Based on Endogenous Development <i>Yoshiaki Nishikawa</i></p> <hr/> <p>Seed Governance in Sri Lanka During the Social and Economic Crisis <i>Mitsuyuki Tomiyoshi, A.M.S.M.R.S.G. Bandara, D.A.M. De Silva</i></p> <hr/> <p>Indirect Seed Conservation in Small-Scale Agroecosystems of Laos and Japan <i>Isao Hirota</i></p> <hr/> <p>Diversity and Usage of Capsicum Peppers in Southeast Asia <i>Sota Yamamoto</i></p> <hr/> <p>A Scoping Review of Participatory Research Methods in Agroecology Studies Conducted in South Asia <i>Heather Ohly, Zainab Ibrahim, Champika Liyanage, Andrew Carmichael</i></p> <hr/> <p>Evaluating the Suitability of Manilkara zapota (Sapodilla) and Madhuca longifolia (Mee tree) Seedlings as the Rootstock for Grafting Manilkara haxandra (Palu) in Sri Lanka <i>R.M.K.S.Rathnayake, N.P. Vidanapathirana, L.M. Rifnas, A.J.M.C.M. Siriwardana</i></p>

*Poster
Presentations*

Life-History Traits Divergence of Selected Natural Populations of *Oryza rufipogon* in Sri Lanka

B.M.P.D.B Wijerathna, P.S. Sandamal, T.M.S.A Tennakoon and D. Ratasekera

Developing Strategies for Sustainable Farming Using SWOT Analysis: A Case Study of Midigama Fruit Farm

W.A.L.P. Madhushika, W.N. De Silva and P.V.A.C. Udayanga

Session Two - Ecosystem Management and Socio-ecological Resilience

Ecosystem Management and Socio-ecological Resilience	
Chair and Co-Chairs	Prof Nishara Fernando Prof Champa Navaratne
Short Description	<p>Ecosystem management involves employing practices and strategies to sustain the health and functionality of ecosystems, whereas socio-ecological resilience refers to the capacity of social and ecological systems to adapt and recover from disturbances and shocks.</p> <p>The main focus is on managing ecosystems in a way that supports socio-ecological resilience. This necessitates considering the social, economic, and cultural factors that influence how people interact with and rely on ecosystems, as well as the ecological processes and services that support these interactions. There are various challenges, such as balancing the demands of economic development with the need to safeguard natural resources and the services they provide.</p> <p>The sub-theme explores the intricate relationship between ecosystem management and socio-ecological resilience and serves as a forum for exchanging knowledge, best practices, and solutions to create more adaptive and resilient socio-ecological systems.</p>
Session Format and Programme	Agenda item
Oral Presentations	<p>Assessment of Groundwater Vulnerability in Sri Lanka: A Systematic Literature Review <i>O.D.I.P. Dissanayake, T.A.N.T. Perera and G.Y. Jayasinghe</i></p>
	<p>The Role of The Informal Municipal Solid Waste Management' Sector In Improving Socio-Ecological Resilience <i>Nishara Fernando, Malith De Silva</i></p>
	<p>Video as a Tool to Educate Farmers about Climate Smart Agricultural Practices for the Sustainable Management of Small Irrigation Tank Cascade Systems (STCS) <i>K.P.P. Kopyawattage, Sanjaya Fernando and M.A.H.T. Madurasinghe</i></p>
	<p>Quantitative Sequencing of 16S rRNA Gene for Comprehensive Pathogen Tracking in a Municipal Wastewater Treatment Plant <i>R.U. Galagoda, Monychottepy Chanto, Yasuyuki Takemura, Noriko Tomioka, Kazuaki Syutubo, Ryo Honda, Ryoko Yamamoto-Ikemoto, Norihisa Matsuura</i></p>
	<p>Impact of the Physical Environment of Slum Dwellers during the Relocation Process in Sri Lanka: With Special Reference to the Peliyagoda Urban Council in Gampaha District, Sri Lanka. <i>D.M. Chandradas and H.D.H. Jeewanthi</i></p>
	<p>Mimicking Nature for Disaster Risk Reduction in Coastal Regions <i>Nuwan Dias, Chethika Abenayake, Naduni Kasturiarachchi, Richard Haigh, Dilanthi Amaratunga</i></p>
	<p>Nature Based Solutions for Building Resilient Food Systems in Sri Lanka: an Analysis of Agricultural Landscapes. <i>D.A.M.D Silva, Kavindi Seenapatabendige, Ruwini Bandara, Ruwini Basnayake and S.K. Gunathilake</i></p>
	<p>The art of imitating nature: a potential application of biomimicry in shaping the future of multi-hazard evacuation <i>Malith Senevirathne, Dilanthi Amaratunga, Richard Haigh</i></p>
	<p>Building resilient agri-food value chains role of innovation, product development and commercialization <i>W.M.T. B Weddagala, D.A.M De Silva, R.K.C Jeewanthi, & A.M.C. Adhikari</i></p>

	<p>A University-Enterprise Collaborative Framework for Disaster Resilience <i>Kinkini Hemachandra, U.T.G Perera, Dilanthi Amaratunga, and Richard Haigh</i></p>
	<p>Recommendations for Improved Transboundary Flood and River Governance in the Urban Ciliwung River Basin, Indonesia <i>G. Clegg, R. Haigh, D. Amaratunga, H.P. Rahayu</i></p>
<p><i>Poster Presentations</i></p>	<p>SWAT Model for Streamflow Simulation in Nilwala River Basin: Calibration, Validation, and Sensitivity Analysis <i>S.H.S.R Silva, L.S.B. Dhanapala, M.H.J.P. Gunarathna and G.Y. Jayasinghe</i></p>
	<p>“Best Practices for Lobsters”: A Precautionary Approach for Lobster Fisheries Management in Sri Lanka <i>B.M.R.L. Basnayake and D.A.M. De Silva</i></p>
	<p>A Review on Application of Wetland Aquatic plants as a Sustainable Phytoremediation method for Heavy Metals in Polluted Water <i>A. Thashanth, I.W. Edirisooriya, S.B.H. Madhurangi, W.G.K.D. Jayalath, A. Judejokkimson and W.G.S.M.K. Wakkumbura</i></p>
	<p>Potential of Oyster Mushroom (<i>Pleurotus ostreatus</i>) in Degrading Agent for Selected Agro – wastes <i>A. Azna and R. Kapilan</i></p>

Session Three - Green Infrastructure and Urban Resilience

Green Infrastructure and Urban Resilience

Chair and Co-Chairs	Prof Ranjith Dissanayake Prof. Lalith Rajapakse
Short Description	<p>Green infrastructure encompasses natural and semi-natural green spaces, such as parks, wetlands, and green roofs, that offer multiple ecological, social, and economic benefits to urban areas. Urban resilience denotes the ability of urban systems to endure and rebound from environmental and socio-economic stresses and shocks.</p> <p>The sub-theme focuses on leveraging green infrastructure to augment urban resilience. This necessitates designing and managing urban green spaces to provide a variety of ecosystem services, including air and water purification, temperature regulation, and carbon sequestration, and also to bolster human well-being and social cohesion. The challenges include addressing issues of social equity and environmental justice in the design and management of green infrastructure, as well as securing long-term funding and political support for these efforts. The sub-theme examines the intricate interplay between green infrastructure and urban resilience and offers a platform for exchanging knowledge, best practices, and solutions to build more adaptive and resilient urban systems.</p>

Session Format and Programme	Agenda item
<i>Oral Presentations</i>	<p>A Cost Benefit Analysis of Vertical Greeneries of Sri Lanka; A Simulation Analysis Based on Design Builder Software <i>G.D.C.Jayakody, G.Y. Jayasinghe, R.U. Halwatura and K.G.N.H. Weerasinghe</i></p> <p>Degradation of Wood Quality of Eucalyptus Grandis Logs Exposed to The Natural Environment <i>W.V.T.D. Amarasinghe and C.K. Muthumala</i></p> <p>Unheard Voices of Flood-Affected People in the Process of Urban Disaster Resilience Building in Kolonnawa, Sri Lanka <i>H.U.S. Samaraweera</i></p>
<i>Poster Presentations</i>	<p>Urban flood assessments in low lying areas: case study in Kelani River Basin, Sri Lanka <i>T.A.N.T Perera, S.H.K Semasinghe and R.U.K. Piyadasa</i></p> <p>Particulate Matter Passive Mitigation by the Foliage of Green Infrastructure <i>H.A.T.N. Perera, G.Y. Jayasinghe, R.U. Halwatura and K.G.N.H. Weerasinghe</i></p> <p>Building Resilience in Changing Climate through Land Use and Land Cover Management - A Case Study in Colombo, Sri Lanka. <i>P.M.I. Mathota Arachchi, C.M. Navaratne and L. Manawadu</i></p> <p>The Verandah: Building Resilient Housing for Internally Displaced People <i>K.B. Seenapatabendige</i></p> <p>Applicability of Green Roofs to Improve Urban Resilience in Sri Lanka: A Review <i>S.V. Gunathilaka, A.H. Weerakoon, H.G.O. Piyumanthi, T. N. Samarakkody, W.D.G.N. Bandara and H.E.M.I.G.J.U.K. Ekanayake</i></p> <p>Effectiveness of Different Plant Species for Green Roofing to Reduce Building Temperature – A Review <i>Y.Aingaran, N.N.N Amani, R.M.S Jayarathna, K.M.S.T Kulasekara, K.S.M Udayakantha and R.M.S.L Ranasingha</i></p> <p>Development of an Energy Trading Model between Renewable Energy-based prosumers and Electric Vehicle users: A literature review <i>A.C.W. Haputhanthirige, C. Liyanage, R. Yapa and R.M.U.S. Udagedara</i></p>

The Role of Green Infrastructure in Making Smart Cities Disaster Resilient: A
Mutually Beneficial Relationship
Aravindi Samarakkody, Dilanthi Amaratunga, Richard Haigh

Session Four - Indigenous Knowledge, Precision Agriculture and Agricultural Productivity

Indigenous Knowledge, Precision Agriculture and Agricultural Productivity	
Chair and Co-Chairs	Emeritus Prof. K.D.N Weerasinghe Prof. Artūras Kaklauskas
Short Description	<p>Indigenous knowledge pertains to the traditional knowledge and practices of local and indigenous communities, while precision agriculture pertains to the utilization of advanced technologies, such as sensors and data analytics, to optimize agricultural production.</p> <p>The primary focus is on integrating indigenous knowledge and precision agriculture to boost agricultural productivity. This entails acknowledging and appreciating the contributions of indigenous knowledge to sustainable agriculture, while simultaneously leveraging the potential of precision agriculture to increase yields, decrease inputs, and enhance resource-use efficiency. Numerous challenges exist, including the need to address issues of intellectual property rights and traditional knowledge protection, as well as ensuring that the advantages of precision agriculture are disseminated fairly and equitably.</p> <p>The sub-theme explores the intricate interplay between indigenous knowledge, precision agriculture, and agricultural productivity, and provides a platform for exchanging knowledge, best practices, and solutions to construct more comprehensive, sustainable, and resilient agricultural systems.</p>
Session Format and Programme	Agenda item
<i>Oral Presentations</i>	Effect of Commercial Compost Enriched with Eppawala Rock Phosphate and Feldspar on Growth of Tomato <i>W.H.A.N.C. Wijesekara, S. Wijetunga, J. Weeraratne and M.D.S. Samaraweera</i>
	Sugarcane Growth and Yield Estimation Using UAV-Based RGB Images and Ground Observation <i>M.D.S. Samaraweera, P.P. Ruwanpathirana, W.M.C.J. Wijekoon and G.Y. Jayasinghe</i>
	A Simulation Model to Estimate Actual Evapotranspiration of Sugarcane Plantations in Sevanagala in DL1 Agro Ecological Zone Using Global MODIS Data Product By NASA <i>L. M. J. R. Wijayawardhana, K. D. N. Weerasinghe, C. M. Navaratne</i>
	Sensitivity Analysis of Cultivar Trait Parameters in Agricultural Production Systems Simulator (Apsimx) Sugarcane Model: Reference to the Production Environment in Higurana, Sri Lanka <i>R.T. Nethmini, W.B.M.A.C. Bandara and G.Y. Jayasinghe</i>
	An Impact Assessment of Mango value chain to Investigate the value chain Upgrading Potentials <i>H.W.K.Madumalka and D.A.M. De Silva</i>
	Banana Value Chain and its Market Landscape <i>W.M.Sandamith and D.A.M. De Silva</i>
	Climate Resilience through Product and Process Innovation: A Case of the Tomato (<i>Solanum lycopersicum</i>) Value Chain <i>G.H.K Wanigasinghe and D.A.M. De Silva</i>
	Marketing Efforts of Small Business in a Post-Covid Landscape in Kandy District <i>M.A.E.K.Jayasinghe and D.A.M. De Silva</i>
	Role of Indigenous Knowledge in the Chilli Value Chain <i>K.P.H.P.R.Dayarathna and D.A.M.De Silva</i>

	Status of Seed Paddy Production and Seed Poverty of Traditional Rice Farmers of Central Highland of Sri Lanka <i>A.M.S.M.R.S.G. Bandara and D.A.M. De Silva</i>
	Impact of the decaying of community-based knowledge on local environment towards agro-ecosystems resilience <i>D.A.M. De Silva, R. Haigh, and D. Amaratunga</i>
	Technical Efficiency and its Determinants in Cinnamon Cultivation Sector in Galle District of Sri Lanka: An Application of Stochastic Frontier Approach <i>J.A.S.H. Jayakody and T.A.M. Pushpakumara</i>
	Impact of Irrigation Ecology on Rice Productivity: Evidence from Sri Lanka <i>Priyanga Dunusinghe</i>
	Design of Robust Eddy current brake system for Green Houses in Agriculture <i>Anupa Koswatta and W.M.R.H. Wickramasinghe</i>
	Development of Crop Yield Prediction Model Using Machine Learning Algorithms: A Review <i>H.M. Munasinghe, E.G.T. Dasunika, W.W.L. Subhodani, M. Janotheepan, E.M.U.W.J.B. Ekanayake and T.A.N.T. Perera</i>
Poster Presentations	A Key to Identify Woods of Different Eucalyptus Species <i>C.K. Muthumala and K.K.I.U. Arunakumara</i>
	A Review Study of Panchagavya Liquid Application as a Growth and Yield Promoter on Vegetable Crops <i>R.M.I. Gayathri, S.L. Nawarathna and N.P. Vidanapathirana</i>
	Developing APSIM Cultivar File for Simulating Rain-fed Sugarcane Crop Yield of Sevenagala Plantation for Changing Climate <i>S. Yogeswaran, L. M. J. R. Wijayawardhana, C. M. Navaratne, D. A. B. N. Amarasekera and K. D. N. Weerasinghe</i>
	Assessing the Crop Species Diversity and Productivity Between Organic and Chemical Agriculture Lands <i>I.C.S. Wijesinghe, and C.M.K.N.K. Chandrasekara</i>
	Impact of stocking fish fingerlings on inland fish production in Sri Lanka <i>P.S.S.L. Wickrama and A.L. Sandika</i>
	Vulnerability of rural farmers, seed poverty and readiness for own seed production: A case of hybrid maize value chain <i>P.G.W.S.L. Weerasinghe and D.A.M. De Silva</i>
	Gender, Employee Rights and Participation in the Cut Flower Value Chain <i>W.G.C.D.K. Wedage, S.T. Hansika and D.A.M. De Silva</i>
	Honeybee Value Chain: Social, Economic and Environmental Benefits & Costs <i>I.M. Wickramarathna and D.A.M. De Silva</i>
	Importance of Promoting Passion Fruit Value Chain Sri Lanka - Opportunity Overview <i>W.M.J.M.N. Weerakoon and D.A.M. De Silva</i>

Session Five - Global Food Safety and Security

Global Food Safety and Security	
Chair and Co-Chairs	Prof S.B. Navaratne Dr. R.P. Godawatte Liyanage
Short Description	<p>Food safety refers to measures taken to ensure that food is free from harmful contaminants and pathogens, while food security refers to the accessibility, availability, and affordability of safe and nutritious food for all people. This sub-theme focuses on achieving global food safety and security in the face of emerging threats and challenges, such as climate change, foodborne illness outbreaks, and food insecurity. This involves strengthening food systems' capacity to provide safe and nutritious food while addressing the root causes of food insecurity, such as poverty, inequality, and environmental degradation. Challenges include improving food safety regulations and standards, reinforcing food traceability and transparency, and promoting sustainable agricultural practices that enhance food security and reduce environmental impacts. The sub-theme will explore the complex interplay between food safety, food security, and sustainable food systems and provide a platform for sharing knowledge, best practices, and solutions to establish more inclusive, resilient, and sustainable food systems that ensure global food safety and security for all.</p>
Session Format and Programme	Agenda item
Oral Presentations	<p>Effect Of Dietary Replacement of Fish Meal with Black Soldier Fly (<i>Hermetia illucens L.</i>) Larvae Meal on Growth Performances of Broiler Chickens <i>E.W.D.M. Ellawidana, R.K. Mutucumarana, H.A.D. Ruwandeepika and M.P.S. Magamage</i></p>
	<p>Contribution of backyard poultry production systems towards the household nutritional status in Sri Lanka <i>N.S.B.M. Atapattu, W.W.D.A. Gunawardana, L.M. Abeywickrama and M. Munasinghe</i></p>
	<p>Global Food Safety and Security <i>P.D.A.G. Samarakoon, N.M.S. Kristeen, K.M.K.D. Weerasekara, J.A.T.N. Jayasooriya, H.D.C. Prasad and J.A.L.P. Jayamanna</i></p>
	<p>Development of Cookies from Chayote (<i>Sechium edule</i>) Fruit and Wheat (<i>Triticum aestivum</i>) Flour Mixture <i>W.M.J.C.B Mahaulpatha, D.M.C.C.Gunathilake and U.R.Chandimala</i></p>
	<p>An investigation into Household Food Security Access and Dietary Diversity in Southeast Nigeria <i>I.C. Ukonu, C.A. Wallace and N.M. Lowe</i></p>
	<p>Evaluation of effectivity of stigma receptivity for the successful hybrid seed production of Platycodon (<i>Platycodon grandiflorus</i>). <i>R.M.M.M. Rathnayaka, N. Dahanayaka and A.S. Balasooriya</i></p>
	<p>Analyze the Correlation Between Fruit Setting and Seeds Quality of <i>Capsicum Annuum L</i> <i>W.M.D.Dilrukshi, Nilanthi Dahanayake, A.S.Balasooriya and U.Priyadarshana</i></p>
	<p>Emergent or a Tip of Iceberg: Vulnerability of Food Security Sector in Sri Lanka <i>S. Madurapperuma, D. Amaratunga, and R. Haigh</i></p>
	<p>Can the biofortification of staple crops be part of the solution to addressing micronutrient deficiency? Key findings from the BiZiFED2 study. <i>Nicola M Lowe</i></p>

Poster

Presentations

Charcoal Evaporative Cooling Technology for Extend Shelf Life of Perishables
in Developing Countries

T.D. Karunathilaka and C.P. Rupasinghe

Challenges in Addressing Food Security and Malnutrition in Developing
Countries in Asia as a Measure of Sustainability.

*J.C.S. Rajapaksha, G.C.M. Silva, D.A.B.P. Denawaka, P.H.P.N.
Wickramasinghe, Y.D.A.S. Sandaruwan, V.A.S. Bandara and H.M.S.N. Herath*

Impacts Of Global Mega Trends on Food Security: A Review

*K.A.R. Fernando, P.L.C. Perera, B.K.V.H. Jayasinghe, U. Kesavan, N.
Thirukumaran, M.D.I.D. Manathunga and M.M.S. Ahamed*

Session Six - Disasters and Agricultural Vulnerability

Disasters and Agricultural Vulnerability	
Chair and Co-Chairs	Prof Dilanthi Amaratunga Prof Richard Heigh
Short Description	<p>Both natural and human-made disasters can have severe impacts on agricultural systems and rural communities' livelihoods. Agricultural vulnerability refers to the susceptibility of these systems to such impacts, which can be influenced by various factors such as climate variability, land use changes, and socio-economic conditions.</p> <p>The sub-theme of this discussion focuses on reducing agricultural vulnerability to disasters and building more resilient and adaptive agricultural systems that can withstand and recover from these impacts. This involves strengthening the capacity of farmers and rural communities to prepare for, respond to, and recover from disasters, while also addressing the underlying drivers of vulnerability, such as poverty, inequality, and environmental degradation. Additionally, integrating disaster risk reduction and climate change adaptation into agricultural policies and programs and ensuring vulnerable communities have access to the necessary resources and support to build resilience are crucial steps.</p> <p>The sub-theme aims to explore the complex relationship between disasters and agricultural vulnerability, providing a platform for sharing knowledge, best practices, and solutions for building more adaptive and resilient agricultural systems that can reduce vulnerability and enhance the well-being of rural communities.</p>
Session Format and Programme	Agenda item
<i>Oral Presentations</i>	<p>Modeling hydrological parameters using Soil and Water Assessment Tool (SWAT) in the Kelaniya River Basin of Sri Lanka <i>T.A.N.T. Perera, R.U.K. Piyadasa, M.H.J.P. Gunarathne and D. N. Kumar</i></p> <hr/> <p>Exogenous Application of Salicylic Acid Alleviates Negative Effects of Drought Stress in Rubber Nurseries in the Intermediate Zone of Sri Lanka <i>S.A. Nakandala, K.D.N. Weerasinghe and P. Seneviratne</i></p> <hr/> <p>Application of Circular Statistic on Wind Direction and Adjust the Sowing Date Considering Wind Characteristic and Rainfall in Galle District, Sri Lanka. <i>K.P.I. Inoka, D.A.B.N. Amarasekara, and A.L.K. Wijemannage</i></p> <hr/> <p>Opportunities and Entry Points for Enhancing Inclusive Climate Risk Management and Addressing Climate-Related Loss and Damage in Sri Lanka's Agriculture Sector <i>Dennis Mombauer</i></p> <hr/> <p>The impact of government's Agricultural policies on agricultural vulnerability in Sri Lanka <i>H.T.K.I. Jayarathne</i></p> <hr/> <p>Dynamics of Social Vulnerability among Farmers in Irrigated-Agricultural Settlements in the Dry Zone Sri Lanka <i>T. Kamalrathne, D. Amaratunga and R. Haigh</i></p> <hr/> <p>Understanding the Institutional Landscape to Increase Disaster Risk Resilience Through University-Enterprise Collaborations <i>C. Robnson, S. Robnson, C. Liyanage, A. Carmichael</i></p>

Poster

Presentations

Flood Susceptibility Assessment using Frequency Ratio and Statistical Index Models

H. D. M. Ekanayaka and G. Y. Jayasinghe

Maintaining Cropping Intensity in the face of changing Climate in village Tank Cascade Systems in the Intermediate Zone of Sri Lanka

B.M. N. Balasooriya, K. Umashankar and A.S. Hewage

Session Seven - Life Cycle Assessment and Circular Economy

Life Cycle Assessment and Circular Economy

Chair and Co-Chairs Prof Champika Liyanage
Prof Irene Lill

Short Description Life Cycle Assessment (LCA) is a tool used to evaluate the environmental impact of a product or service throughout its entire life cycle, from raw material extraction to disposal. The assessment includes analyzing the use of resources, energy, and emissions of pollutants during the various stages of the life cycle. The LCA can be used to identify opportunities for improving the environmental performance of a product or service and guide decision-making towards more sustainable options.

The Circular Economy is an economic system that aims to eliminate waste and the continual use of resources by recycling and reusing materials. It involves designing products with the intention of reusing or repurposing them at the end of their life cycle. The circular economy promotes the use of renewable resources and energy, and reduces waste by designing products for reuse and repair.

The integration of LCA and Circular Economy principles can help to reduce the environmental impact of products and services while promoting a sustainable and circular economy. By assessing the environmental impact of a product or service through LCA, designers and producers can identify opportunities for reducing the use of resources and minimizing waste. The Circular Economy can then provide solutions for designing products that can be easily reused or recycled, promoting a closed-loop system where waste is minimized, and resources are conserved.

The sub-theme aims to examine how the integration of Life Cycle Assessment (LCA) and Circular Economy principles can contribute towards creating a more sustainable future. This involves reducing the environmental impact of products and services by considering their entire life cycle, from raw material extraction to disposal or recycling, and promoting a circular economy that prioritizes the reuse and regeneration of resources.

The discussion will focus on identifying practical approaches and solutions for incorporating LCA and Circular Economy principles into business operations, supply chains, and policymaking. Challenges include the need to develop standardized LCA methodologies and metrics, promote eco-design and product innovation, and foster collaboration among stakeholders to create circular value chains.

The sub-theme will explore the interrelationship between LCA and Circular Economy principles and offer a platform for sharing knowledge, best practices, and solutions for building a more sustainable and circular economy.

Session Format and Programme

Agenda item

Oral Presentations Development of Syphoned DHS Reactor for Improving Denitrification Efficiency of Sewage Water Treatment System
S.S. Maheepala, M. Hatamoto, T. Yamaguchi

Development of the Mobile Smart Agroecosystem-based Resilience Centre for Teaching, Learning, Research and Development
Arturas Kaklauskas, Ieva Ubarte and Loreta Kaklauskiene

Integration of Circular Economic Principles within a Disaster Resilient Housing Sector
Shavindree Nissanka, Dilanthi Amaratunga and Richard Haigh

Environmental Impacts of Chicken Production Using Life Cycle Assessment:
A Case Study in Vavuniya District for Backyard Chicken and Broiler Chicken
N. Muthukumarasamy, K. Kumareswaran, S. Wijetunga, and J. Weerathne

Impact on Sustainable Development on the Tea Estates of Badulla: A Case
Study on Zero Carbon Footprint Towards Tea Estates and Community
N.M.S.U. Nissanka

Mobile Technologies for Waste Management: Design Considerations,
Challenges and Implications for Circular Economy
Ruchira Yapa, Champika Liyanage, Nishara Fernando and Naduni Jayasinghe

Agriculture Sector Modernization Project (ASM) Responding to the Economic
Crisis while Developing the Blue Economy in Sri Lanka: A Review of ASMP
Contribution to the Shrimp Industry in the Country
*M.D.N. Gunaratne, Nemindra Manamperi, M.A. Kumarasinghe, and Rohana
Gamage*

Reconstruction for Resilience and Sustainability: A Bibliometric Analysis
Mohamad Roumyeh, Emlyn Witt and Irene Lill

Can Lifecycle Thinking Lead to Burden Shifting and Incorrect Conclusions in
Agro-ecosystems?
Karl S Williams, Dan Lythogoe and Champika Liyanage

Session Eight - Agricultural Policies, Concepts and Strategies

Agricultural Policies, Concepts and Strategies

Chair and Co-Chairs	Prof. Mohamed Esham Prof Achini de Silva
Short Description	Effective development and implementation of agricultural programs and initiatives at local, national, and international levels rely heavily on critical agricultural policies, concepts, and strategies. The subtheme of this conference focuses on exploring ways to develop and implement agricultural policies, concepts, and strategies that promote sustainable and equitable agricultural development. This involves evaluating various approaches to agricultural policymaking, including market-based, participatory, and ecosystem-based approaches, while also examining innovative concepts and strategies, such as agroecology, digital agriculture, and circular agriculture. One of the key challenges in agricultural policymaking is finding the right balance between economic, social, and environmental considerations. Additionally, ensuring that policies and strategies are responsive to the diverse needs and priorities of stakeholders, including small-scale farmers, women, and youth, remains a significant challenge.
Session Format and Programme	Agenda item
<i>Oral Presentations</i>	Impact of the Organic Fertilizer Policy on Agrarian Societies in Sri Lanka: A case study of Mahaweli System C. <i>Mahesh Senanayake</i>
	Strengthening University-Industry Collaboration in Agro-Industry Innovation in Sri Lanka <i>T.G.K.D. Samaraweera, C.M. Navaratne and G.Y. Jayasinghe</i>
	Policy and Legislative Background Applicable to Tropical Agroecosystems Resilience in Sri Lanka <i>K. Hemachandra, D. Amaratunga, R. Haigh, A. De Silva and T. Uduwage</i>
	Emphasis Given to Climate Change, Sustainability, and Environmental Issues in Subject Benchmark Statements Recommended for Undergraduate and Postgraduate Programmes of Sri Lanka <i>M.H.D. Madumadhawa and N.S.B.M. Atapattu</i>
<i>Poster Presentations</i>	Source Emission Air Quality Standards for Sanitary Landfill Sites in Sri Lanka <i>D.H.U. Lakshani, G.Y. Jayasinghe and R.N.R. Jayarathne</i>
	Asymmetric and seasonal effects of precipitation and temperature on selected vegetable and dry fish prices in Sri Lanka <i>AL Sandika and P.S.S.L. Wickrama</i>
	Estimating Crop Water Requirement and Crop Coefficient of True Cinnamon (<i>Cinnamomum zeylanicum</i> Blume) at Initial Stages Using Simple Lysimeter and Pan Evaporation Approaches <i>A.M. Weerasinghe, P.K.D. Pabasara, N.S. Withanage and S.R.W.M.C.J.K. Ranawana</i>
	The Impact of Climate Change and Variability on Household Food Security in the Smallholder Farming Sector in the Dry Zone of Sri Lanka: A Case of Hambantota District <i>H.E.H. Dineshika, M. Esham and W.H.A. Shantha</i>
	Social Impact of Investment on Research, Innovation, and Commercialization: A Case Study on the Cinnamon Research Projects. <i>D.A.M De Silva, W.M.T. B Weddagala, R.K.C Jeewanthi, A.M.C. Adhikari and M.A.E.K. Jayasinghe</i>
	Problem-Based Learning and Co-Creation: An Experience with Undergraduates of Agricultural Sciences <i>A.S. Hettige and D.A.M. De Silva</i>

Conference Proceedings

Conference Sub Theme One
Agro Ecosystems and Biodiversity Conservation

A Systematic Review of SWAT Model Applications, Performance, Challenges, and Future Need for Simulation in Tropical Watersheds in Asian Context.

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Abstract

Climate change has most likely increased hydro-climatic extremes like droughts and floods, which could have detrimental effects on the socio-economic, structural, and environmental sectors. The Soil and Water Assessment Tool (SWAT), with nearly 5,000 publications, is undoubtedly one of the most widely used eco hydrological model globally. 50 publications that were published between 2000 and 2020 were examined. We excluded papers from lower-ranking journals and restricted our search to high-ranking journals (Scopus). There were just English-language papers covered. In the Asian context the majority of previous research has focused on issues such as the assessment of land use and climate change, the use of soil and water resources for agriculture and food security, flooding problems, water quality concerns, and soil erosion. This present systematic literature review focused on the SWAT model studies in the Asian context, with a focus on its applications, performance, challenges, and the prospects. Most of the SWAT calibration and validation results for these investigations were rated as satisfactory to very good results based on generally accepted performance measures. The coefficient of determination (R²) and Nash-Sutcliffe Efficiency (NSE) are the most frequently used statistics to evaluate the efficacy of the SWAT model. Several publications, however, fall short in their descriptions of the calibration and validation procedures. The availability of reliable data is one of the biggest problems in this region. A lack of hydrologic research pertinent to SWAT modeling, problems with hardware and software, human resource capacity, and a lack of institutional or financial support are also significant issues. With the highest number of publications reported for studies conducted in China, hydrological modeling is increasingly utilizing alternative climate products, such as gauge-based gridded data, ground-based weather radar, satellite precipitation, and climate reanalysis products. Future studies should concentrate on locating and generating reliable input data for SWAT modeling.

Keywords: Applications, Asian context, Challenges, SWAT model

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Abstract ID: ICBRITAE001

Life-History Traits Divergence of Selected Natural Populations of *Oryza rufipogon* in Sri Lanka

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Abstract

Information on the life history traits of the progenitor of modern rice, *Oryza rufipogon*, in Sri Lanka is relatively low, even though it has enormous potential for use in crop improvement programs of modern rice (*Oryza sativa* L.). The present study was carried out to identify the variation of life history traits of *O. rufipogon* in different natural habitats. To determine variation in life history traits across two natural *O. rufipogon* populations, reproductive data were gathered over one year from three replicated plots of naturally existing populations in Kesbawa (WL₄) and Thihagoda (WL₂). Data were analyzed considering the bimodal flowering pattern (PHASE I and PHASE II) of *O. rufipogon*. The independent t-test revealed that the Kesbawa population in PHASE I, had significantly the longest vegetative period (60.667 ± 0.66 days), flowering period (130.67 ± 4.67 days), and days to 50% heading (70.00 ± 8.08 days). However, the booting period and days to first flowering were not statistically different. The Thihagoda population showed the significantly highest booting period (88.67 ± 4.67 days) in PHASE II. The Kesbawa population takes more days to first flowering (79.33 ± 4.67 days) in PHASE II. The vegetative and flowering periods did not significantly differ between populations (PHASE II). The results suggest that the strong influence of ecology, microclimate, and geographic area is caused to the divergence of life history traits in naturally existing *O. rufipogon* populations. These findings would facilitate avenues to design breeding strategies and proper utilization of ecotype variation of wild rice resources for rice genetic improvement.

Keywords: Wild rice, AA genome, Reproductive traits, Life cycle

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Abstract ID: ICBRITAE002

Impact of Land Use and Land Cover Changes on the Mangrove Diversity of the Negombo Lagoon, Sri Lanka

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Abstract

The present research dealt with impact of population pressures and Land Use and Land Cover (LULC) changes on the mangrove diversity of the Negombo lagoon. A field survey carried out to collect data on mangrove species and Shannon diversity index was used to identify the species diversity. A LULC change assessment has been carried out using aerial photo, topographic sheets and google earth images. A human perception on LULC change has been assessed through household questionnaire survey using 300 families.

Total of 18 mangrove species were identified belong to 14 genera and 12 families from the lagoon. Land cover change analysis revealed that, mangrove specie in the area have been reduced with the time. Spatially the highest mangrove species diversity has been identified at the lagoon inlet and less species diversity around the outlet. Relatively low species diversity is identified at the middle periphery. People in the area highlighted that the land man ratio has been reduced exerting excessive pressure on the mangrove ecosystem. Urbanization, development activities, land reclamation, construction of expressway, industrial developments, unplanned constructions, unplanned mangrove plantations, fisheries industry and tourism industries were the contributing factors which create negative impact on the mangrove ecosystem.

Results of the study proved that the most common mangrove species types in the Negombo lagoon are *Rhizophora mucronata*, *Rhizophora apiculata*. Mangrove associates establish their habitats towards the proximity of the freshwater sources. *Xylocarpus granatum* is the sole species recorded in the study. Influence of *Annona glabra* is an invasive species identified towards the Muthurajawela marsh. The periphery of the Negombo lagoon is severely disturbed by different types of anthropogenic activities. Thus, the mangrove species in the area are highly vulnerable for degradation and the implementation of conservation measures is an urgent need to protect the diversity of mangrove ecosystem in the Negombo lagoon.

Keywords: Mangrove ecosystem, Human disturbance, Negombo lagoon

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Abstract ID: ICBRITAE003

Developing Strategies for Sustainable Farming Using SWOT Analysis: A Case Study of Midigama Fruit Farm

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Abstract

The Midigama fruit farm had been abandoned and has now begun to re-establish itself with an improved range of multiple cropping systems. Most farms have now begun to embrace the concept of sustainable agriculture. Therefore, this study aims to identify external and internal factors affecting sustainable farming and to develop the strategies. Data were collected through structured interviews with all levels of employees (15) at the Midigama Fruit Farm, a thorough review of documentation and farm observations. The data were analyzed using three matrices: Internal Factor evaluation (IFE) and External Factor Evaluation (EFE) matrices, the TOWS matrix, and the Quantitative Strategic Planning Matrix (QSPM). The results find that IFE and EFE are 2.77 and 2.74, respectively, and both are above 2.5, indicating that SO (strength-opportunities) strategies are appropriate to develop sustainable agriculture. Results of the TOWS matrix describe the SO strategies such as: develop the farm into an agro-ecotourism enterprise; establish a farm gate processing center; developing village-based small and medium-scale farmers' sustainable supply chains; implement fruit tracking and traceability to supply chains through QR code verification and establish open-air eco training center. QSPM confirms that the farm can develop into an agro-ecotourism enterprise which could be the most productive strategy. This study concludes that strategies based on existing opportunities and strengths are more appropriate, and that effective implementation of these strategies would help achieve the goals of sustainable agriculture.

Keywords: Agro-ecosystem, Strategies, Sustainable farming, SWOT

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Abstract ID: ICBRITAE004

Roles of Small-scale Seed Companies for Agrobiodiversity Conservation and Social Mechanisms Behind the Seed Industry in Japan

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Abstract

Sustainable agriculture relies on the on-farm conservation of crop diversity through the active use of major and minor crop varieties. Locally operated small-scale seed companies play a vital role in providing diverse varieties to farmers. However, the mechanisms that allow these companies to sustain their businesses are understudied. The aim of this research is to identify social mechanisms that allow(ed) locally operated small-scale seed companies to sustain their businesses and to conserve agrobiodiversity. This research employed semi-structured interviews among four small-scale seed companies and two large seed companies in Japan. The results revealed that customary practices in the seed industry, including pricing mechanism and seed exchange systems, enabled locally operated small-scale seed companies to be competitive in the seed industry. In addition, the research shows that small-scale seed companies actively provided local varieties in response to farmers' demand, even when it was unprofitable. Recent changes to the customary practice in the seed industry pose both opportunities and challenges among locally operated small-scale seed companies to maintain local varieties. An alternative social and / or economic mechanism is required for small-scale seed companies to continue providing minor varieties.

Keywords: Crop diversity, Small-scale seed companies, Customary practices

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Abstract ID: ICBRITAE005

Seed System Governance for Sustainable Agriculture - Management of Bio-cultural Diversity Based on Endogenous Development

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Abstract

Crop diversity with genetic variability is crucial to resilience of crop production, then, sustainability of rural society. Seeds are not only physical entities for agricultural production, but also carrier of genetic information. These parallel characters of seeds create diversity of values they embody. The endogenous development theory emphasizes importance of stakeholders in the fields who take care of local resources. With this background, present study was aimed to contribute to a more nuanced debate around seed system resilience that go beyond the dominant dichotomous conceptualization of seed governance often characterized as traditional vs modern, subsistence vs commercial, or local vs global. I will propose that such classifications limit our ability to critically reflect on and acknowledge the diverse approaches through which seed governance is practiced around the world, at various scales, creating a mosaic of dynamic complementarities and autonomies. In this study, agroecology, the economics of solidarity, the collective concept of property, the need for mutually supportive transformations in political systems towards realization of food sovereignty have been identified as major existing narratives and literature around seed system resilience. However, from our own field study in Nepal, Myanmar, and Japan and analyses on the endogenous development literature, it was revealed that putting farmer practices and cultural values first, recognizing and supporting inclusive seed commons, and adding rural realities and voluntary practices to agroecological research are key factors for sustainable seed system governance. The starting point for building a better seed management system is local decisions based on actual practices, not outsider's ideologies.

Keywords: *Bio-Cultural Diversity, Endogenous Development, Practices, Seed Governance*

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Abstract ID: ICBRITAE006

Seed Governance in Sri Lanka During the Social and Economic Crisis

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Abstract

Among the biodiversity conservation themes, this study focuses on the diversity of crop varieties used directly by humans in their daily lives. This study investigates the current state of various organizations engaged in seed conservation activities in Sri Lanka. The Purpose of this study is to verify the impact of formal and local seed supply systems on the sustainability of farmers' seed preparation. Sri Lanka is currently in the midst of a serious economic crisis. Under these circumstances, the flexibility and resilience of rural communities and local agriculture are being challenged. Additionally, the government's strong promotion of organic farming has created some controversy in the industry. Due to a lack of chemical pesticides and fertilizers, farmers are having a variety of problems and are also being pushed to modify their traditional agricultural production practices.

This study explores the functions performed by these organizations' activities by conducting interview surveys with farmers, agricultural cooperatives, government agencies, research institutes, and NGOs. We also look at how stakeholders may help preserve agro biodiversity on a local and a global scale.

The survey results suggest that many of vegetable seeds are imported seeds from Malaysia and abroad. The government agency has conserved more than 16,000 accessions of plant genetic resources (PGR). However, due to the high maintenance costs, it was planning to promote conservation in community seed banks in the future.

The characteristics of the local seed conservation systems will then be compared with those in other Asian countries and regions. We will discuss how social and economic upheaval affects farmers' seed procurement habits and seed supply systems based on the survey results.

Keywords: Community seed bank, Local varieties, Plant Genetic Resources Center, Seed company, Smallholder farms

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Abstract ID: ICBRITAE007

Indirect Seed Conservation in Small-Scale Agroecosystems of Laos and Japan

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Abstract

In agricultural villages, there are various kinds of crop fields and their scales also vary according to their roles. Major crop fields mainly focus on economic roles, but small-scale fields and their agroecosystems form unique environments. Local people might cultivate traditional crops and keep these seed in the environments. In this study, the author focused on the small-scale agroecosystems and tried to understand their roles in seed conservation. Case studies were conducted in rural villages in Laos and Japan. Sample size was 42 households and 42 home gardens in Laos and 77 households and 156 home gardens in Japan. In home gardens of a study village in Xien Ngeun district, Luang Phabang Province, Laos, various local crops and useful plants were found. These crops were supported supplementary for main crop field production and people's livelihoods and food culture. Cultivation history of around 15 % of constituent species were not remembered by local people and it suggests these species were from natural or unconscious propagation. In the small-scale crop field in a study village in Ibigawa Town, Gifu Prefecture, Japan, livelihoods were mainly self-sustaining, especially for rice and vegetables. Field survey on all small-scale crop fields over through a whole year, three unique local crops such as "Akauri (*Cucumis* sp.)", "Akimame (Leguminosae sp.)" and "Yatsugashira (*Brassica napus*)" were found. Many local people did not so much pay attention to cultivation in spite of its uniqueness. Livelihoods in mountain villages in Japan generally rely on public pension and thus, their livelihoods are basically secured by the system. Local people cultivated crops not only for production but also as a hobby, and the small-scale farming system played roles for introducing new crops and conserving traditional ones. Unconscious seed propagation and conservation in Laos and seed conservation of local crops outside economic system in Japan were observed and viewpoint of "Indirect Seed Conservation" is necessary for more precise observation and to know actual dynamics of seed succession.

Keywords: Traditional vegetable, Homegarden, Self-consumption, Unconscious seed propagation

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Abstract ID: ICBRITAE008

Diversity and Usage of *Capsicum* Peppers in Southeast Asia

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Abstract

Capsicum peppers (belonging to the Solanaceae family) are native to tropical and temperate regions of the America. Of the approximately 35 currently recognized species, five are domesticated; *C. annuum*, *C. frutescens*, *C. chinense*, *C. baccatum*, and *C. pubescens*. *Capsicum* peppers are thought to have been introduced to Europe in 1493 by Columbus and to Southeast Asia, via Africa and India, in the late sixteenth century. However, detailed genetic studies on the dispersal routes of *Capsicum* peppers into Southeast Asia are poorly known. *Capsicum frutescens* is a very popular spice in tropical and subtropical area of Southeast Asia. Therefore, genetic diversity and relationships among 357 accessions of *C. frutescens* in Japan, Southeast Asia, Oceania, and the Americas were investigated using RAD-seq and intraspecific variation of chloroplast genome. It is found that accessions in Japan are genetically closely related to those in the Americas, Oceania, and the insular region of Southeast Asia, but are genetically distant from those in the continental region of Southeast Asia, which suggests that some accessions of *C. frutescens* were introduced from the Americas to Asia via the Pacific. Moreover, ethnobotanical surveys on *Capsicum* peppers were conducted to investigate the local nomenclature for, and usage of, *Capsicum* peppers in Southeast Asia. It is known that *Capsicum* fruits are an essential spice and vegetable and very important economically in the world. But, people in Southeast Asia also use *Capsicum* leaves as a vegetable, fruit and leaves as a medicine, and fruit for rituals and popular beliefs. It is necessary to collect “cultural resources” (usage) as well as genetic resources of each crop during a field survey.

Keywords: *Capsicum frutescens*, dispersal routes, ethnobotany, leaves as a vegetable, local nomenclature, medicinal use

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Abstract ID: ICBRITAE009

A Scoping Review of Participatory Research Methods in Agroecology Studies Conducted in South Asia

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Abstract

Agroecology is widely regarded and advocated as a participatory approach. This scoping review assessed the extent, range, and nature of available evidence on participatory research methods in agroecology studies conducted in South Asia. From 2069 records identified in two databases, we included a total of 27 studies, of which 20 were conducted in India. We found that a diverse range of participatory research methods have been used in agroecology studies. However, farmers are rarely engaged as study collaborators, co-researchers and decision-makers. We recommend that more researchers consider the full potential of participatory methods to develop relevant and effective agroecological solutions.

Keywords: Agroecology, Participatory approach, Scoping review, South Asia

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Abstract ID: ICBRITAE010

Evaluating the Suitability of *Manilkara zapota* (Sapodilla) and *Madhuca longifolia* (Mee tree) Seedlings as the Rootstock for Grafting *Manilkara hexandra* (Palu) in Sri Lanka

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Abstract

Manilkara hexandra (Palu) is an underutilized fruit in Sri Lanka, which is propagated by seeds. However, low germination due to the hard seed coat and slow growth rate hinders plant distribution. Hence, an experiment was carried out to investigate the suitability of the *Manilkara zapota* (Sapodilla) and *Madhuka longifolia* (Mee) rootstock for grafting the *M. hexandra*. Two rootstocks *M. zapota* and *M. longifolia* were used with ten replicates and three plants per replicate. The experiment was conducted at Horticultural Crop Training and Development Institute, Bibile, Sri Lanka, during December 2021 to May 2022. Graft success percentage was measured three weeks after grafting. Graft survivability percentage, average number of leaves per graft, and average shoot length were measured weekly up to six weeks from three weeks after grafting. Data were analyzed using two-sample t-test using Minitab 19. The significantly highest percentage of graft success (70.79%) was observed in *M. zapota* compared to the *M. longifolia* (8.32%) at the end of three weeks after grafting. Although, *M. longifolia* were not survived after five weeks of grafting. Significantly highest graft survival percentage (74.99%) was observed in *M. zapota* at the end of the fourth week. It was gradually decreased and recorded as 35.4% in the sixth week and kept constant until the evaluated period. The average number of leaves per plant and average shoot length were recorded as 2.1 and 0.48 cm, respectively, six weeks after grafting in *M. zapota* rootstock. The results indicated that among the two seedling rootstocks of *M. zapota* and *M. longifolia*, *M. zapota* shows the highest graft compatibility.

Keywords: Grafting, *Madhuka longifolia*, *Manilkara hexandra*, *Manilkara zapota*, Vegetative Propagation

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Abstract ID: ICBRITAE011

Conference Sub Theme Two
Ecosystem Management and Socio-ecological Resilience

Assessment of Groundwater Vulnerability in Sri Lanka: A Systematic Literature Review

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Abstract

In many developing nations, including Sri Lanka, the lack of adequate drinking water has a significant influence on people's general health and life expectancy. Groundwater supplies are vital to meeting the ever-increasing demands of the agricultural, industrial, and residential sectors of Sri Lanka. As a result, a holistic literature analysis was done to (a) disseminate knowledge on groundwater pollution, (b) investigate existing management challenges, and (c) assess future environmental, social, health, and economic issues. We examined 50 scientific communications published between 2000 and 2022, confining our search to English-language scientific publications in high-impact journals. Those studies were critically reviewed, major groundwater contamination sources were identified, a comprehensive analysis of social, economic, and health issues caused by groundwater pollution was presented, and existing and future management challenges were examined. Groundwater contamination studies, in general, are the scientific investigation of biological, chemical, and physical factors that impact pollutant fate and mobility in the subsurface environment. Poor drinking water quality, loss of water supply, deteriorated surface water systems, high cleaning costs, growing prices of alternative water source, and/or significant health risks can all come from ground water contamination. There is an urgent need to develop a scientifically sound and reasonably adaptable technique to evaluate groundwater vulnerability, and it is suggested that further research be directed on vulnerability assessment. Analyzing groundwater contamination sensitivity is a more important component of managing groundwater resources and ensuring the country's human health and socioeconomic status.

Keywords: Biological contaminants, Chemical contaminants, Groundwater, Health risk, Physical contaminants

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Abstract ID: ICBRITAE012

The Role of The Informal Municipal Solid Waste Management' Sector in Improving Socio-Ecological Resilience

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Abstract

Management of municipal solid waste is a key prerequisite to build socio-ecological resilience of food systems. Therefore, a large number of scholars have paid attention to study solid waste management and its ecological implications to improve the sustainability of management mechanisms. However, they have limited their inquiries to exploring formal municipal solid waste management and have neglected the role of the informal sector in improving socio-ecological resilience. This study aimed to address this research gap by exploring the contributions made by the informal waste management sector of Sri Lanka in building socio-ecological resilience. The objectives of the study were (a) to comprehend the nature of services offered by the informal waste management sector; (b) to identify the forward and backward linkages that exist between the formal and informal waste management sectors; and (c) to identify ways of improving the informal waste management sector to increase its contribution to build socio-ecological resilience. The study was carried out by conducting 30 in-depth interviews with informal waste managers, informal waste workers, and national, provincial, and local council level government officials and conducting focus group discussions with stakeholders such as NGOs, and community organizations. The gathered data was transcribed and analyzed using thematic analysis method. According to the findings, informal waste managers manage more than 30% of the waste generated in Sri Lanka and, as well as more than 60% of economically viable waste such as hard and soft plastics, PET bottles, copper, steel, iron, and Aluminium. It was also revealed that linkages between the formal and informal sectors are limited to forward linkages. The lack of financial, technological, labour, and skill transfer and information linkages have limited the management capacity of the informal sector. Findings elucidated the importance of backward linkages between the formal and informal sectors to facilitate the development of the informal sector. Moreover, findings identified taking measures to change the negative social discourse on the informal sector as a timely requirement.

Keywords: Municipal solid waste management, Socio-ecological resilience, Informal waste management

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Abstract ID: ICBRITAE013

SWAT Model for Streamflow Simulation in Nilwala River Basin: Calibration, Validation, and Sensitivity Analysis

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Abstract

Natural biogeochemical and hydrological processes interact with social and economic factors at various scales via land -use changes and human activities. The impacts of watershed management and processes on soil and water resources can be simulated using watershed models. In this context, the Soil and Water Assessment Tool (SWAT) basin-scale model was applied to the Nilwala river basin, which is located along Sri Lanka's Southern coast. Calibration and validation of the model sensitivity analysis were performed using the Sequential Uncertainty Fitting Algorithm (SUFI-2) of the SWAT Calibration and Uncertainty Program (SWAT-CUP). The analysis used a study period spanning 1997 to 2015, with a four-year warm-up period for model setup. In SWAT simulations the hydrologic and meteorological datasets were divided into two sub-datasets; one for SWAT calibration (2001 - 2011) and one for SWAT validation (2012 – 2015). Using eight parameters, the model was successfully calibrated for observed stream flow data from Pitabaddara. The findings of the uncertainty analysis revealed that the R- factor-1.08 and P- factor- 0.83 are both acceptable. The model performance evaluation also revealed that the acceptable value ranges of Nash Sutcliffe Efficiency (NSE), Observations standard deviation ratio (RSR), and Percent Bias (PBIAS) for calibration were 0.78, 0.47, and 4.1, respectively, whereas during the validation periods the values were 0.86, 0.38, and 3.7, respectively. The findings demonstrate that SWAT performed successfully in this application. Overall, the model performed well in capturing the patterns and trends in the observed flow series, confirming its suitability for future scenario modelling. Future research on the Nilwala watershed model should focus on water quality concerns and the evaluation of best management strategies. The SWAT is a useful model for analysing coupled natural-human system dynamics in agricultural watersheds and evaluating socio-ecological trade-offs.

Keywords: Calibration, Hydrological modelling, Nilwala River basin, Sensitivity analysis, Validation

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Abstract ID: ICBRITAE014

Video as a Tool to Educate Farmers about Climate Smart Agricultural Practices for the Sustainable Management of Small Irrigation Tank Cascade Systems (STCS)

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Abstract

Climate change has adversely impacted the agriculture sector in developing countries. Lack of knowledge on climate smart agriculture (CSA) has threatened the resilience of Small Irrigation Tank Cascade Systems (STCS) in Sri Lanka with the adoption of improper agricultural practices by farmers. Therefore, raising farmers' awareness could help sustain the resilient capacity of these systems. This study tested the effectiveness of videos in educating farmers in STCS about CSA. The process mainly followed two steps: the development of an educational video and testing the effectiveness of it. The methodology followed three phases namely pre-production, production, and post-production. In the pre-production phase, existing knowledge and awareness of smallholder rice farmers about climate change and CSA were identified through a focus group discussion and a questionnaire survey. Concept designing, preparation of visual script, background sound and music selection, location, set, crew, and costume selection were also conducted in this stage. The production phase involved field recording of the video, assembling video shots, and editing. In the post-production phase, the effectiveness of the video was evaluated. The video was very satisfactory in terms of its content, language, message delivery, audio, visuals, sounds, and length. The video significantly elevated farmers' knowledge on CSA. In particular, the video was very effective in communicating location-specific CSA practices compared to more common CSA practices. The results could be particularly useful to help in the design of policies focused on improving the effectiveness and efficiency of disseminating CSA. The findings of the study would help to sustain the resilience of the STCSs.

Keywords: Climate change, Farmers' knowledge, Climate-smart agriculture, Village Tank Cascade System, Video production

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Abstract ID: ICBRITAE015

Quantitative Sequencing of 16S rRNA Gene for Comprehensive Pathogen Tracking in a Municipal Wastewater Treatment Plant

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Abstract

Absolute quantity fluctuation of bacterial pathogen in a wastewater treatment plant (WWTP) is crucial to determine the hygiene risks of treated water for downstream consumption. Primer/probe specificity and need for prior knowledge on sample microbial community limits the application of many quantification tools. In this study, we applied quantitative sequencing by incorporating spike-in internal standards with microbial 16S rRNA gene on Illumina MiSeq platform for comprehensive pathogen quantification in a WWTP. An own constructed pathogenic bacteria database based on biosafety levels was referred for rapid pathogen identification using BLAST at 99.5% similarity. Pathogen quantities at treatment stages were calculated based on a log-linear regression model. Total pathogens in influent; 6.8E+07 copies/mL (25.6% in total 16S rRNA gene copies), anoxic/oxic treatment; 3.7E+07 – 1.4E+07 copies/mL (4.5% – 2.9%), final sedimentation; 1.9E+05 copies/mL (7.2%) and effluent; 1.6E+05 copies/mL (9.3%) were observed. The total pathogen quantity was decreased gradually along the WWTP. *Arcobacter cryaerophilus* was dominant throughout the treatment process. An overall, 99.8% total pathogen absolute quantity removal was obtained at effluent compared to the influent. Yet, several moderate risk pathogens were reluctant to remove from WWTP such as *Aeromonas veronii* (85% removal), *Bacteroides fragilis* (49.2%), and *Mycobacterium sphagnii* (13.6%) exhibiting persistence in harsh treatment conditions. This understanding of pathogenic microbial quantity fluctuations along the WWTP supports the enhancement of treatment procedures and the protection of the environment and the consumer communities.

Keywords: Biosafety level, Internal standard, Pathogen database, Quantitative sequencing (qSeq), Wastewater treatment

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Abstract ID: ICBRITAE016

Impact of the Physical Environment of Slum Dwellers during the Relocation Process in Sri Lanka: With Special Reference to the Peliyagoda Urban Council in Gampaha District, Sri Lanka.

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Abstract

Relocation is a complicated process that is surrounded by socioeconomic and environmental considerations. The physical environment is important throughout the relocation process among Sri Lankan slum dwellers. This study was conducted at the Peliyagoda urban council ward of Peliyagoda Gangabada. A qualitative research design was employed in the study. Data was gathered through in-depth interviews with individuals. The ward's 40 respondents were chosen using stratified random sampling based on their age, gender, and ethnicity. This study seeks to address the research problem: “does the relocation process enhance the quality of physical environment of slum dwellers?” The objectives of the study were to examine the (a) impact of the relocation process on the physical environment (b) effectiveness of the relocation process under the slums regeneration projects (c) socio-economic and environmental impacts of the relocation process on slum dwellers. According to the study, nonrelocatees faced physical environmental hazards during the relocation process as a result of improper management by stakeholders such as urban development authorities. According to the study findings, inappropriate waste management of nonrelocatees becomes a severe issue throughout the relocation process. According to this study, the buildings of dislocatees were not fully demolished, and as a result, the remaining structures posed a safety hazard. Moreover, respondents reveal that housing under the slums regenerated projects did not allow pets; as a result, dislocatees deserted their pets, resulting in animal homelessness among nonrelocatees. The study demonstrates that inappropriate demolition, partial demolition of the abandoned buildings poses a variety of challenges to the physical environment, such as blocking existing drains and natural drainage; lack of upkeep of nonrelocatees' sewer and soakage pits has clogged drainage channels. As a result, in order to achieve social and physical environmental sustainability, the relocation process in Sri Lanka should be complemented with sustainable relocation practices.

Keywords: Demolition, Nonrelocatees, Physical environment, Relocation process, Slum dwellers

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Abstract ID: ICBRITAE017

Mimicking Nature for Disaster Risk Reduction in Coastal Regions

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Abstract

Coastal zones are highly vulnerable to a range of natural hazards, including storm surge, tsunami, coastal erosion and coastal flooding. Such hazards can have a devastating impact on coastal communities around the world and are responsible for many deaths and loss of livelihoods. A range of interventions have been developed to address such threats, including hard and soft engineering, and early warning systems. These have been able to effectively reduce disaster risk in many cases, but often fail to protect communities, as evidenced by the increasing number of people affected and levels of economic losses. A variety of naturebased approaches have also been promoted in global policy agendas for disaster risk reduction (DRR) in coastal regions, including the Sendai Framework for Disaster Risk Reduction 2015-30, which provides an opportunity to integrate Nature-Based Solutions (NBS) into national and local disaster risk reduction strategies. There are already examples of NBS being implemented in DRR applications, for example growing mangroves and forest vegetation along the coastal belt as an eco-engineering solution for nature based coastal defences. Although there has been growing interest in NBS for DRR, there has limited attention on the use of nature inspired solutions (NIS), despite its effectiveness in addressing other societal challenges. Accordingly, this study uses a comprehensive research methodology which comprises a systematic review (Scopus, Science Direct, Emerald), semi-structured expert interviews (15) and a focus group discussion. Currently, the research team is carryout the systematic literature review, which will lead to the developing the initial conceptual framework. Some promising findings are emerging from the systematic review of using NIS for DRR in coastal regions. For examples, case studies on NIS reveal that natural root systems on the sand offer inspiration for designing resilient coastal infrastructure, using native marine organisms to inspire more resilient concrete structures.

Keywords: Coastal hazards, Global agendas, Nature inspired solutions

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Abstract ID: ICBRITAE018

Nature Based Solutions for Building Resilient Food Systems in Sri Lanka: an Analysis of Agricultural Landscapes.

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Abstract

Local food systems are increasingly challenged to meet growing demand for staple as well as essential crops due to the effects of recent economic crisis fueled by COVID-19 pandemic along with climate change and growing competition for resources. Evidences highlighted that urban and peri urban dwellers are more vulnerable compared to rural. Agricultural landscapes are diverse geographically and compositions are compatible with the agro-ecology of the locations. In general, household are strengthening with any kind of home garden which is tagged as Kandyan forest garden, home garden, backyard or mixed garden. Present study aimed to investigate the structure, functions, management and values of landscapes of home gardens of Sri Lanka and find out the nature-based solutions of home gardens for building resilient food systems in different agroecological zones. Case studies were conducted in 10 districts (Kilinochchi, Vavuniya, Anuradhapura, Kandy, Badulla, Ampara, Monaragala, Hambantota and Galle) of Sri Lanka. Participatory appraisal tools were used to understand the systems and storytelling and in-depth interviews with key informants were utilized to explore the interventions of nature base solutions in building resilient food systems. Results revealed that rural food systems were remarkably resilient, through its own home garden-based supplies. Landscapes were diverse in bio-physical main structure, vegetation & land use patterns and cultural elements. Food basket composition along with species diversity varied across the districts and developed the typology of home gardens based on structure, composition, economic, social and environmental contribution.

Keywords: Food system, Home gardens, Nature-based solutions, Sri Lanka

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Abstract ID: ICBRITAE019

“Best Practices for Lobsters”: A Precautionary Approach for Lobster Fisheries Management in Sri Lanka

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Abstract

Lobster fisheries are a pioneer among high-value fish species, and they are a socially and economically important sub-sector of the Fisheries industry. Overexploitation and extensive anthropogenic interference have pushed the industry to an unsustainable status, with several species being listed as endangered. As a result, the research sought to determine the level of compliance on marine bio resource management of each value chain member of lobster fisheries, and to develop a complete strategy of "best practices" on marine bioresource management for the lobster value chain. Respondents to the field survey included the main lobster fish landing locations such as Galle, Tangalle, Matara, Negombo and Kaplitiya in the southern and north western coastal zones. Data was collected from participants of the lobster value chain including 40 fishermen, 10 collectors, 10 retailers and 12 exporters by using participatory statistics to identify the contribution of each value chain member on resource management and measured their compliance level on mandatory regulations, voluntary regulations, good practices' and ethical practices. Moreover, lobster collection centres (05), local public markets, researchers, policymakers, and legal officers were also interviewed in depth. Policies, regulations, and lack of enforcement on fishing seasons, closed season (September to February), species protection (egg bearing adults, Spiny Lobster, and Prawn), and reducing fishing pressure in lobster fisheries were established, but implementation bottlenecks disrupted the management system. The level of compliance of each value chain actor with marine bio resource management varied across the value chain as well as by location. All performers (85%) shown a lack of awareness, participation, and compliance. Upstream contribution was minimal in comparison to downstream contribution. Moreover, the fragile institution network, the development of coastal tourism, and weak law enforcement processes rendered the resource base vulnerable.

Keywords: Best practices, Compliance level, Lobster fisheries, Sri Lanka

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Abstract ID: ICBRITAE020

The Art of Imitating Nature: A Potential Application of Biomimicry in Shaping the Future of Multi-Hazard Evacuation

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Abstract

During the rapid onset natural hazards vulnerable communities are usually advised to reach the nearest refuge along the shortest route. However, disruptions to the routes and external impacts such as communicable diseases may cause to disrupt the safe evacuation along the shortest route. In this purview, studying nature-inspired systems can provide key insights into the way organisms are organised when facing critical conditions. Ex: the ability of ants as a social insect to self-organise and determine the shortest path from their nest to a food source, or vice versa (Ant Colony Optimization model). However, the application of these models to design and optimize multi-hazard evacuation routes is not apparent. From this perspective, this research aims at exploring the key elements of the microstructural network patterns in the relevant biomimetic models for determining multi-hazard evacuation routes. The study is designed by a systematic review of the literature linking to the outputs of an ongoing research for identifying the most suitable evacuation strategy for natural hazards amidst a pandemic outbreak using weighted centrality-based scenarios. The study is drawn from the analysis of weighted centrality, pandemic outbreak, and biomimetic simulation models to study an allocation method for vulnerable communities and evacuation routes to optimise the effectiveness of multi-hazard evacuation plans. The study has identified the evident relationship between the weighted centrality and biomimetic simulation models leading to the conclusion that modelling evacuation routes through weighted centrality can provide an effective real-life representation of the evacuation routes which consist of the capacity to self-organise and sustain within multi-hazard conditions.

Keywords: COVID-19, Ecosystem-level biomimicry, Network centrality, Rapid onset hazards, Risk assessment

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Abstract ID: ICBRITAE021

Building Resilient Agri-Food Value Chains Role of Innovation, Product Development and Commercialization

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Abstract

Resilient agrifood value-chains over conventional agri-food system was contrasted in academia to alarm the world but lack of innovation with rich potential to commercialization, disturbs the way forward. Resilience indicates the ability to get back into usual form against a shock. Identification risks in value chains are important in building resilience. In recent trends, tropical and exotic fruits have recognized with increased consumer interests due to high flavour profile and potential health benefits but level of utilization of the opportunity is questionable. Future of the years old raw material supply chains are debatable. Study aims to example the consumer-led product development by soursop (*Annona muricata L.*) combination with Ceylon cinnamon to build resilience with reduction of value chain demand risk. Soursop leaves and fruit exports were practiced as raw material with minimal value addition. Comparatively, the herbal infusion was developed with ratio of soursop leaves, dehydrated fruit and low temperature fruit and cinnamon extracts (control -31.2: 62.5: 3.1: 3.1) gaining high level value addition. 3 different ratios and 4 different brewing time 1,3,5 & 7 mins treatments were practiced to identify the best taste, colour, odor and mouth feeling with 20 trained sensory panel. Ratio no 2 (32.2: 64.5: 1.6: 1.6) in 3min brewing treatment recorded the highest overall appealing. Great innovations die with unplanned commercialization. Therefor the study was identifying the gap and ready to consume product prototype was developed contributing the novel trends of private labelling, functional benefits, traceability etc. to build resilience by recognizing accurate demand risks.

Keywords: Resilient agri-food value chains, Demand risk, Soursop, Ceylon cinnamon, commercialization.

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Abstract ID: ICBRITAE022

A Review on Application of Wetland Aquatic plants as a Sustainable Phytoremediation method for Heavy Metals in Polluted Water

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Abstract

Global population growth, industrialization, and urbanization have all had a significant negative impact on the environment. Numerous anthropogenic activities result in the daily emission of significant amounts of environmental pollutants. One of the main types of pollutants that has been found to have a negative effect on the quality of soil, water bodies, and air is heavy metal pollution. Worldwide reports of heavy metal-related water contamination have been made, and this dire situation has been exacerbated by the global water crisis. Because of their powerful and long-lasting ability to remove toxins from water, wetlands are frequently referred to as the "kidneys of the earth." bioaccumulation process, wetlands plants have proved crucial in the purification of heavy metal-contaminated water. Because of the convenient, successful, and cost-effective phytoremediation procedure used, as well as its broad applicability on a large scale, phytoremediation can be seen as a viable and sustainable method to purify heavy metal-contaminated water. This work aims to support bioaccumulation of heavy metals in wetland plants as a long-term, environmentally friendly way to treat heavy metal-contaminated water. When the biomass generated during the phytoremediation process is commercially valorized in the form of bioenergy, phytoremediation offers a low-cost solar-powered option for decontaminating contaminated water. Other heavy metal remediation techniques are subject to a variety of limitations, including the production of harmful gases like hydrogen sulfide, high sediment removal costs, and increased energy usage. For heavy metal-contaminated water, wetland plants produced in artificial wetlands can bioaccumulate heavy metals and remove them.

Keywords: Heavy metals, Phytoremediation, Bioaccumulation, Contamination, Water scarcity, Urbanization, Industrialization

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Abstract ID: ICBRITAE023

Potential of Oyster Mushroom (*Pleurotus ostreatus*) in Degrading Agent for Selected Agro – wastes

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Abstract

Agro-wastes which are leftovers in the field can be degraded naturally using oyster mushroom. This study was conducted to determine the degrading capacity of oyster mushroom *Pleurotus ostreatus* (introduced as mycelial plugs on substrates) on paddy straw, banana stalk, and banana leaf during 45 days period. Physical and chemical characteristics of substrates degraded by *Pleurotus ostreatus* were determined at 15- day intervals. Percentage of lignin, cellulose, and hemicellulose contents ($p \leq 0.05$) showed a significant decrease in all 3 substrates. Manganese peroxidase enzyme activity was optimum on 30th day in all three substrates. Endo-1,4- β -D-Gluconase activity was significantly high in paddy straw (164.38 ug/ml \pm 2.00) and in banana leaves (166.12 ug/ml \pm 2.00) on the 30th day and while it was significantly high on banana stalk (152.6 ug/ml \pm 2.60) in the 15th day. Exo-1,4- β -D- Gluconase activity was significantly higher on 45th day in all 3 substrates. Percentage of protein content (0.083- 0.0583% \pm 0.001) was increased within 45 days while percentage of reducing sugar content (0.15 to -0.12% 0.005) was decreased. The pH of the substrates varied differently among the three utilized substrates during the observation period. The ash content and the degraded weight of all 3 substrates decreased significantly with the time. Degrading capacity of *P. ostreatus* was significantly high in paddy straw (53 %) after 45 days than the other wastes banana leaves (34.23%) and banana stalk (40.18%). Therefore, *P. ostreatus* mushroom could be recommended as a natural degrader of paddy straw left over in the field after harvesting, thereby enhancing the soil fertility.

Keywords: Agro-wastes, Paddy straw, Biodegradation, *Gluconase*, *Pleurotus ostreatus*

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Abstract ID: ICBRITAE024

A University-Enterprise Collaborative Framework for Disaster Resilience

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Abstract

Partnerships between higher education institutions and enterprise can aid in the production of high-impact, enterprise-relevant research outcomes. Strengthening disaster resilience cannot be accomplished by working in isolation and it necessitates a multi-stakeholder approach at various levels of engagement. This is a significant challenge in Asia, a region particularly vulnerable to natural hazards and home to many vulnerable populations. In this context, a study was initiated by several higher education institutions in Asia as part of the SECRA project (Strengthening University Enterprise Collaborations for Resilience Communities in Asia) with financial support from the European Commission. As a part of the project, this study aims to develop a relational framework to guide future university-enterprise collaboration for a resilient society. This study included an extended literature review as well as expert workshops. The literature review was carried out using peer-reviewed academic papers chosen for their relevance and timeliness. The data was analysed thematically to highlight the importance of UECs for disaster resilience, particularly during the pandemic. These factors were presented at project workshops in 2021 and were improved with the help of experts in relevant fields. Several factors and strategies were identified and classified thematically into four categories: cultural, material, relational and structural. Based on the initial findings, a multi-level UEC collaborative framework is proposed, incorporating stakeholders, challenges, and suggestions to improve future training programmes for both university and industry partners. The framework will be further tested among the partner countries to validate and provide feasible solutions to improve university-enterprise collaboration for building resilient communities.

Keywords: Asia, Disasters, Framework, University-Enterprise collaborations

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Abstract ID: ICBRITAE025

Recommendations for Improved Transboundary Flood and River Governance in the Urban Ciliwung River Basin, Indonesia

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Abstract

The Ciliwung River is one of the major rivers that passes through Indonesia's capital city Jakarta. The basin is highly urbanised, and has undergone significant structural management, especially in the downstream reaches. The basin, however, experiences flooding on a frequent basis, which has had devastating impacts on the city of Jakarta and its residents. Severe flooding in January 2020 was reported to have resulted in 66 fatalities, and the displacement of 36,000 people. Studies have identified that a key issue in the Ciliwung is ineffective basin governance. The project Mitigating hydrometeorological hazard impacts through improved transboundary river management in the Ciliwung River Basin sought to develop plans to improve the river's governance to enable effective flood management. The project first identified the primary challenges facing river governance. It then sought to develop recommendations for how river governance could be improved. The project adopted an interdisciplinary and holistic approach to the investigation, and applied a transboundary river management lens, which has not been widely considered in a within-country context. The recommendations represent the culmination of the project and were developed based on a range of inputs including systematic literature reviews, semi-structured interviews and focus group discussions with key basin stakeholders. Respondents were selected for their expertise, and included key government departments and agencies who were project partners. The governance challenges identified were that current governance arrangements are fragmented, key actors commonly work independently, local governments often lack the capacity to implement their flood management responsibilities, and while there are integrated arrangements for water management, flood management is not well integrated within this. Recommendations are to clarifying roles and responsibilities, to integrate flood management into water management policy, to develop synergies between local and national policies regulations and planning, and to improve data access, among others.

Funder statement: This project is supported by the UK Natural Environment Research Council (Project Reference: NE/S003282/1), the Newton Fund, the UK Economic and Social Research Council, and the Ministry of Research, Technology & Higher Education of the Republic of Indonesia (RISTEK-BRIN).

Keywords: Flood management, Governance, Jakarta, River basin, Transboundary

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Abstract ID: ICBRITAE026

Conference Sub Theme Three
Green Infrastructure and Urban Resilience

Urban flood assessments in low lying areas: case study in Kelani River Basin, Sri Lanka

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Abstract

The Kelani River basin in Sri Lanka experienced frequent floods and inundations due to the unavoidable rapid population increase and land cover change, endangering the lives of the inhabitants and their ability to support themselves through agriculture. This study was conducted to ascertain changes in vegetation cover and population density in low lying areas of the Kelani River basin, as well as their relationship with frequent floods. The study period was from 1995 to 2015, and the research region was 1.5 km from the left bank of the Kelani River. The changes in the vegetation pattern were examined using satellite image-based NDVI from Landsat 5 TM, Landsat 7 ETM+, and Landsat-8, as well as ArcGIS 10.7.1. According to the findings, the percentage of "healthy plant cover" declined considerably (by 5.66 %), while the percentages of "no plant cover" (by 0.37 %) and "poor plant cover" (by 5.28 %) increased. Furthermore, the overall vegetation cover declined from 34% to 32%. Population density was estimated in 2005, 2010, and 2015 by predicting population statistics released by the Census and Statistics Department of Sri Lanka, and the population density map showed that the population swelled by 35% during the study period. The study has employed the bivariate Pearson Correlation approach to examine the correlation between changes in plant cover, population density, and flood level data in each GN division in the study region. In the majority of GN Divisions, there is a reverse correlation between population vs. vegetation and vegetation vs. floods, which leads to severe flooding. As a result, there was a significant correlation between the local flood level, plant cover, and population density. As a result, it's important to focus on and implement the new flood control approaches that were discovered under the best flood management procedures.

Keywords: Flood management techniques, Landsat images, Land cover, NDVI, Urban population

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Abstract ID: ICBRITAE027

A Cost Benefit Analysis of Vertical Greeneries of Sri Lanka; A Simulation Analysis Based on Design Builder Software

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Abstract

Vertical greenery systems are a passive design concept that significantly contributes to accomplishing environmental and social rewards by enhancing the environmental conditions of densely populated urban settings. Many studies have been undertaken to evaluate the ecological and social benefits of green façades; nonetheless, it is unknown if vertical greeneries are economically sustainable. The existing research gap should be solved by evaluating the economic value of various vertical greenery systems. This study evaluates the economic worth of direct green façade (DGF), indirect green façade (IGF), and living wall systems (LWS) through a cost-benefit analysis, taking into account installation and maintenance expenses as well as energy-saving benefits throughout their life cycle. Cost Benefit Analysis (CBA) is calculated under three separate conditions (worst, middle, and best). To ascertain the possibilities for energy savings, the design builder tool simulates the commercial building in the Colombo region. The four metrics used to compute CBA are Net Present Value (NPV), Internal Rate of Return (IRR), Pay Back Period (PBP), and Benefit-Cost Ratio (BCR). The analysis found that DGF had positive NPVs in all scenarios, respectable IRR and BCR values, and a payback period of six years. Acceptable NPV, IRR, and BCR values for a 6–7-year payback time with best and middle case scenarios. Over three situations, LWS exhibits negative NPVs and indefinable IRR values. DGF and IGF are economically viable from a point of view and living wall systems are not economically viable.

Keywords: Cost-benefit analysis, Design-builder, Net present value, Vertical greenery system

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Abstract ID: ICBRITAE028

Particulate Matter Passive Mitigation by the Foliage of Green Infrastructure

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Abstract

Increased particulate matter concentration (PM; PM_{2.5}, PM₁₀, PM_{1.0}) due to vehicle emission exposes the health of city dwellers to risk by 50-60 %. Green infrastructure (GI) is identified as a potential strategy to reduce passive exposure to air pollution. The objective of this research is to investigate the relationship between vegetation boundary layouts and particulate matter accumulation. Densely vegetated fruit plantations nearby congested roads in the Kandy district were selected for the study. On-site air quality measurements were taken every 5 m from the ten adjacent roads with vegetation barriers and steady traffic congestion from 9 am to 12 pm for a 5-month period. Factory-calibrated logging facility with automatic testing method instruments installed at 1 m height from the ground level was used to record data at a 1-minute interval. Later, a “Typical site” was generated by summarizing to provide a general vegetation barrier to the adjacent roads. The study demonstrated a significant reduction (15%) of PM in GI-installed sites compared to a clear area; the reduction followed the trend of PM_{1.0}<PM_{2.5}<PM₁₀. The study also demonstrated that GI (vegetation barrier) constructed 100 to 150 meters from the nearby road reduces the possibility that particulate matter will have an adverse effect on building occupant comfort while ensuring the best possible air quality level, which is consistent with 2020 WHO Air Quality Guidelines.

Keywords: Building establishment, Green infrastructure, Near-road, Optimum air quality, Particulate matter

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Abstract ID: ICBRITAE029

Building Resilience in Changing Climate through Land Use and Land Cover Management - A Case Study in Colombo, Sri Lanka.

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Abstract

Effects of Land Use and Land Cover (LULC) on change of Land Surface Temperature (LST) using satellite imagery in Colombo Divisional Secretariat Division (CDS), Sri Lanka, was determined by this study. Landsat 8 satellite images were obtained from the USGS GloVis website from 2014 to 2019. Images were processed using the Esri ArcMap software 10.8 version. To analyze the LST values for spatial clustering Getis-Ord G_i^* tool was applied. Referring to the Google EarthPro images for the study period, six LULC classes were marked. LULC classification was done by Maximum Likelihood Classification. Each LULC type was analyzed using Geographically Weighted Regression (GWR) to determine its spatio-temporal relationship to LST. Harbour, the Port-City, coastal-belt, and main transportation ways accumulated higher LSTs. The western coast showed wide-spread LST clusters. Significant increments of 'Impervious Surfaces' (IS) and 'Bare land and Sand' (BL) were found. The Vegetative areas (VG) had a slight increment. The 'Commercial/ Residential' (CR) areas have depleted, and 'Water Bodies' (WB) was significantly lost. LULC had a substantial impact on the change of LST values throughout the study. The IS, CR, and BL have significantly increased the LST. The expanding neighboring cooling effects of WB and VG have reduced LST. BL affected the LST hotspot formation more than the IS and CR. Furthermore, LULC dynamics considerably expanded and intensified LSTs in CDS. Therefore, to control the prevailing LST intensification and hotspot expansion, urban development can be coupled with balanced LULC management. Moreover, the urban-ecosystem resilience can increase by emphasizing urban greenery conservation and management.

Keywords: Climate change, Geographically Weighted Regression (GWR), Land Surface Temperature (LST), Land-Use and Land Cover (LULC), Urban-ecosystem resilience.

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Abstract ID: ICBRITAE030

Degradation of Wood Quality of *Eucalyptus Grandis* Logs Exposed to the Natural Environment

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Abstract

Eucalyptus grandis (EG) is one of the major lengthy construction timbers in Sri Lanka. Severe weather and rough terrain restrain the continuous timber supply; some converted logs of EG plantations might be stored in outdoor yards inside the plantations for a few months. Moreover, illegal timber and timber of hazard trees have to be kept long period at the felling sites due to lack of accessibility or high supply cost. The goal of the present study is to better understand how the wood quality of EG logs degrades over time under natural conditions. Logs of a 24-year-old EG plantation in WU 2 agro-ecological region were selected that were stocked in an outdoor yard while samples of fresh logs of nearby trees were collected as the control. The stocked logs were kept for 24 months; thereafter-wood samples were extracted. All samples were collected from heartwood and strength properties; bending strength Modulus of Rupture, Modulus of Elasticity, Compression Parallel to Grain, and wood density of all samples were tested. Splitting and decayed features of the logs were studied. The independent t-test results show that no significant difference in tested properties between control and exposed logs ($P < 0.05$). The sapwood has completely decayed; hence, 30% of the total log volume has been lost. Both ends of the logs have split, mean splitting length is 1.23 m. The conclusions are 24 months of the exposure is not affecting on wood strength of the heartwood, however, sapwood is unusable. Splitting prevents the production of larger cross-sections of sawn timber.

Keywords: Decay, Expose, Logs, Strength, Wood quality

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Abstract ID: ICBRITAE031

Unheard Voices of Flood-Affected People in the Process of Urban Disaster Resilience Building in Kolonnawa, Sri Lanka

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Abstract

Urban disaster resilience building has gained increased currency in the current disaster scholarship and parlance where its operationalization raises a number of concerns. However, the role of flood-affected people has been often overlooked in resilience building processes in Sri Lanka. Hence, this research paper aimed to explore the importance of incorporating flood-affected people's voices and local experiences into disaster and urban resilience building processes. The research problem investigated the role and engagement of flood-affected people in building disaster resilience. Using a mixed method approach the research conducted 102 questionnaires with flood-affected households, 30 in-depth interviews and 3 focus group discussions with flood-affected people and 5 semi-structured interviews with flood-affected community leaders in Kolonnawa. Questionnaires were analysed using the SPSS software and interview information was analysed using the thematic analysis method. The findings indicate that the flood-affected majority lives in wooden houses in flood prone disaster vulnerable localities and is from the lower socio-economic backgrounds including informal work where their socio-economic identity intersects with other identities such as geographical locality, gender, age and ethnicity. In addition, the findings reveal their voices and experiences were often overlooked not only in post disaster recovery and reconstruction stages but also during the disaster and urban resilience building processes. Hence the study indicates acknowledging local flood responses, everyday lives of flood-affected people when building disaster and urban resilience in their geographical locality. The study further raises the concern of measuring intangible disaster losses, long-term trauma and suffering and brings the important question of whose disaster resilience is decided by whom.

Keywords: Disaster resilience, Urban resilience, flood-affected people, Sri Lanka

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Abstract ID: ICBRITAE032

The Verandah: Building Resilient Housing for Internally Displaced People

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Abstract

Design of house is a combination of culture, social and economic status of the dweller and its surrounding environment. Present study focused to identify the perception of displaced communities on housing design, especially veranda as a missing component from the traditional housing design, find out the dynamism of the vernacular house influencing on the transformation process of resettlement and cultural landscape; and finally, to explain the perceived process and response of local people towards meaning and changes of cultural landscape. Nine different resettlement villages, 20 houses from each re-settlement along with 10 contemporary houses of the villages were explored to investigate the perception of dwellers on missing component of housing design, the Veranda. Ethnography of the villages considered, in-depth interviews with the dwellers of cultural landscape and structured questionnaire were the main data collection tools. Both checklist and mapping techniques were employed together with the visual survey in the areas under studied to collect the physical settings, daily activities, and other spatial behaviour. Of the sample Veranda like space found in only one resettlement village of single-story duplex house. Characteristics of the housing design and components had been transformed in accordance with the modern life style, but traditional style Veranda still remains without any improvement. Housing designs of the resettlements were different from contemporary houses and heavy presence of western housing style is common in both single- and two-story duplex houses and flats. Extra living room of re-settlement houses occupied the space of veranda to accommodate the extended family. Veranda of contemporary houses was converted into functions of household. Public space of the house, 'fuzzy space' between inside and outside, verandah improve communication with others, utilize the natural and cross ventilation, improve ventilation performance of the single side house, shaded tractional space and multifunctional space were compared between houses with verandah and houses without verandah.

Keywords: Housing design, Perception, Resettlement, Verandah

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Abstract ID: ICBRITAE033

Applicability of Green Roofs to Improve Urban Resilience in Sri Lanka: A Review

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Abstract

Green infrastructure is acknowledged as a new strategy to address the environmental issues currently dominating in urban resilience. Green roofs are one of the many nature-based remedies that effectively reduce the negative effects of improper development. An enclosed vegetative area on top of a constructed environment is what is meant by a "green roof system." In Sri Lanka, some of the primary problems facing municipal areas, which demand quick correction, are flash flooding, heat island effect, poor air quality, and aesthetic disruptions. By implementing green roofs effectively, such conditions can be changed and the economic, social, and environmental sustainability of urban dwellings can be significantly improved. Based on existing literature from 2010 to 2020, this review seeks to determine the role of green roofs in improving the sustainability of urban centers in Sri Lanka. The scope of the study includes a thorough, holistic, and thematic analysis of the idea of green roofs and facades. The research is divided into several subfields which discusses the energy saving, thermal comfort features, stormwater retention, air quality improvement and noise reduction. Moreover, the environmental and socioeconomic potential and constraints are identified, and the feasibility of creating green roofs in Sri Lanka is discussed. The potential is centered on improved ecological performance, climate change mitigation, recreation, and a favorable impact on urban livelihood through stormwater management. The constraints emphasize the initial costs of green roof which tend to be expensive and requires extra maintenance than traditional roof system. A sophisticated adaptation of green roofs with unique designs that are appropriate for Sri Lankan conditions is recommended in this review in order to improve the quality of life of urban communities.

Keywords: Green infrastructure, Green roof, Heat island effect, Stormwater management, Sustainability

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Abstract ID: ICBRITAE034

Effectiveness of Different Plant Species for Green Roofing to Reduce Building Temperature – A Review

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Abstract

In recent years, the use of greenery on building roofs and facades has drastically risen, getting special attention in urban planning and architecture. Therefore, the purpose of this study is to review the different plant species used for green roofs and their comparative effects on temperature variations within a building. Responding to factors like empty space usage and natural building insulation are some of the primary arguments for this, in addition to the aesthetics of architecture (heat, humidity, and noise). The most significant amount of current global energy consumption is allocated for heating and cooling purposes in residential structures. Numerous studies have shown that installing an extensive green roof system is one of the effective ways to reduce energy use. Green roofs remove heat from the air through evapotranspiration and also act as building insulators, lowering the energy required to provide cooling and heating. Additionally, green roofing strives to reduce air pollution, boost atmospheric oxygen levels, integrate built structures with nature, enhance the urban environment by enriching biodiversity and diminish runoff quantity. The effectiveness of a green roof for cooling a building depends mostly on the plant species with various photosynthetic and water-use strategies. Various researches have been conducted worldwide to determine the effect of different plant species on green roofs for building cooling. The most widely used species on green roofs are Sedum species such as Sedum album and Sedum acre, tropical plants, C₄ plants, C₃ plants and CAM plants. This article compares the effectiveness of C₃ plants, C₄ plants and CAM plants as green roofing plant species on building temperature reduction using local and global studies.

Keywords: Building cooling, C₃ plants, C₄ plants, Green roof

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Abstract ID: ICBRITAE035

Development of an Energy Trading Model between Renewable Energy-based prosumers and Electric Vehicle users: A literature review

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Abstract

Global electric vehicle (EV) usage is expected to reach 750 million by the year 2030 due to their environmental benefits. However, EVs can still account for indirect carbon emissions due to usage of grid electricity for charging them. One solution for this can be proposing energy trading models (ETMs) which use electricity generated from renewable energy sources (RESs) for charging EVs. There are limited number of studies which propose RE trading to charge EVs. However, these studies are inadequate to examine the ET problem among EVs and RE-based household prosumers. Therefore, to get insights into proposing a novel ETM for them, a literature review was conducted to critically evaluate existing ETMs and to identify the user requirements in designing ETMs. The literature review involved keyword searches in electronic databases: Scopus, Web-of-Science and Science Direct in July-December 2020. Review included only peer-reviewed journal articles, which were subjected to title, abstract and full-text screening. 156 articles were finally selected to include in the literature review. The studies proposed different ETMs for EVs and RESs prosumers based on market-construction and trading mechanism. A majority of studies have proposed peer-to-peer (P2P) models, quantitatively validating their individual user economic benefits and the overall system benefits: reducing grid-dependency, transmission losses and improving RE penetration. Further, the studies highlighted requirements such as cost reduction, reducing travel distance for EVs, revenue improvement, utility maximisation for RESs prosumers, social welfare maximisation and promoting RE utilisation for overall system. Above findings imply that novel ETMs between RESs prosumers and EVs could improve energy resiliency in communities by reducing grid-dependency and carbon emissions. Given that cities account for nearly 70% of global emissions while expecting a rapid energy demand growth, this study findings can be used as a reference by stakeholders and policy makers to design solutions and action plans towards the improvement of energy resilience in cities.

Keywords: Electric vehicles, Energy resilience, Energy trading, Renewable energy, Urban resilience

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Abstract ID: ICBRITAE036

The Role of Green Infrastructure in Making Smart Cities Disaster Resilient: A Mutually Beneficial Relationship

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Abstract

Urban infrastructure is crucial to generating sustainable growth across the board. The over-engineered infrastructure interferes with natural processes in a city, such as ecological and plant succession, the food chain, water flow, and habitat loss, aside from the direct harm to the abiotic environment. This is accurate even though smart environments and environmental sustainability are essential smartness measures in a smart city. While biodiversity loss gives rise to numerous public health problems, recent studies suggest that technologies jeopardize the viability of biodiversity (for instance, novel biosafety risks ranging from the production of wearable technologies to their e-waste). Not only the biodiversity crisis within the Smart Cities case is under-researched, but its direct and indirect impacts cannot be rectified or recoverable overnight. Therefore, the role of nature-based green infrastructure in Smart Cities brings benefits beyond the cooling effects, reduced floods, restored local groundwater reserves, etc. However, green infrastructure initiatives and smart cities have largely run parallel to each other. Therefore, this study investigates the mutually beneficial relationship between green infrastructure and Smart Cities in creating resilience. A comprehensive literature review is undertaken with keyword searches including peer-reviewed publications, case study reports, global development agendas and Smart City action plans. Findings suggest that not only green infrastructure brings wide benefits to Smart Cities and their citizens, but the inherent Smart City features and technology (alone as a key element) help tell the story of the importance of nature while protecting it; resulting in an evident enhancement of the city's resilience.

Keywords: Green infrastructure, Natural assets, Resilience, Smart cities

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Abstract ID: ICBRITAE037

Conference Sub Theme Four

Indigenous Knowledge, Precision Agriculture and Agricultural Productivity

Effect of Commercial Compost Enriched with Eppawala Rock Phosphate and Feldspar on Growth of Tomato

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Abstract

Inorganic fertilizers are being extensively used in agriculture for the enhancement of food production for ever growing population. However, the usage of inorganic fertilizers adversely effects on the environment. Therefore, replacing of inorganic fertilizer with organic fertilizers such as compost is one of the alternatives. The main disadvantage of compost usage is the lack of sufficient amount of NPK required for crop growth. The objectives of this study were to evaluate the effect of compost enriched with Eppawala Rock Phosphate (ERP) and Feldspar on the growth and yield of tomato (*Solanum lycopersicum*) and; to determine the changes of selected soil properties when using the compost enriched with ERP and Feldspar. Normal soil (T1), compost with soil (T2), soil + enriched compost with feldspar and ERP (T3), soil + compost mixed with chemical fertilizer (80% recommended MOP, TSP, and Urea) (T4), and soil with chemical fertilizer (T5) were used as the treatments. A completely randomized design (CRD) with seven replications was used. The experiment was carried out in a protected house as pot experiments. Plant height, number of leaves, and stem diameter were measured five times during the study period (1, 3, 5, 7, and 9 weeks) as growth parameters. Finally, total biomass, number of flowers, and fruit yield were recorded. The pH and EC of treatments were also measured. The lower growth performance and yield were observed in T1 and T5 where only soil and soil with chemical fertilizers used. The treatment with chemical fertilizer and compost mixture (T4) showed the highest performances than other treatments. Though, T3 showed growing performance as much as T4. Moreover, the number of fruits in T3 and T4 were also similar. However, the weight of yield was significantly higher in T4 than T3. The enriched compost (T3) showed higher yield than T2 and T5. The yield in T4 was 17.3% higher than that of T3. It can be concluded that even though higher yield was reported on enriched compost over inorganic fertilizer, the enriched compost mixed with inorganic fertilizer performed well over the use of chemical fertilizer only.

Keywords: Enriched compost, Eppawala rock phosphate, Feldspar, Inorganic fertilizer, Tomato

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Abstract ID: ICBRITAE038

Sugarcane Growth and Yield Estimation Using UAV-Based RGB Images and Ground Observation

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Abstract

Sugarcane (*Saccharum officinarum* L) is a significant plantation crop in Sri Lanka. Because of manpower constraints and the difficulties of forecasting yield, satellite imagery-based mapping will become more significant. Due to the high cloud covering and limited resolution of aerial photographs, unmanned aerial vehicles (UAVs) with red-green-blue (RGB) images have become intriguing remote sensing platforms for field surveillance. The purpose of this study was to monitor sugarcane growth and development by processing high-resolution aerial images collected by UAVs, to find field anomalies with UAVs, and to evaluate the accuracy of yield estimation through imagery. UAV images were captured by a DJI Mavic pro drone over a 1ha sugarcane field from 9 a.m. to 11 a.m. at various development phases (i.e., tillering, grand growth, and ripening) with a flying height, forward and side overlap of 50m, 75 %, and 70%, respectively, and field data were collected. Using Arc GIS Pro, images were mosaicked and digital elevation models (DEM) were generated. Five RGB-based vegetation indices [Red Green Index (RGI), Green Leaf Index (GLI), Visible Atmospherically Resistant Index (VARI), Green Red Vegetation Index (GRVI), and Modified Green Red Vegetation Index (MGRVI)] were computed to identify the best vegetation index by supervise classification. Crop Surface Models (CSMs) derived from DEM data were used to extract plant heights per ten sample plots, and UAV data was validated using field-measured plant heights. At each development phase, MGVRI (accuracy>94%) was deemed to be the best colour recognition approach among the other observed vegetation indices through supervise classification. The relationship between UAV data and field-measured plant height data was strong early on ($R^2>80\%$), but it gradually faded. Furthermore, there was a weak relationship ($R^2<30\%$) between biomass yield and vegetation indices in the early stages. There was no relationship during the ripening period. According to the study's findings, UAV technology with an RGB camera coupled with MGVRI and CSMs can be successfully deployed in large-scale sugarcane fields to monitor crop growth with high accuracy and observe field irregularities.

Keywords: Crop Surface Model, Digital Elevation Models, Satellite Imagery, Unmanned Aerial Vehicles, Vegetation Indices

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Abstract ID: ICBRITAE039

A Simulation Model to Estimate Actual Evapotranspiration of Sugarcane Plantations in Sevanagala in DL₁ Agro Ecological Zone Using Global MODIS Data Product By NASA

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Abstract

The present study was conducted to introduce an easy, accurate and rapid method to estimate sugarcane evapotranspiration for DL₁ agro-ecological zone, Sri Lanka using the version of satellite-based global model “MODIS” available at “APPEARS Earth Data Cloud-NASA”. Actual evapotranspiration data of sugarcane measured in daily basis by a weighing type lysimetric study conducted in *Sevanagala* sugarcane plantation during 2018 to 2020 has been used to check the applicability of the simulated evapotranspiration data of MODIS global model. The lysimeter system consisted of 5 replicates.

It was revealed that MODIS model could be successfully implemented to estimate evapotranspiration of sugarcane with fair accuracy. The proposed mathematical model would be $ET_{crop} = 9.46365 + (0.7707 * X_l * Kc)$. Here X_l is MODIS potential evapotranspiration data, which is expressed as mm per 8 days, and Kc is the crop factor applicable for different growth stage of sugarcane crop. The above mathematical model is recommended to use evapotranspiration calculations for sugarcane grown in *Sevanagala* with an accuracy of 77% compared to the actual evapotranspiration data estimated by the lysimeter. The model can be successfully used as a rapid and low-cost tool to simulate actual sugarcane crop evapotranspiration (mm/8 day) for sugarcane plantations in *Sevanagala* which is in DL₁ agro-ecological zone.

Keywords: Evapotranspiration, Lysimeter, MODIS, Remote sensing, Sugarcane

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Abstract ID: ICBRITAE040

Sensitivity Analysis of Cultivar Trait Parameters in Agricultural Production Systems Simulator (Apsimx) Sugarcane Model: Reference to the Production Environment in Higurana, Sri Lanka

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Abstract

Sugarcane is an important crop all over the world. Despite the fact that Sri Lanka is now focusing on increasing sugarcane output, the use of process-based crop models is critical in defining management choices for dealing with the temporal and spatial variability of sugarcane yield. Cultivar parameterization is critical when implementing such a model in order to provide accurate model predictions. Sensitivity analysis (SA) can be used to solve the problem because measuring a lot of parameters is practically challenging. However, performing SA on process based crop models can often be an expensive undertaking. We performed a global sensitivity analysis utilizing Gaussian process emulation to determine the impact of trait parameters on cane dry weight (CDW) and biomass weight (BM) in the Agricultural Production System Simulator (APSIM)-Next Generation Sugar model under specific environmental and management conditions in Hingurana, Sri Lanka, to evaluate the sensitivity of the model to these parameters. A 37-year simulation was conducted with three different soil types (Reddish Brown Earth, Alluvial and Non calcic Brown), and under rain-fed and irrigated conditions. The most sensitive parameters on CDW and BM were found to be radiation use efficiency (RUE), green leaf no (GLN), transpiration efficiency coefficient (TEC), thermal time from emergence to beginning of cane (EB) and cane fraction (CF). RUE and TEC were found to be sensitive and needed to be assessed before parameterizing APSIM-Sugar model for a new cultivar. Our findings provide information to enhance the precision and efficiency of sugarcane crop modeling and identify optimal management practices. This knowledge can be used to refine sugarcane crop models and develop targeted strategies to boost production, address variability and enhance sustainability in the region.

Keywords: APSIM; Gaussian process emulation; Global sensitivity analysis; Sugarcane

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Abstract ID: ICBRITAE041

A Key to Identify Woods of Different Eucalyptus Species

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Abstract

Wood anatomy is regarded as a precise and rapid method for identifying wood. Eucalyptus is a diverse genus of trees in the *Myrtaceae* family. Various *Eucalyptus* species are used to produce commercially valuable timbers, and as a result, they have been planted in many places around the world. Timber identification of *Eucalyptus* species is now reliant on visual observations and personnel skills due to a lack of effective systematic approaches. As a result, the authenticity of *Eucalyptus* species is frequently called into doubt on the timber market. The identification of *Eucalyptus* species based on anatomical features is seen as a critical activity since it can help to reduce potential misinformation in the timber industry. Nine *Eucalyptus* species, including *E. camaldulensis*, *E. citriodora*, *E. torelliana*, *E. pilularis*, *E. tereticornis*, *E. globulus*, *E. microcorys*, *E. Robusta*, and *E. grandis*, were grown in Sri Lanka and were used in this study to identify the variation of wood anatomical features with the aim of differentiating the species. As a reference, IAWA's (International Association of Wood Anatomists) publications on anatomical characteristics were consulted. To determine the microscopic traits, twelve wood sections (Radial, Tangential, and Transverse sections of the wood) representing each species were employed. The anatomical characteristics of the timber were examined using Micrometrics SE Premium 4 software. A Dichotomous key was developed for the exact identification of Eucalyptus species based on the anatomical characteristics of rays, vessels, and parenchyma.

Keywords: Dichotomous key, *Eucalypts*, IAWA features, Wood anatomy

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Abstract ID: ICBRITAE042

A Review Study of Panchagavya Liquid Application as a Growth and Yield Promoter on Vegetable Crops.

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Abstract

The greatest challenge faced by the nation in the coming years is to demand safe food for the growing population in the country. Inspired by this, organic farming which, leads to improving the health of the agro-ecosystem has gained wide revealing as a valid alternative to conventional food products and confirms safe food for human consumption. Therefore, it is necessary to use organic applications like panchagavya to produce chemical residue-free food crops; hence panchagavya can play a major role in sustainable farming. Panchagavya is an organic product produced using five specific through-products of cow such as cow dung, cow urine, cow milk, cow ghee, cow curd, and other substances. It has the capability to play the function of promoting bloom and supplying immunity in plant, thereby conferring's resistance against pests and diseases. Panchagavya is a source of macronutrients like N, P, K and micronutrients which required for the growth of vegetation. Additionally, it consists of various amino acids, vitamins, and growth increase like auxins and, gibberellins, It consists of be beneficial microorganisms like Pseudomonas, Acetobacter, and phosphor bacteria and enhance soil fertility status, thus balancing the soil pH. It was evident that, with the application of panchagavya, it enhances the vegetative growth and yield of crops and positively affects beneficial micro-organism activity in the soil and suppresses adverse effect of soil pathogens.

Keywords: Panchagavya, Sustainable farming, Beneficial microorganism

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Abstract ID: ICBRITAE043

Developing APSIM Cultivar File for Simulating Rain-fed Sugarcane Crop Yield of Sevenagala Plantation for Changing Climate

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Abstract

The "APSIM" crop simulation model has been frequently used to estimate sugarcane crop yields around the world. Due to non-availability of parameterized sugarcane cultivars, it is quite challenging to use it in Sri Lankan conditions. Aiming at this, 94 rain-fed sugarcane farmer fields were selected via random sampling among new planting lands of 2018. Daily weather data gathered at the Sevenagala meteorological observation station and the soil database from the crop and resource management division of the sugarcane research institute, Udawalawe were used in the simulations for the period from 2007-2018. In order to develop a hypothetical sugarcane cultivar, 27 such cultivars has been introduced (SLhypo1 to SLhypo27) by factorially combining three parameters (leaf area, green leaf number and thermal time) with three levels of each of these parameters (3X3X3) given in the default ini file of the APSIM using the literature evidences. For the model calibration, actual yields of sugarcane in 94 farmer fields of Sevenagala rain-fed plantation from 2008 to 2018 period were statistically tested with the simulated yield of the APSIM model. Out of the tested three parameters, green_leaf_number and thermal time exhibited a significant influence on the simulated yields ($p=0.000$). Conducted statistical test based on the Mean Absolute Percentage Error (MAPE) clearly identified that the hypothetical cultivar SLhypo17 has explained the yield variations more accurately. As per the model validation conducted based on the degree of agreement test, the developed model has shown an accuracy of about 65 %. Cultivar trait parameter values of the best fit cultivar SLhypo17 were 1900, 6500 and 2250 for thermal time in °C day and 9 for green_leaf_number. Since the model calibration was conducted only using 10 years dataset and gave only about 65% accuracy, the developed model needs to be fine-tuned by continuing the experiment in future years.

Keywords: APSIM, Changing climate, Hypothetical cultivar, Sevenagala, Sugarcane

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Abstract ID: ICBRITAE044

Assessing the Crop Species Diversity and Productivity Between Organic and Chemical Agriculture Lands

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Abstract

Ecological green villages program was introduced by the Department of Export Agriculture of Sri Lanka in 2017, to promote the concept of organic agriculture. One such program is being implemented in the Kurunegala district as the “Indulgodakanda organic crops village”. The present study aimed compares the impact on the diversity of crop species (banana, pepper, coconut) and the productivity of yields by considering organic lands and chemical lands. Total of 41 families worked in their sustainable lands under the project used for the study. Data related to crop species in 2017 was collected from the project report and a structured questionnaire survey and interviews were carried out to collect the data on present status of the agricultural lands. The results revealed that, at the commencement of the project (2017) high species diversity identified in chemically cultivated lands and two years later (2019) the highest species diversity was identified in organic lands. According to the Shannon diversity Index, crop species diversity was high in over 60% of the total 41 organic in 2017. By 2019, the index values were increased in nearly 80% organic lands and crop species diversity was decreased in close to 20% of chemical lands. The yield of organic land is high for only 65% out of all organic lands according to the Average Productivity Index (API) while the index was high for over 95% of chemical lands. Changing of the fertilizer in a short time period and less of adaptability of farmers may be affect for the decrease the productivity in organic lands. According to the above results, this project helped to increase the diversity in organic lands than the chemically cultivated lands. However, the low yield productivity of organic lands may adversely affect to the success of the project. Therefore, the quality of organic farming and the efficiency of farmers should be more developed to manage sustainability of lands with securing the optimum yield.

Keywords: Organic agriculture, Diversity, Productivity

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Abstract ID: ICBRITAE045

Impact of stocking fish fingerlings on inland fish production in Sri Lanka

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Abstract

Large numbers of 1,398 reservoirs are identified in Sri Lanka with 167,385 ha of total water area. There is a significant amount of inland fishing craft (9870), fisheries organization (445) and active fishers (70,715) in Sri Lanka. However, local inland fisheries contribution to national GDP (0.2%) is insignificant indicating low fish productivity (<700kg/ha). Its contribution and potential are inadequately researched. Therefore, present study was designed to ascertain the impact of stocking fish fingerlings on inland fish production in Sri Lanka and investigate the reasons for variations in inland fish production. Primary data were collected through administering pre-tested structured questionnaire. Simple random sampling technique was used to select inland fishers (n=50) in Wellawaya DS division, Monaragala district. Secondary data of the period during 2011-2019 were collected from the Ministry of Fisheries and Aquatic Resources Development. Data were analyzed using both descriptive and inferential methods. Results indicate, stocking of fish fingerlings per hectare is increased by 51.38% in 2019 compared to 2011. The highest amount of stocking per hectare (84.09 fingerlings/ ha) was observed in 2018. However, fish productivity per fish fingerlings decreased years from 2011 to 2019. It decreased in 2019 by 22.44% and 63.26% comparatively years of 2011 and 2012 respectively. The lowest amount was recorded in 2018 as 7.95 kg. Further, fish productivity per area slightly decreased through the year from 2011-2019. The 6.71% and 08% of decreased are recorded in 2019 comparatively to 2012 and 2014. There are negative significant correlations between fish productivity per fingerlings with fish stocking per hectare ($r=-0.853$, $p=0.00$). According to the perception of respondents, lack of fish fingerlings, variation of climatic conditions, underutilization of resources, poor extension services, lack of financial support, and inactive fisher association are significantly affected ($\bar{X} > 4.0$, $P < 0.00$) to lower fish productivity in the Wellawaya area. In contrast, stocking fish fingerlings may not considerably effects on increasing fish productivity and many factors affect to variation of inland fish productivity. Therefore, this study feed for further research and proper policies should be established for effective utilization of available resources toward improving fish productivity.

Keywords: Fingerlings, Inland fisheries, Productivity, Stocking

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Abstract ID: ICBRITAE046

An Impact Assessment of Mango Value Chain to Investigate the Value Chain Upgrading Potentials

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Abstract

Mango is the second widely cultivated commercial fruit with great variety that is grown in Sri Lanka. *TJC*, *Karthakolomban* and *Vilad* are popular trading names in traditional, modern, and export-oriented value chain models. This study intended to explore the mango value chain, an impact assessment on generation of income, profits, creation of employment, gender inclusiveness and identify the value chain upgrading potential. Environmental scanning along with institutional analysis and participatory methods appraisal of mango value chain were key data collection tools. Sample compost of 155 respondents representing various actors of mango value chain from input suppliers to consumers. Participants were identified through snowball sampling technique. Qualitative tools were mainly used, and descriptive statistics were useful to explain the value chain profile. Both regional and export-oriented mango value chains were short, fragile and operations were seasonal. Despite its huge potential, the mango sector is facing multiple challenges that range from postharvest losses to limited outreach into high-end global markets. Barriers in the mango value chain were huge postharvest losses (30-35%), poor market linkages, inferior logistic supplies, and access to quality input supplies. Small scale and export-oriented mango farmers are identified as the midstream actors and wholesalers, informal and formal retailers, domestic consumers, and exporters represented downstream value chain actors. Income distribution of TJC mango value chain was measured as farmer 45%, wholesaler 26%, retailer 29% while Karthakolomban mango value chain shows different figures, farmer 17%, wholesaler 21%, retailer 62% share. Sri Lanka's competitive threshold is relatively lower, due to the dominance of regional players with their quality of fruit, extended shelf life, higher productivity, effective marketing, innovative packaging, reliable distribution networks and the ability to meet the international quality standard prerequisites.

Keywords: Impact assessment, Income distribution, Mango, Value chain, Upgrading

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Abstract ID: ICBRITAE047

Banana Value Chain and its Market Landscape

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Abstract

In terms of volume and value, Banana (*Musa*) is the leading fruit crop in global market. Market landscape research helps rural farmers improve their enterprises. This study intends to identify the market landscape of banana value chain, determine the recurrent issues of value chain, nature of the human resources and their roles, and income distribution along the value chain. The study is based on Kolikuttu, Ambul, Ambun and Anamalu banana types. Primary data were acquired from 35 respondents including growers, traders and whole sellers through participatory approaches, field observations, focus groups and telephone interviews. Banana's value chain was short and network structure was prominent. Upstream of banana value chain has small scale growers. Intermediaries are in downstream of the value chain. Few horizontal nodes interconnected to many vertical nodes in the value chain. Shorter, fragile regional banana value chains feed the lengthier export-oriented value chains. Upstream end and downstream of the Kolikuttu and Ambul banana value chains are dispersed compared to midstream. Kolikuttu and Ambul value chains were organized and market oriented. There were obvious uneven profit distributions among value chain actors. Kolikuttu value chain farmers possess 25% of total profit while wholesalers and retailers possess 26% and 49% respectively. Ambul value chain farmers, wholesalers and retailers possess 26%, 24% and 51% respectively. In Ambun it was 15%, 35% and 50% for farmers, wholesalers and retailers respectively. In Anamalu, it was 10%, 19% and 71%. The study identified less bargaining power of farmers, poor market information and fragile correlation among value chain actors as major causes of trade injustice. The study emphasizes the need of strategically upgrading the value chain with the aid of private sector towards digital marketing, direct selling and issuing gap certificates. Involvement of indirect value chain actors such as business advisories, logistic services, and market information systems to the value chain should be strengthened.

Keywords: Banana, Landscape, Profit, Value chain

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Abstract ID: ICBRITAE048

Climate Resilience through Product and Process Innovation: A Case of the Tomato (*Solanum lycopersicum*) Value Chain

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Abstract

Tomato is the second most consumed vegetable, cultivation varied from home gardens to commercial cultivations all over the country and different marketing channels distribute the fresh and processed products to diverse marketplaces. The study attempts to investigate the climate vulnerability of the tomato value chain and determine the role of product and process innovation as a climate resilience mechanism. To collect data on the tomato value chain, main tomato growing areas, Rathnapura, Badulla, Monaragala districts, dedicated economic centers of Dambulla, Keppetipola, villages fairs, and retail chains were used, and respondents were farmers of various operation scales, collectors, distribution channels, intermediaries retail formats. The climate vulnerability status of the value chain actors was measured through participatory approaches and analysis of the market landscape provided the product and process innovation adopted to mitigate the losses. The influence of climate change and post-harvest losses have very close harmony in every stage of the tomato value chain. Rainfall patterns, intensity, shifting seasons, and dry spells were the main disturbances upstream of the value chain while heavy rains and floods were the main barriers downstream. Climate change-induced disease outbreaks, post-harvest losses, and disturbances to distribution networks were claimed as significant losses. Common resilient mechanisms adopted were the best-fit varieties for the area and the season, adjustments to the crop calendar, cultivation in protected houses, disease management measures, and post-harvest chain management. Value addition, packaging, storage, and transport options were strengthened downstream of the value chain. Ready-to-eat and cook-type products were identified as important interventions for consumers.

Keywords: Climate resilience, Innovation, Tomato, Value addition, Value chain

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Abstract ID: ICBRITAE049

Vulnerability of rural farmers, seed poverty and readiness for own seed production: A case of hybrid maize value chain

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Abstract

Maize (*Zea mays* L.) is a highly recognized cereal crop cultivated in Sri Lanka for the animal feed production. Economic crisis led import ban of hybrid maize as well as seeds crippled the animal feed industry in one hand. On the other hand, unavailability of animal feed supplies adversely affected on the national protein supply. This study focused on to identify vulnerability of rural farmers on hybrid maize seeds, level of seed poverty and farmers readiness to produce own seeds. Primary data were collected from 100 farmers of two main maize growing DS divisions (Kandeketiya and Meegahakiula) of Badulla district. Structured questionnaire, focus group discussions with key informants of the value chain and field visits were main data collection tools and analyze done with secondary data. Results revealed that hybrid maize value chain comprised with seven major stakeholders. Farmers cultivate ‘99 Jet’, ‘808’, ‘SA 336’ and ‘HP 4311’ varieties majorly. Of the four hybrids varieties grown, none was locally produced and import ban on seeds left them in high level of income vulnerability and seed poverty stats. Locally available hybrids, Ruwan and Badhra growers showed moderate level of seed poverty and low-income vulnerability. While Farmers with own seed stocks were secure better returns and low level of seed poverty. Of the sample over 83% of the farmers indicated readiness to produce maize hybrid seeds if parental lines are provided. The empirical model reveals that farmers’ readiness to adopt maize hybrids is positively influenced by gender, age, and high yield and constraints variables such as high cost of production and pests and diseases.

Keywords: Hybrid maize, Sri Lanka, Seed, Value chain

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Abstract ID: ICBRITAE050

Gender, Employee Rights and Participation in the Cut Flower Value Chain

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Abstract

Cut flower value chain of Sri Lanka recognized as small holder driven, largely unorganized informal venture. Driven by various concerns of value chain actors, regulators and civil society organizations flower growers have to comply with a number of codes of conduct developed by their buyers and national industry associations. The research examines how such codes address employment conditions in the industry, especially the experiences of women of the workforce. The cut flower value chain is explored considering gender contribution, participation and employee rights with special emphasis on quality requirements. Primary data were collected through focused group discussions with growers (30), collectors (10), florists (5), floral arrangement suppliers (5), and exporters (3) and from web sites of floriculture companies of Orchid, Anthurium and Roses in Gampaha, Kegalle, Kandy, Ratnapura and Badulla districts. Trade statistics were used to analyze the market. Criteria from a selection of labour codes adopted by major producers were used in Funnel-shaped value chain to assess how women are being affected by the industry, and to show the extent to which women's priority issues are included. Participatory social auditing and local multi-stakeholder initiatives are used as significant elements of implementation of industry regulations. The study found that, the ways workers are affected depends on the employment status. Women make up the majority of non-permanent workers and areas of job security, working hours, wages, discrimination and harassment, pregnancy and maternity leave, women appear to have separate concerns from men that has not being addressed by any of the formal channels among all other common problems. The research suggests that there is a need to consider the industry's gender-specific impacts, and that gender-sensitive solutions necessitate capacity building among employers and workers. Equal understanding of ways of improving labour conditions relates to productivity and quality in the cut flower industry.

Keywords: Cut flower, Employee rights, Gender, Participation, Value chain

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Abstract ID: ICBRITAE051

Honeybee Value Chain: Social, Economic and Environmental Benefits & Costs

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Abstract

Honeybee value chain, one of the oldest ventures of rural communities and globally recognized as multi-faceted contribution on pro-poor and contribute to biodiversity and ecosystem conservation. Medicinal benefits and consumer trends convert traditional business into modern value chain. The honeybee value chain business landscape of Sri Lanka scattered, fragile, regionally operating as SME. Present study focused on identifying the structure of the honeybee value chain and its business environment, functions and products, and finding out the social, economic and environmental benefits. Participatory approaches: Field observations, in-depth interviews with key players, storytelling and transit walks were main primary data collection tools. Market analysis was instrumental in identifying marketing elements of bee-honey value chain. Honeybee value chain actors include beekeepers, local traders, home brewers and herbalists, consumers, producers, retailers, wholesalers and exporters. Bee-honey production still depends on wild collection and home gardens. Institutional landscape composed of few government organizations, NGOs and SMEs. Improper value chain linkages, robust structure and poor market intelligence hinder the success of honeybee value chain. Unfair income distribution, limited returns and adulteration were key threats identified. Beekeepers and homes should collaborate in order to protect the environment, the protection of an apiary against predators and maintenance of a favourable environment for the production of honey. An apiary should be located in an area with a variety of flora, which should last all year around. Community' capacity in honey production is vital and empowers chain supporter's artisan hive makers, money-lenders and microfinance institutions, professional beehive management services, quality control, processing, and packaging

Keywords: Bee honey, Beekeepers, Value chain

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Abstract ID: ICBRITAE052

Importance of Promoting Passion Fruit Value Chain Sri Lanka - Opportunity Overview

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Abstract

Passion fruit (*Passiflora edulis*) is an attractive, sweet, and sour fruit with a delicate flavor, pleasing aroma, and high nutritive value. Therefore, passion fruit production plays a key role in the food and beverage industry in Sri Lanka. The objective of this study is to focus on the passion fruit value chain and its opportunities, the current demand for passion fruits from the perspective of value additions, and the importance of strengthening the passion fruit value chain. The survey method was used with primary, secondary data and a qualitative analysis was done. The primary data were collected through observations, group discussions, and expert opinions of farmers and other value chain actors in Kalutara and Galle districts. For the sampling, perspective sampling method was used. Total sample was 25 including 10 farmers, 5 wholesalers and 10 retailers.

Passion fruit value chain can be split into three primary segments. Production, primary processing distribution / marketing. At the farmers level, significant value creation in productions cannot be apparently seen. Value addition starts when the wholesaler node enters to the chain. Focusing on value creation and preservation is the best investment opportunity. Having a high demand from local and foreign markets, attention from investors towards quality productions, creating macro-level and micro level benefits are opportunities of the value chain. The demand for passion fruit varies depend on the value chain segments. The Entire chain should be strengthened to facilitate each value chain segments, to diversify value additions, to eliminate post-harvest losses and finally to meet the end-user requirements. The recommendations to promote the value chain include the development of an integrated effort among all value chain participants, strengthening other auxiliary activities that support the value chain like proper post-harvest management, and starting and developing ventures to boost value additions.

Keywords: Opportunities, Passion fruit, promote, Value additions, Value chain

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Abstract ID: ICBRITAE053

Marketing Efforts of Small Business in a Post-Covid Landscape in Kandy District

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Abstract

The negative impacts of the pandemic have forced many entrepreneurs to review their business model, especially marketing strategies. Objectives of this study were to investigate the marketing strategies of small businesses in a post Covid landscape in Kandy District, Sri Lanka and to explore factors that influence moving from non-digital tools to digital tools for marketing. Thus, questionnaires were developed and distributed via an online platform as main data collection tool and in-depth interviews with selected proprietors and stakeholders feed the gaps of qualitative data. Post COVID market landscape developed with the main concerns on products, prices, distribution channels and promotional mix. Product strategies were re-designed to fit with the new distribution channels and pricing strategies were varied along with segments and special efforts were on price led promotions. Promotional strategies were evolved with digital applications where social media and mobile technology were identified as leading players. Distributional strategies were yet to develop to meet the requirements of digital element of the marketing mix. SMEs were unable to manage the appropriate distribution channels to reach its distinct consumers and marketing costs were significantly high for both producers and consumers. Product strategies, especially packaging and servings were shifted to fit with the new distribution channels. Market landscape and service providers were ill prepared for digital applications.

Keywords: Covid, Marketing, Social media ,Digital marketing , Small businesses

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Abstract ID: ICBRITAE054

Role of Indigenous Knowledge in the Chilli Value Chain

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Abstract

Indigenous knowledge of dry chilli production refers to the unique, traditional, local knowledge existing within rural farming communities for the preparation of hot delicacies. Indigenous knowledge of the preservation of spices is unique and the diversity of the process depends on the generation's old experimentations. The main intention of this article is to analyse the importance of indigenous knowledge related to dry chilli production to improve value chain operations and explore gender mainstreaming through the applications of indigenous knowledge. This study is qualitative in nature. Case study was conducted on Moneragala, Ampara and Dambulla areas in Sri Lanka due to the higher production. Participants represented chilli value chain from farmers to whole sellers to retail sellers. Primary data collection was done through the semi structured questionnaires and interviews. Secondary data were collected from the Department of Agriculture (DOA), Department of Census and Statistics, Department of customs published reports and previous research articles. According to the findings in these areas farming activities are done by farmers and their family members. Both men and women are equally engaged in farming activities. The main indigenous practice for preservation is sun drying in study areas. It depends on the climate, and it takes only 5-6 days. Pests and diseases, and unexpected climate changes are the major environmental issues associated with current farming activities in study areas. This study has been analysed under some major parts namely definitions of indigenous knowledge and its importance, introduction to spice, chilli preservation in rural areas, and indigenous knowledge related to the postharvest chain management of chilli. This study shows the significance of preserving and integrating this indigenous knowledge and practices in dry chilli production and storage and finally has suggested some implications regarding the sustainable traditional methods and techniques

Keywords: Dry chilli, Indigenous knowledge, Value chain upgrading

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Abstract ID: ICBRITAE055

Status of Seed Paddy Production and Seed Poverty of Traditional Rice Farmers of Central Highland of Sri Lanka

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Abstract

Ancestral paddy farmers playing a major role in preserving the gene pool of traditional rice varieties from generation to generation. Traditional rice, one of the attractive sub sectors of the rice industry and local farmers are contributing greatly on upstream activities of the value chain, especially production and the supply of seed paddy and other logistics arrangements. Thus, this study intended to identify the existing seed paddy production and preservation systems, the community participation in maintaining biocultural diversity and the issues associated with the existing seed supply mechanism. Field observations, focus group discussions and storytelling exercises were instrumental in the data collection. 50 farmers from traditional rice farming communities of Rathnapura, Badulla, and Kandy were joined the study. Descriptive statistics of the results revealed that informal seed system was the main method of seed ownership where farmers produce, select, store, share/gift/bartered the traditional rice seed paddy. Economic and socio-political pressures had transformed rural communities, although vestiges of traditional seed production, preservation, storage and sharing systems are still being practiced. Induced market demand on traditional rice places demand on seed paddy but seed production systems were unable to cater the needs. Informal seed ownership and sharing made seed markets fragile and common issues of variety mixing, germination, and issues of mixed harvest. Community-based seeds banks empowered through local knowledge will be able to bridge the market demand and fill the gaps in seed paddy market.

Keywords: Central highlands, Rural farmers, Seed paddy, Traditional rice

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Abstract ID: ICBRITAE056

Impact of the Decaying of Community-Based Knowledge on Local Environment Towards Agro-Ecosystems Resilience

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Abstract

Knowledge about local environment and its processes is important when understanding the real-world scenarios for decision making towards community resilience. Experience of the local communities gained through their day-to-day activities make them experts on local environmental knowledge. Such knowledge will support agro-ecosystems resilience by identifying the precise conditions, needs, issues, and measures catered for their local environment for better decision making. Therefore, incorporating community-based knowledge into local level planning can be identified as one of the important steps towards agro-ecosystems resilience. Within that scope the study aims to explore the impact of decaying community-based knowledge of local environment towards agro-ecosystems resilience. The study adopted a case study approach based in Sri Lanka, where members of local communities who reside in landslide and flood-prone areas were interviewed. Key findings were extracted based on a thematic analysis, and the conclusions were drawn after a few validation interviews. The results highlighted that apart from the knowledge transferred by the relevant authorities and the basic awareness of their surrounding environment, there is limited knowledge to be extracted relevant for decision making. Some experts believe that due to the commercial economy, industrialization, and service-oriented job markets, people are detaching from their local environment. People do not have time to observe and engage with their local environmental processes, which has resulted in the decaying of local environment knowledge. It will also threaten the traditional knowledge relating to agro-ecosystems which may cascade into food insecurities. Therefore, preservation of the limited community-based knowledge on agro-ecosystems is imperative in preparedness planning and making towards communities resilient.

Keywords: Community-based knowledge, Local environment, Ecosystems resilience

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Abstract ID: ICBRITAE057

Technical Efficiency and its Determinants in Cinnamon Cultivation Sector in Galle District of Sri Lanka: An Application of Stochastic Frontier Approach

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Abstract

The Cinnamon industry in Sri Lanka plays a leading role in the international market by providing high-quality pure cinnamon products to the world. However, this sector has been experiencing a prominent issue of low productivity that prevents farmers from realizing the maximum possible yield from their plantations. Hence, farmers tend to enhance their level of productivity mainly by expanding the area of cultivation and increasing the application of fertilizer, labour, and other inputs used for production. Although these options are economically viable to increase productivity, they may not be environmentally sound as they may pose possible threats to the ecosystem and agricultural sustainability in the long run. Accordingly, the most feasible strategy for improving the productivity of the cinnamon cultivation sector is increasing the technical efficiency of the farmers, as it will enable them to utilize the existing resources in the best possible manner with minimal effect on the ecosystem. Therefore, the objective of this study was to investigate the determinants of the technical efficiency of Cinnamon farmers in the Galle District of Sri Lanka. The study was based on the data collected from 80 Cinnamon farmers in Karadeniya and Elpitiya Divisional Secretariat Divisions in the Galle District relevant to the 2021 production year. The Cobb-Douglas stochastic frontier production function model with the technical inefficiency effect model was used to estimate the technical efficiency of the farmers in the study area. Accordingly, the results showed that the farmers' level of education, experiences in the field, family size, occupation, membership in a cinnamon farmers' society, and access to credit facilities were significant determinants of the technical inefficiency. The mean technical efficiency of the farmers was 74.8%, implying that the farmers could further increase the cinnamon output by 25.2% using available inputs and technology. Therefore, this study concludes that with the development of appropriate policies and strategies, farmers should be encouraged to optimize the utilization of the available resources in order to enhance the productivity and environmental sustainability of the cinnamon cultivation sector in Sri Lanka.

Keywords: Ceylon cinnamon, Galle district, Stochastic frontier model, Technical efficiency

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Abstract ID: ICBRITAE058

Impact of Irrigation Ecology on Rice Productivity: Evidence from Sri Lanka

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Abstract

Irrigation has a number of merits and demerits on environment, and, among them, irrigation induced land productivity improvement is critically important for a land scarce country like Sri Lanka. A number of major irrigation projects have been initiated in the country during the post-independent period, partly because her food staple crop, rice, needs a sizable amount of water. However, impact of irrigation on rice productivity has limitedly been investigated in Sri Lanka, and the existing studies mostly examined the impact at household level rather than at agricultural system level. Filling this research gap, this study aims at investigating the impact of irrigation ecology on rice productivity by using agriculture system specific data; namely annual costs of cultivation data published by Department of Agriculture, for 2008-2019 period. This study employs a panel regression technique, after controlling for a number of standard production function variables, in isolating the irrigation specific impact on rice productivity. Our findings indicate that there is a strong positive relationship between irrigation and rice productivity. For instance, rice productivity in irrigated production system is around 40 per cent higher compared to that of in the rain-fed systems. In other words, irrigation has enabled Sri Lanka to achieve her rice requirements by utilizing less land resources which would otherwise be stressful to the existing limited land resources. Moreover, it is found that water stress, either drought or flood, has been a major factor affecting the rice productivity in rain-fed agriculture systems. Thus, irrigation, both at micro and macro level, could promote food security and environment sustainability.

Key words: Irrigation, Rice productivity, Panel regression, Sustainable development, Sri Lanka

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Abstract ID: ICBRITAE059

Design of Robust Eddy current brake system for Green Houses in Agriculture

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Abstract

The brake system of a small-scale horizontal axis wind turbine (HAWT) is crucial for producing reliable and effective electricity at different wind speeds. Since the turbine could be over-rotated and broken if the brake mechanism is not strong enough to maintain a consistent angular velocity, small-wind power production systems are challenging to operate in strong wind regions. Friction brakes are used by the majority of small-scale HAWTs to regulate the turbine speed and produce stable electricity. We offer an eddy current-based wind turbine braking system that is contactless with the rotor as a replacement for the friction brake system because friction brakes gradually wear out, require frequent maintenance, and eventually need to be replaced. The advantage of the suggested braking system is that it will outperform friction brakes in terms of durability and energy lost due to friction. The mathematical implementation of the eddy current braking system carried out in the DC-Green house for various wind penetrations in order to confirm the performance and stability requirements. Finally, the results of the simulations indicate the viability of the eddy current brake system.

Keywords: HAWT, Eddy current brake, Strong wind, Friction brake, Contactless brake

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Abstract ID: ICBRITAE060

Development of Crop Yield Prediction Model Using Machine Learning Algorithms: A Review

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Abstract

Machine learning (ML) has been used in agricultural production as a decision support tool to get insights, monitor crops, and equip farmers with vital information on crop variety selection and field management throughout the crop growth cycle. Several approaches to machine learning have been used to help predict agricultural yields. This literature review was undertaken to investigate the various ML techniques for yield prediction and to design a hybrid approach for Crop Yield Prediction Using ML Algorithms. The study's keywords were "ML algorithms," "crop yield prediction," and "hybrid ML algorithms" and 748 pertinent publications were retrieved. Using inclusion and exclusion criteria, we selected 50 publications from three databases for further analysis. The methodology and attributes employed in these carefully selected studies were evaluated, and suggestions for further studies were proposed. According to our findings, the most commonly used variables are soil type, temperature, and rainfall, and the most frequently employed method in these models is Artificial Neural Networks (ANN). Furthermore, ML approaches such as Random Forest (RF), Naive Bayes (NB), and K-Nearest Neighbors (KNN), as well as RF-NB, KNN-NB, and ANN-RF as hybrid ML models, are used to improve ML algorithm prediction accuracy. Because most ML algorithms are tailored to a certain dataset or task, and because they perform best when combined, integrating multiple ML approaches can significantly enhance the final product. Hybrid techniques, in particular, are the most successful crop prediction method and may be widely used with ML technology.

Keywords: Artificial neural network, Crop prediction, Climate, Machine learning, Hybrid approach

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Abstract ID: ICBRITAE061

Conference Sub Theme Five
Global Food Safety and Security

Charcoal Evaporative Cooling Technology for Extend Shelf Life of Perishables in Developing Countries.

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Abstract

Proper storage is crucial for extending the shelf life of perishables. The most important factors in determining the shelf life of perishables are appropriate temperature and humidity conditions of the storage. In Sri Lanka, a developing nation, the annual loss of fruits and vegetables is 30%–40% and 20%–40%, respectively. Financial losses from fruit and vegetable were about US\$ 90 million and US\$ 110 million, respectively. Evaporative cooling is an innovative and environmentally friendly air conditioning system which operates with following heat and mass transfer principle and water and air are working fluids. This provides an inexpensive cooling system without contributing any greenhouse gas emission.

The majority of rural farmers in developing nations are unable to afford the high-tech cooling systems required to preserve their gathered fruits and vegetables due to their exorbitant cost. As a result, evaporative cooling techniques reduce temperature while increasing relative humidity very effectively and affordably.

Charcoal is used because of its porous structure that can retain water. A cooling effect is produced inside the cooler by water evaporating from the charcoal structure's surface. Charcoal is one of the most useful with highly available material. A cooling process ensures that a low temperature is maintained during post-harvest handling which is critical for the preservation of perishable and the reduction of post-harvest losses. The low cooler temperature is accompanied by an increase in the relative humidity within the storage structure which minimizes the moisture loss from the fresh produce.

Therefore, a charcoal evaporative cooler can be utilized for immediate storage following harvesting. A cooler can be produced affordably, with a low carbon footprint, and without the use of power. Cooler keeps perishables fresh for a limited time as a result.

Key words: Evaporative cooler, Perishable, Zero-energy

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Abstract ID: ICBRITAE062

Effect Of Dietary Replacement of Fish Meal with Black Soldier Fly (*Hermetia illucens* L.) Larvae Meal on Growth Performances of Broiler Chickens

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Abstract

The poultry sector is the most efficient and fast-growing agricultural sub-sector encompasses food security and human nutrition. FAO (2013) emphasizes that the global protein malnutrition and food insecurity are expected to advance by 2050. Ever-increasing feed cost inclusive of cost for crude protein sources and importation trade barriers demoted poultry production and consumer purchasing power. The black soldier fly larvae (BSFL, *Hermetia illucens* L.) is a promising nutrient source for replacing costlier feed ingredients as a bio-waste decomposer. The present study aims to evaluate the growth performances of broilers fed with full-fat (FF) BSFL meal and de-fatted (DF) BSFL meal replacing cost-demanded fishmeal at different inclusion levels (2.5%, 5%, 7.5%, and 10%). Two-hundred and sixteen, 14-day old, unsexed Cobb 500 broiler chickens (BW±SD: 343±13g) were assigned randomly into 36 battery cages (04 replicates per treatment, 6 birds/replicate). Dietary treatment effects on average weekly feed intake (FI), average weekly body weight gain (WBG), feed conversion ratio (FCR), average body weight (BW) and average carcass weight (CW) at day 35 were evaluated. Data were analyzed by one-way ANOVA. Total FI was influenced ($P < 0.05$) by the diet incorporated with 10% FF BSFL (Mean ± SEM; 2145±0.03 g) where BSFL full-fat meal were shown to be more palatable than the remained test diets. No negative impact was observed over tested parameters; BWG (1213.21-1466.17 g), FCR (1.7-2.01), BW (1721.96-2006.8 g) and the CW (1111.7-1209.55 g) at the slaughtering time by both FF BSFL and DF meals during the entire period tested. On the contrary BSFL inclusion guaranteed no negative effects over broiler performances and could be a promising expensive feed ingredient replacer for fish meal.

Keywords: Bio-waste, Broiler, BSFL, Fishmeal, Growth

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Abstract ID: ICBRITAE063

Contribution of backyard poultry production systems towards the household nutritional status in Sri Lanka

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Abstract

Backyard poultry keeping is valued as a resilient livestock production system due its use of genetically-heterogeneous, indigenous breeds or their crosses which withstand harsh climatic and management conditions. Backyard poultry production systems (BY) offer numerous other economic, social, environmental and cultural benefits as well. Objective of this study was to estimate the contribution of BY towards the household nutritional status in Sri Lanka. Demographic and egg consumption information of 295 households, along with egg production and selling data of the backyard poultry flocks that each family raised were collected for two months. Of the 134 of monthly egg production, 62 (46%) were used for household consumption. Cost of production was as low as 3.90Rs/egg (as of 2016). Only twelve households (4.1%) opted to sell all the backyard chicken eggs without using any for household consumption. Per day household egg consumption was estimated to be 2.2 (approximately 110g). Egg consumption/head/month did not vary depending on the purpose of poultry keeping; as an additional income source (10 eggs), main income source (14 eggs) or a hobby (10 eggs). Egg consumption per person per week (3.8 eggs) was significantly higher than national per capita egg availability (1.96). Weekly household egg consumption (15.5 eggs) was significantly higher than that reported for a rural household in Colombo District (9.1 eggs/week). Backyard chicken egg consumption fulfilled 9.5%, 7.1, 6.8%, 3% 1.8% and 1.4% of the household riboflavin, protein, Phosphorus, Vitamin D, energy and Ca requirement, respectively. In 49% of the farms, hygienic conditions of the eggs were below “satisfactory level”. Removal of dirt by washing eggs was seen in as high as 80% of the households. Results of the study highlight that backyard poultry production systems contribute substantially towards the household food and nutritional security, though there are some food safety issues.

Keywords: Backyard, Egg, Food, Nutritional, Security, Sustainability

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Abstract ID: ICBRITAE064

Global Food Safety and Security

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Abstract

The onset of the Covid-19 global pandemic brought forth a critical situation for Global Food Safety and Security. Millions of people are now suffering from its negative backlash and live troubled lives within counties succumbing to unprecedented economic shutdowns. As such, Food Security is a greater problem now more than ever. Following a systematic review of articles from both the ScienceDirect and Web of Science databases, policy briefs, country papers, and noteworthy publications of the UN, WHO, FAO, and OECD, this paper encompasses a comprehensive overview of existing literature regarding the adverse effects of the Covid-19 pandemic on agricultural food systems. In the face of such an enormous threat, potential strategies to build up robust, resilient, and sustainable food systems that are capable of ensuring global food security, safety, and endeavours take prime importance. Utilizing multivariate data analysis, the elements that have the greatest effect on a given product during manufacturing are understood. Thus, it can predict the impact of these factors on quality and taste. Future global emergencies and new research policies must also be addressed while achieving the SDG targets. These actions would help fill the void in the relevant research, while also yielding long-term benefits for health, agriculture, and food resilience in an ever-dynamic world. This pandemic clearly portrayed how humans, animals, and the environment are all heavily interconnected, further emphasizing the need for a budding health legislation and a widespread shift in planetary health. The world as a whole must now identify and implement potential mechanisms for the reconstruction of better Food systems via a shift in priorities towards policy coherence, innovative food system administration, re-engineering market, and nexus thinking within food systems. As per our findings, the COVID-19 situation posed unavoidable interruptions to achieving SDG targets on the food security and household poverty fronts.

Keywords: Covid-19, Global food security, Legislation, Resilient, Robust, Succumbing

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Abstract ID: ICBRITAE065

Challenges in Addressing Food Security and Malnutrition in Developing Countries in Asia as a Measure of Sustainability.

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Abstract

In order to ensure sufficient access food and nutrition in developing nations, this study aims to outline the risks and problems that must be overcome. Lack of food or not having continual availability of food to maintain a healthy lifestyle, has become a major problem in poor countries because of the COVID-19 pandemic, the economic crisis, poverty, and climate change. Moreover, emerging problem of malnutrition has made the situation of the poor worse by weakening their immune and repeatedly exposing them to infections. Lack of food supplies is a serious issue for the survival of mankind. In this review, important policies that guarantee food security in emerging nations are under consideration. In order to increase long-term productivity in food supply, it looks at the use of current scenario and less wasteful food supply chains, preservation techniques, climate-resilient agriculture, and legislative changes. The main ways to enhance agricultural activities are to give farmers subsidies and introduce new workable technologies. This review also emphasizes the need of enhancing food security by reducing the negative consequences of climate change and environmental degradation, as well as expanding possibilities for the poor to earn more money and find work. It also emphasizes the significance of contemporary, effective, transparent land tenure regulations for enhanced access and rights as a means of eradicating poverty. Strengthening food security through a long-term framework can contribute to sustainable development in a progressive approach. Based on existing literature for 10 years period, this review seeks to identify challenges in food security and malnutrition in developing countries in Asia.

Keywords: Climate change, Covid-19, Malnutrition, Sustainability, Climate resilient agriculture

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Abstract ID: ICBRITAE066

Impacts Of Global Mega Trends on Food Security: A Review

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Abstract

In 2050 and 2100 respectively, it is predicted that there will be 9.8 billion and 11.2 billion people on the planet. Population growth results in increased food demand, and its impacts are amplified by changes in the types and amounts of food needed by each individual. Poverty is the main source of world hunger. Due to the unequal distribution of income and lack of resources, millions of people in developing countries simply cannot afford the land or farming equipment they need to grow food or else gain access to it. New global megatrends including inflation, civil wars, the COVID 19 pandemic, urbanization, and climate change, as well as aging populations, urban expansion, and scientific and technical developments, have an impact on the ability of the world's population to access food. These trends present issues for the world food market. The objective of this study is to understand the impact of global mega trends on food security and safety to identify ways to ensure the food security in future situations. Currently, food safety is challenged by the global nature of food supply systems. Food protection needs to be handled internationally because of how widely organizations, infrastructure, and teaching capacity vary across countries. It is fairly apparent how current global megatrends will affect food availability and security. A literature survey of comparative case studies is conducted to find out the information. A few strategies to lessen adverse effects include the development of tracing and tracking technologies, big data analysis, ICT and IOT, risk assessment and life cycle assessments of food chains, active packaging, and biotechnology advancement with whole genome sequencing.

Keywords: Food availability, Food safety, Food security, Megatrends, Population growth

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Abstract ID: ICBRITAE067

Development of Cookies from Chayote (*Sechium edule*) Fruit and Wheat (*Triticum aestivum*) Flour Mixture

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Abstract

Chayote (*Sechium edule*), known as Chow Chow, is a less popular vegetable in Sri Lanka. Chayote is known to be rich in many nutrients, including a range of vitamins and minerals. It's evident that highly perishable fruits like Chayote, possess a short shelf life. Hence, it requires testing the potential to incorporate Chayote fruit flour in bakery products with longer shelf life. An experiment was conducted with the objective of investigating the possibility of making cookies incorporating dehydrated Chayote fruit flour so as to increase the popularity of Chayote among people and to use Chayote fruit flour as a substitute for wheat flour in bakery food products. The flour was developed by dehydrating Chayote flesh at 175°C temperature for 15 minutes and grinding well. The three treatments compositing Chayote fruit flour and wheat flour were; 40:60 (T1), 50:50 (T2), and 60:40 (T3) respectively. The flour mixture of 100g was mixed with butter (40g), sugar (56g), sodium bicarbonate (2g) and salt (1g) and baked at 180°C temperature for 30 minutes. Sensory analysis was conducted using a panel of 30 members with a five-point hedonic scale and statistically analyzed using the Friedman test. The best treatment was used for the analysis of nutritional properties using the proximate analysis in triplicate. The study revealed that T1 possesses the best sensory acceptability. It was noted that the product has a low water activity (0.376). Proximate composition confirmed the product is a good source of carbohydrates (51.66%), minerals as a considerably high amount of total ash (1.4%), crude fat (19.39%), and crude protein (16.99%). It concludes that Chayote fruit flour can be successfully used to substitute 40% of wheat flour to make a nutritious cookie. Further studies are required to improve the quality of this product, evaluate its shelf life, and introduce it to consumers.

Keywords: Chayote fruit flour, Cookie, *Sechium edule*, Wheat flour

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Abstract ID: ICBRITAE068

An investigation into Household Food Security Access and Dietary Diversity in Southeast Nigeria

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Abstract

The worsening level of food insecurity has remained a global challenge, especially in developing countries. The Food and Agriculture Organisation in 2021 estimated that 12.1 million Nigerians are facing food security crises, hence, the need to tackle food insecurity. This paper investigated the prevalence of food insecurity, household dietary diversity level, causes, and solutions towards food security; it developed a draft roadmap for achieving food security in Nsukka Local Government Area (LGA) in the South-East of Nigeria. Using the Household Food Insecurity Access Scale and household Dietary Diversity Score, 390 women from the 20 communities in Nsukka LGA representing their households were recruited through their women's group meetings, randomly sampled, and surveyed. Descriptive analysis revealed 83% of households reporting various degrees of food insecurity, with 60.3% severely food insecure. About 53.6% of households fell at or below the average HDDS. Considering the high level of food insecurity in the area, interview sessions were held with two women from each of the five most food-insecure communities (n = 10) to understand the household's perception of causes and solutions to food insecurity. Using thematic network analysis, food security SWOT analysis, and Stetler's model of research utilisation, a draft roadmap was developed regarding sustainable policies toward food security, and food intervention programs to improve food security in Nsukka and is recommended for adoption.

Keywords: Dietary diversity, Food access, Food security, Food insecurity, Household

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Abstract ID: ICBRITAE069

Evaluation of effectivity of stigma receptivity for the successful hybrid seed production of *Platycodon* (*Platycodon grandiflorus*).

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Abstract

Platycodon is a native plant in Japan that was brought to Europe in 1972. The plant's cultivation has advanced more recently as it has been used for cut flowers. Wild edible plants are extremely valuable as food sources and for domestication. In Asia, the bellflower (*Platycodon grandiflorus*) is a widely using as food, medicinal, and ornament purposes. Its root has been a well-liked food addition in traditional medicine for more than 2000 years due to its therapeutic properties. *P. grandiflorus*, which includes 12 cultivars, has gotten excellent reviews for its habitat and floral displays on the ornamental flower market. It is a bisexual flower stigmatic receptivity is facilitating pollen germination, an essential step in successful fertilization that varies greatly among plant species. The dynamics of pollination, the success of reproduction, and plant productivity are all greatly influenced by flower receptivity. Since stigmatic receptivity is sensitive to temperature changes, it is an obvious candidate for climate change vulnerability. A brief period of stigmatic receptivity may impair crop yield. However, despite the physiologic consequences of stigmatic receptivity being widely felt. For plants to successfully reproduce and for regulated pollination to produce hybrids, stigma receptivity is essential. The generation of exudates high in proteins, free amino acids, lipids, and carbohydrates is a sign of stigma receptivity in wet stigmas, which creates an ideal environment for pollen hydration, germination, and early pollen tube growth. In *Platycodon* surface of the stigma becomes sticky and the stigma is fully opened on most effective receptive stage. For a crossover or hybridizing program to be successful, it can be highly useful to know how long stigma receptivity lasts. High enzymatic activity is a characteristic of receptive stigmas. The objective of the study is to find the most effective receptive time period for the cross pollination in *Platycodon* for hybrid seed production. The highest hybrid seed production yield in *Platycodon* was obtained plants which pollinated during most effective receptive stage.

Keywords: Flower receptivity, Hybrid seeds, *Platycodon grandiflorus*, Stigma

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Abstract ID: ICBRITAE070

Analyze the Correlation Between Fruit Setting and Seeds Quality of *Capsicum Annuum L*

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Abstract

High-quality hybrid pepper seeds can only be produced with careful parental line management, expert cross-pollination, and seed processing. The quantity of fruits on the plant has an impact on the seeds' quality in capsicum annum plants. Since plant nutrients and space are limited, the quality of the seeds decreases as the quantity of fruits per plant increases. Consequently, there is a relatively poor overall fruit production. Fruit set peaked early in the crop's development but then decreased when the majority of flowers aborted. Overall, there was a negative relationship between fruit weight and seed weight and seed quantity during the course of the crop's life. In comparison to plants cultivated at higher densities, those that were planted at lower densities produced relatively bigger fruits and seeds that germinated more quickly. The C exchange rate and assimilate export rate of plants with non-thinned fruit loads were greater than those of plants with extremely few fruits, respectively. However, compared to plants with a huge number of fruits that exceed their maximum capacity, these plants' seeds had a substantially greater germination percentage. The *Capsicum annum* plant's fertilization and seed setting are most significantly impacted by nighttime temperatures. Sweet pepper will yield few seeds if the night temperature falls below 15 ° C. Temperatures below 10 ° C at night hinder fertilization and encourage pathenocarpic fruit set. The ideal number of fruits for maximal seed laying and seed vigor in open field hybrid seed production of sweet peppers is believed to be 6-8 fruits. The ideal number of fruits per plant for the elongated bell pepper type is 7-9.

Keywords: *Capsicum annum*, Fruit setting, Germination, Quality, Seeds

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Abstract ID: ICBRITAE071

Emergent or a Tip of Iceberg: Vulnerability of Food Security Sector in Sri Lanka

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Abstract

Food insecurity has never been felt and debated as today in Sri Lanka. Economic crisis, COVID-19, organic fertilizer policy, and past policies and practices are among the few reasons to blame. It remains to be seen whether this is an emergent issue or the tip of the iceberg resulting from inherent and systemic vulnerabilities of the sector, exacerbated by climate change and disaster risks. Most countries consider food security a fundamental right. It is the second priority of the sustainable development goals (SDGs), 'Zero Hunger.' It aims to 'end hunger, ensure food security, improve nutrition, and advance sustainable agriculture.' It directly links to the first SDG, 'No Poverty,' yet Sri Lanka struggles as never before with increasing poverty, hyperinflation, and economic shocks leading to widespread food insecurity. Therefore, this research aims to identify inherent and systemic vulnerabilities that have elevated the overall risks of the food security sector in Sri Lanka. Using a case study research strategy, semi-structured interviews were conducted with policymakers, technical experts, and practitioners in the domains of food security, climate change, disaster risk reduction, and socio-economic development planning. Collected data and evidence were analyzed using Thematic Analysis and Cognitive Mapping with the assistance of Nvivo-20, Computer-Aided Qualitative Data Analysis Software. The findings suggest that current food insecurity in Sri Lanka is not an emergent issue but a range of systemic vulnerabilities associated with institutional, policy, planning, and practice gaps, exacerbated by the ongoing economic crisis, Covid-19 pandemic, climate change and climate-induced disasters, have led to the current food insecurity crisis across the country. Worse is yet to come if the underlying vulnerabilities are not addressed.

Keywords: Climate change, Disaster risk, Food security, Vulnerability

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Abstract ID: ICBRITAE072

Can the Biofortification of Staple Crops be Part of the Solution To Addressing Micronutrient Deficiency? Key Findings from the Bizifed2 Study.

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Abstract

The climate crisis is causing an increase in frequency of humanitarian disasters, requiring multisectoral interventions to alleviate and mitigate impacts on food security, nutrition emergencies and the longer-term sequelae of malnutrition. Globally, 1 in 2 children under the age of 5 years and 2 in 3 women of reproductive age have at least one micronutrient deficiency, with highest prevalence in South Asia and sub-Saharan Africa. One strategy to improve micronutrient intake on a population scale is through biofortification of staple crops. We have recently completed the first effectiveness trial of a zinc biofortified wheat variety, Zincol-2016, for alleviating zinc deficiency in a rural region Pakistan. The trial, entitled “BiZiFED2” was comprised of three research streams: a randomised controlled trial to examine the impact of consuming zinc biofortified wheat flour on health outcomes; an evaluation of the crop performance under differing soil organ and inorganic compositions; a qualitative analysis of the acceptability of biofortified crop varieties to farmers and consumers. The key findings of this study were that consumption of zinc biofortified wheat flour increased the daily dietary zinc intake by 20% in adolescent girls. A survey of farmers revealed that the Zincol-2016 wheat variety performed well in terms of its yield and disease resistance compared with standard wheat varieties, and consumers reports regarding taste and acceptability of flour made from the Zincol-2016 wheat were broadly positive. These data provide valuable evidence to support the scale-up of the release of biofortified staple crops to address micronutrient deficiencies globally.

Keywords: Malnutrition, Micronutrient deficiencies, Crop biofortification, Randomised controlled trial, Pakistan.

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Abstract ID: ICBRITAE073

Conference Sub Theme Six
Disasters and Agricultural Vulnerability

Modeling Hydrological Parameters Using Soil and Water Assessment Tool (SWAT) in the Kelaniya River Basin of Sri Lanka

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Abstract

Environmental impact of land use, land change, and climate change have been perilous around Sri Lanka during past few decades. SWAT is a small watershed to river basin-scale model used to simulate the quality and quantity of watersheds and the impacts of climate change. This study was carried out to (a) explore the performance of the SWAT in simulating streamflow from the Kelaniya river basin of Sri Lanka, and (b) execute a sensitivity analysis utilizing SWAT-CUP software. ArcSWAT version 2012.107.24 was used to create the model of the Kelaniya River sub-basin. The basic inputs for this study were topography, soil type (DSMW-1:5.000.000), land use (30×30m), and climate data [rainfall (RF), minimum and maximum temperatures, solar radiation, wind speed, and relative humidity (RH) from 2000 to 2021]. SWAT-CUP SUFU2 calibration uncertainty procedure was used for calibration and validation. The Nash-Sutcliffe efficiency (NSE), percent bias (PBIAS), and R^2 , as well as model prediction uncertainty at 95% confidence intervals, were used to evaluate model performance (95PPU). SWAT was demonstrated to be capable of reproducing the observed daily fluctuation in streamflow, satisfying the model performance evaluation criteria ($R^2=0.5$, NSE=0.5, and PBIAS=25). The findings also indicated a moderate to a satisfactory degree of agreement between SWAT's simulations of catchment peak flow events. It also confirmed that SWAT performs well to simulate the daily streamflow in Kelaniya river. The SWAT hydrological modeling can be used to estimate water balance in the Kelaniya River basin as an effective and accurate soil water analysis technique.

Keywords: Hydrological modeling, Streamflow, SUFU2, Water balance

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Abstract ID: ICBRITAE074

Exogenous Application of Salicylic Acid Alleviates Negative Effects of Drought Stress in Rubber Nurseries in the Intermediate Zone of Sri Lanka

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Abstract

Drought is a disaster having a huge impact on agricultural production. When the Intermediate Zone and a few parts of the Dry Zone of the country had been targeting to plant rubber, climatic conditions in those areas displayed sub-optimal for growing rubber, especially during nursery and immature stages. However, to alleviate the negative impact of drought stress, it is essential to prime the young rubber plants for enhanced tolerance. Salicylic acid (SA) is an important priming agent known to alleviate drought stress in plants. The present study was to investigate the effect of the exogenous application of Salicylic acid on the growth performance of rubber nursery plants under drought stress conditions in the Intermediate Zone of Sri Lanka. A split-plot experimental design was employed with two factors: different drought severity levels viz. non-stress (at 10 % depletion level of soil moisture), mild stress (50 %), and severe stress (70 %), and different concentrations of SA (0.0 mM, 0.1 mM, and 0.3 mM). Each treatment has four replicates consisting of 30 seedlings in each replicate. Seedlings were treated with 100 ml of SA as a soil drench in monthly applications. Physiological parameters viz. chlorophyll content, stomatal conductance, and plant growth parameters viz. stem diameter, root length and dry matter analysis were recorded. Drought stress significantly retarded the growth of seedlings. The results revealed that drought stress possesses numerous physiological and morphological effects on rubber nursery plants, including decreases in chlorophyll content, stomata closure, dry matter reduction and increase in leaf temperature. However, these adverse effects could be alleviated by applying Salicylic acid and plants that were treated with Salicylic acid at 0.3mM concentration showed improved physiological and morphological parameters and increased water use efficiency compared to untreated or lower concentration (0.1mM) of salicylic acid. Therefore, an exogenous application of Salicylic acid is a viable solution for enhancing the growth of rubber nursery plants in Sri Lanka under drought-stress conditions.

Keywords: Drought stress, Rubber, Salicylic acid

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Abstract ID: ICBRITAE075

Flood Susceptibility Assessment using Frequency Ratio and Statistical Index Models

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Abstract

Flood susceptibility area assessment is a prerequisite for implementing flood mitigation and adaptation strategies. A variety of technologies and models have evolved over time, and this study focused on the Frequency Ratio (FR) and Statistical Index (SI) models to compare their performance in forecasting flood susceptibility areas (FSA). Rainfall, land use land cover (LULC), normalized difference vegetation index (NDVI), elevation, slope, slope aspect, distance to river, soil type, lithology, topographic wetness index (TWI), topographic roughness index (TRI), sediment transport index (STI), and stream power index (SPI) were the major causing parameters of FSA. These components were examined in their contribution to FSA with all location data and field plotting of responsible parameters were done in the study area using Geographic Information System (GIS) software, and model validation was done with a randomly selected data set. Area under curve (AUC) analysis was used to validate accuracy. Models with high accuracy (more than 80%) reflect better performance, and these studies show that the FR method is more accurate than the SI method. However, the result can vary depending on the study area chosen and some other factors that influence flood susceptibility. As a result, more research is required to determine causing factors, as well as advanced computational technologies to optimize model accuracy.

Keywords: Frequency ratio, Flood susceptibility area, Risk assessment, Statistical index

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Abstract ID: ICBRITAE076

Application of Circular Statistic on Wind Direction and Adjust the Sowing Date Considering Wind Characteristic and Rainfall in Galle District, Sri Lanka.

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Abstract

This study is focused on statistical analysis of weather data to determine dates for agricultural practices in paddy farming in Galle district. Wind speed, wind direction and rainfall data were used as weather parameters. The circular statistics were used for analyzing wind directions. All data sets were obtained since 1985 - 2018. The Rayleigh z Test was used to decide uniformity of the mean wind directions. The onset of rains and the length of seasons, sowing dates were determined in Yala and Maha season. At the 5% significant level after applying the Rayleigh Z test, higher rejection percentage of the null hypothesis was observed in May, June, July and September months. It reveals about possibility of significant directional wind flows. Lower percentage of rejection of H_0 can be seen in February, April and November. If the month showed a higher rejection percentage of null hypothesis and higher wind speed, no of rainfall days also high in that months. Most of years the first inter monsoons were activated from 01st to 07th April and southwest monsoon was started in between 1st to 7th May. The optimum time for sowing in the Yala season is on 1st -7th May. Since 3-4 weeks are allocated for land preparation that can be started after the commencing of first inter monsoon in 1st week of April. If paddy farming is started during this time duration, harvesting can be done from 15th August to 1st September. Onset of second inter monsoon is activated on 1st September to 15th October and mostly activated period is 1st -7th September. The North-east monsoon was started in between 1st to 7th December mostly. The optimum time for sowing in the Maha season is in the 3rd week of October. 3-4 weeks are allocated for land preparation that can be started in the 2nd week of September and farmers can harvest the yield in February.

Key words: Circular statistics, Onset of rainfall, Rayleigh z test, Wind direction, Wind speed

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Abstract ID: ICBRITAE077

Maintaining Cropping Intensity in the face of changing Climate in village Tank Cascade Systems in the Intermediate Zone of Sri Lanka

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Abstract

Agriculture in the dry and intermediate zones of Sri Lanka has become one of the key sectors that widely affected by climate change impacts. Farming communities are the most vulnerable in terms of water shortage leading to crop damages and drastic income reduction in the farm households (HH). The village tank cascade systems (VTCS) have proved to be a sustainable system that effectively combats climate shocks on crop cultivation. The socio-economic characteristics and bio-physical features of the farmlands should have a prominent role to play for maintaining crop production in the areas under VTCS. Thus, the present study was undertaken to ascertain the determinants of the crop production indicators, particularly the cropping intensity (CI) in climate-vulnerable agricultural landscape in the intermediate zone. The data collection was conducted through a questionnaire survey for randomly selected 210 farm HH in the *Divulkadawara* VTCS in the *Deduruoya* river basin. After outliers were removed from the sample 190 farm HH selected, and the multiple regression analysis was carried out. The results reveal that the type of land ownership, level of education of the HH head, practicing crop-rotation, total cropland extent, hired labour usage and external support on agriculture have significant relationship with the CI of the farmlands. Years of education (0.01) hired labour usage (0.072), and entitled to government support (0.096) and having both owned and leased land (0.161) showed a positive correlation with the CI at 5%, 5%, 5%, and 1% significant level respectively. Whereas if the farmer practiced crop rotation (0.139), and the total extent of landholding (0.119) showed a negative relationship with CI at a 1% significant level each. The findings highlight the need of initiatives to be taken and strengthened policy makers, implementers for continuity of the crop production under VTCSs and the increased climate resilience in the farm fields.

Keywords: Climate change, Cropping intensity, Intermediate zone, Village tank cascade system

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Abstract ID: ICBRITAE078

Opportunities and Entry Points for Enhancing Inclusive Climate Risk Management and Addressing Climate-Related Loss and Damage in Sri Lanka's Agriculture Sector

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Abstract

Agricultural ecosystems in Sri Lanka's dry zone are increasingly exposed to climate-related disasters and a variety of sudden- and slow-onset climate impacts that threaten to exceed their adaptive and coping capacities. Therefore, it is pivotal to strengthen inclusive, participatory, and evidence-based risk management frameworks for farming communities that integrate traditional and informal risk-sharing as well as formal risk transfer and finance instruments. This research identifies opportunities and entry points for enhancing existing risk management mechanisms as well as innovative mechanisms and partnership approaches, including public-private and multi-actor partnerships. Findings are based on a literature survey; interviews and group meetings with more than 600 members of farming communities in four DS divisions of Anuradhapura and Trincomalee district; and a consultative process engaging key national-level stakeholders from the public sector, private sector, academia, and civil society, which was carried out from March 2020 to October 2022. The research indicates that while there is a range of existing risk management mechanisms (such as social security and the crop insurance scheme operated by AAIB), there remains significant potential to strengthen coordination and knowledge-sharing between key actors; enhance financial literacy and inclusion among farming communities; build human and institutional capacities; introduce new and innovative mechanisms (for example, index-based or hybrid risk transfer schemes, bundled insurance, or risk-related financial instruments); better align plans and actions across stakeholder groups; and contribute to the growing evidence base on climate-related loss and damage that could feed into national as well as global processes, particularly those under the UNFCCC.

Keywords: Sri Lanka, Agriculture, Climate risk management, Crop insurance, Loss and damage

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Abstract ID: ICBRITAE079

The impact of government's Agricultural policies on agricultural vulnerability in Sri Lanka

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Abstract

The impact of government's agricultural policies on agricultural vulnerability in Sri Lanka is examined in this study. Governance is defined by the World Bank as "how authority is exercised in the management of a country's economic and social resources for development". In working on economic governance, the government is focused on the agricultural sector. While agriculture generates approximately 7.4% of national GDP, it employs over 30% of Sri Lankans. The objectives of this study were to (a) investigate newly appointed government policies regarding agriculture, (b) examine the situation that occurs when public policies are implemented from the top down, (c) explore what problems farmers face as a result of government policies, and (d) explore how the government sector works in agricultural vulnerability. 50 respondents from Makandura and Pannala, two villages in the Kurunegala district, were chosen as the sample by using a non-random sampling technique. Face-to-face and in-depth interviews were also done. The practical issues with government's agricultural policy from the top level to the bottom level were the study's results. The people in the agriculture sector have several socio-economic issues as a result of differing policies throughout the change of administrations and a failure to adhere to the policies of the previous governments. This research also showed that when government policies and objectives are implemented from the top down, the current organizational structures are insufficient to produce the intended results. It implies that the situation cannot be addressed by the current government policy.

Key Words: Agricultural vulnerability, Economic development discourse, Government, Governance, Public policy

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Abstract ID: ICBRITAE080

Dynamics of Social Vulnerability among Farmers in Irrigated-Agricultural Settlements in the Dry Zone Sri Lanka

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Abstract

Land colonization and irrigation development projects in the dry zone of Sri Lanka were piloted and established even before Sri Lanka was declared an independent nation. The Accelerated Mahaweli Development Programme (AMDP) was the largest irrigated land development project in Sri Lanka that started in the mid-1970s, which changed the social ecology of dry zone agriculture. Under the AMDP, 331,000 families have been settled by 2018 and 201,672 hectares have been cultivated which 165,420 hectares are dedicated to paddy. Despite having the greater agricultural contribution provided by resettled farmers, social vulnerability among farming communities is significantly high due to commercial farming. Within this outset, the objective of this research was to examine the social vulnerability among farmers caused by commercial agriculture in the irrigated agricultural settlements in the dry zone of Sri Lanka. The research was a qualitative study based on field research among farmers in Dehiattakandiya and Giradurukotte areas. In-depth interviews were used as the tool for data collection from farmers and farmer associations. Findings suggest that the vulnerability faced by farmers is largely caused by the scarcity of land and dependency of economic activities on the recently-emerged-merchant class in the farmer resettlements. Ironically, suicide cases and chronic poverty among farmers in settlements are significantly higher compared to other proximate non-resettled areas, which shows the severity of the social vulnerability among farmers. The social destitute of indigenous communities caused by modern agricultural practices has also been highlighted as a significant factor that needs urgent policy attention.

Keywords: Dry-zone agriculture, Farmer resettlements, Irrigated agriculture, Social vulnerability

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Abstract ID: ICBRITAE081

Understanding the Institutional Landscape to Increase Disaster Risk Resilience Through University-Enterprise Collaborations

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Abstract

University-Enterprise collaborations (UECs) represent an innovative opportunity to develop resilience amidst the threats of a rapidly changing climate. By combining academic expertise and resources with knowledge and capabilities from other sectors preparations can be made to address the priorities of the Sendai framework. However, guidance on how to successfully create and maintain UECs is limited, especially those focusing on reducing disaster risk and enhancing recovery efforts. This research aimed to understand factors that contribute to the development and maintenance of effective UECs in three countries (Philippines, Sri Lanka, Thailand) by drawing on the experiences of managerial and academic staff from resident institutions and their entrepreneurial partners. Three questionnaire studies were completed to identify barriers and enablers of UECs with an emphasis on disasters. Responses to the survey were analysed thematically and four themes emerged: administrative, financial, cultural, and capability factors. From these recommendations to increase UEC success were extrapolated and used to create a UEC framework.

Keywords: Collaboration, Disaster, Enterprise, Partnerships, Preparedness

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Abstract ID: ICBRITAE082

Conference Sub Theme Seven
Life Cycle Assessment and Circular Economy

Development of Syphoned DHS Reactor for Improving Denitrification Efficiency of Sewage Water Treatment System

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Abstract

Down-flow hanging sponge (DHS) is an affordable biological treatment system used in nutrient removal. Though the DHS reactor has high efficiency in organic matter removal and nitrification, the denitrification process has many problems. The main objective of this study was to develop a DHS system to enhance denitrification in sewage water treatment. A laboratory-scale DHS was modified by adding a siphon tube to the effluent port. It created aerobic and anaerobic conditions in the same reactor without using extra energy for pumping. The syphoned height was 3/5 from the reactor's height, which facilitated wastewater accumulating up to 30 cm from the bottom of the reactor. Accumulated water column maintained an anaerobic zone at the bottom part of the reactor and facilitate denitrification. The reactors were operated for 250 days at 24⁰C, and hydraulic retention times (HRTs) were three hours. A conventional DHS similar to the syphoned DHS (volume = 3166.8 cm³) was operated under the equivalent conditions as a controller. The syphoned and conventional DHS were approximately similar in nitrification efficiency (61.7±31.1% and 62.9±30.6%, respectively), and the developed anaerobic column does not affect the ammonium removal process. The total nitrogen removal rates were 17.9±15.7% for syphoned DHS and 8.8±11.8% for conventional DHS. The total nitrogen removal rate of syphoned DHS was two folds greater than the nitrogen removal rates of conventional DHS. The highest number of denitrifiers (*Comamonadaceae* and *Rhodocyclaceae*) were recorded in the bottom part of the syphoned DHS reactor. *Planctomycetota spp.* were recorded as anammox bacteria, and the highest number (7%) was in the middle part of DHS, where had the alternating environmental condition. The denitrification was enhanced by the anaerobic conditions in syphoned DHS and possibly caused by denitrifiers and anammox bacteria.

Keywords: Anaerobic condition, Anammox, Denitrifiers, Nitrification

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Abstract ID: ICBRITAE083

Development of the Mobile Smart Agroecosystem-based Resilience Centre for Teaching, Learning, Research and Development

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Abstract

During COVID-19 pandemic, the advantages of M-learning became conspicuous, and most learners preferred applying the innovative Smart Agroecosystem Based Resilience (SAR) Centre for Teaching, Learning, Research and Development and mobile phones over other media. Whereas there were numerous pathways and techniques to get educational resources throughout the COVID-19 time, most learners preferred applying the innovative Smart Agroecosystem Based Resilience (SAR) Centre for Teaching, Learning, Research and Development and mobile phones as substitutes. Mobile SAR centre allows learners to improve their expertise, discover required knowledge, simplify information distribution and teamwork, and broaden their understanding. Teachers can customize their education over the mobile SAR centre and allow students to self-manage their education. This Centre promotes lifelong learning in the society by making study materials accessible outside the traditional classroom environment to a wide range of users within the community, from students and lecturers to practitioners and policymakers. The mobile SAR centre was developed during the implementation of the project “Building Resilience in Tropical Agro-Ecosystems – BRITAE” (No. 610012-EPP-1-2019-1-LK-EPPKA2-CBHE-JP).

Acknowledgements

This research was supported by the Build Resilience in Tropical Agro-Ecosystems (BRITAE, No. 610012-EPP-1-2019-1-LK-EPPKA2-CBHE-JP) project funded by the Erasmus+ Programme of the European Union.

Keywords: Agro-ecosystems, Innovative teaching and learning, Mobile learning, Student centered learning

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Abstract ID: ICBRITAE084

Integration of Circular Economic Principles within a Disaster Resilient Housing Sector

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Abstract

One of natural disasters' most devastating and destructive consequences is damage to the housing sector, leading to a serious socioeconomic downturn in the human development agenda. Additionally, the shortage of quality, affordable housing is a problem worldwide that is made worse by the disaster losses emerging more frequently.

Therefore, the necessity to improve the housing sector's disaster resilience has been widely explored. Technical expertise for the resilient construction methodology has previously been covered extensively. However, implementing disaster-resilient technology is still challenging because of limited resources and competing demands. In light of this, the research explores how the circular economy principles could improve the housing sector's disaster resilience. The narrative literature synthesis approach was used to conduct a desk review for the study, and the results were then summarised using qualitative content analysis and thematic analysis.

The findings reveal how the circular economic concepts could be integrated within a disaster-resilient housing sector under the physical, economic, social, and environmental philanthropic areas. The circular economic concepts that promote minimising wastage increase reuse and recycling. Moving from an open-ended, linear model of production and consumption can reshape how the housing stock is designed, constructed, and managed. The circular economic concept has the ability to positively influence the disaster resilience of the housing sector by maximising resource consumption and building economic, natural, and social capital leading to resilient and cohesive societies.

Keywords: Circular Economy, The housing sector, Disaster resilience

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Abstract ID: ICBRITAE085

Environmental Impacts of Chicken Production Using Life Cycle Assessment: A Case Study in Vavuniya District for Backyard Chicken and Broiler Chicken

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Abstract

About 14.5% of the world's greenhouse gas (GHG) emissions come from the supply chains of livestock. Poultry is the fastest-growing livestock sector accounting for 64% of all livestock productions in Sri Lanka in 2019. This study compared the environmental impacts of broiler and backyard chicken productions using cradle-to-gate lifecycle approach before slaughterhouse. The study evaluated eight broiler and eight backyard chicken farms located in Vavuniya district in Sri Lanka. Required raw materials (fuel, feed, water, and electricity), egg weight of backyard chicken and final live weight of broiler and backyard chicken were measured. The impact categories such as Global Warming Potential (GWP), Fossil Energy Use (FEU), Water Use (WU) and Feed Conversion Ratio (FCR) were manually calculated. Research findings implied transportation phase as the most GHG emitting process, reporting 71% and 64% of total GHG emissions in broiler and backyard farms, respectively. The average total GHG emission of broiler and backyard chicken were 0.6661 and 0.54634 kg CO₂-eq per 1kg live chicken, respectively, exhibiting no significant difference ($p > 0.05$). In case of water use, cleaning and drinking were identified as the most water-consuming activities demonstrating a significant difference between two types of chicken at $p < 0.05$. The deviation in FCR of both types of chicken farms (Broiler=1.21-2.07; Backyard=1.03-2.75) was due to unsuitable rooftops, insufficient shed area, and poor farm management. Thus, the study concludes backyard chicken production as preferable, more than broiler chicken productions. Further, recommends an effective transportation plan and daily water metering system to lower the environmental impacts.

Keywords: Backyard chicken, Broiler, Feed conversion ratio, Greenhouse gas, Life cycle assessment

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Abstract ID: ICBRITAE086

Impact on Sustainable Development on the Tea Estates of Badulla: A Case Study on Zero Carbon Footprint Towards Tea Estates and Community

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Abstract

Sustainable development of tea estates is necessary to reduce greenhouse gas emissions, support biodiversity and manage agro-ecosystems, while Badulla tea estates comprise uncompensated carbon-neutral. Sustainable development is a dependent variable used to evaluate the relationship between independent variables such as carbon footprint, reforestation, and biodiversity conservation. The research objectives are to examine the Sustainable development of tea estates, its impact on zero carbon footprints, and to provide recommendations to support biodiversity and agro-ecosystems. The sampling method used was simple random sampling with 120 respondents from tea estates. Data was collected through an online Google form and analyzed using SPSS. Carbon footprint, reforestation, biodiversity conservation, and sustainable development were analyzed using Cronbach alpha values: .863, .844, .865, .916, and correlation coefficient values; .785, .832, .811. The adjusted R-value and R square value were .761 and .765 respectively. Hypotheses were tested as all three variables were accepted.

Carbon neutrality can be improved by using renewable energy sources such as wind and hydropower, which can reduce carbon emissions. Strategies such as low carbon transition, industrial/restructuring, energy conservation, improving efficiency to utilize clean energy, and developing a circular economy can help reduce carbon footprint. Carbon neutrality can be improved by using innovative ideas such as fixing thermal solar panels and using renewable energy sources, reducing the environmental footprint of wind and hydropower. Low carbon transition, industrial/restructuring, energy conservation, improving efficiency to utilize clean energy, and developing a circular economy can help achieve sustainability goals. The exportation of tea can improve the sustainability of ecosystems, restore forest cover, and improve conditions in Sri Lanka by increasing plantations and preserving agroforestry. Organic farming, rainwater harvesting, and conservation forestry can reduce waste footprint, increase soil carbon pool, reduce atmospheric CO₂ concentration, and mitigate climate change. Organic fertilizers can help reduce soil erosion and improve the micro-climate of tea bushes, utilizing natural resources such as t-65, carbonic fertilizer, and compost. Sustainable development focuses on protecting soil quality and microbial activities to improve environmental quality and reduce emissions.

Keywords: Sustainable development, Tea, Carbon footprint, Reforestation, Biodiversity conservation

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Abstract ID: ICBRITAE087

Mobile Technologies for Waste Management: Design Considerations, Challenges and Implications for Circular Economy

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Abstract

Municipal Solid Waste (MSW) can be converted into bio-products such as fertilisers, energy and other useful by-products contributing to the circular economy. However, absence of suitable infrastructure has hindered such developments in Sri Lanka. Often these waste products end up in open dumps creating hazards for the local population, thus creating a negative effect on the society and the economy. Mobile applications are a suitable tool for connecting waste producers with recyclers, thereby creating an eco-system through which effective management of biodegradable waste can be achieved. Therefore, the objective of this work is to develop suitable mobile technologies for MSW management and identify challenges in implementing them.

The requirements and constraints for the mobile application were identified through a comprehensive literature review and 117 semi-structured interviews conducted in two local authority areas in Colombo, Sri Lanka. The findings from interviews were analysed using manual content analysis to derive functional and technical specifications for the mobile application. Thematic analysis was used to identify societal and technological challenges. Findings highlighted the suitability of mobile applications for improving waste management and highlighted some of the concerns of the local population and policy makers. Based on the analysis, a prototype mobile application system was developed. The functionality of the system was tested, and user feedback was obtained through another round of semi-structured interviews. The developed system included two mobile applications, one each for the waste disposer and the collector, and a real-time management console for the local authority through which real time data could be analysed.

This work demonstrates mobile applications can work as a catalyst for improving circular economy in developing countries taking Sri Lanka as an example, but for successful deployment technological innovations should always be developed with a wider understanding of social and cultural concerns of the local population.

Keywords: Circular economy, Mobile applications, Municipal solid waste (MSW), Sri Lanka

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Abstract ID: ICBRITAE088

Agriculture Sector Modernization Project (ASM) Responding to the Economic Crisis while Developing the Blue Economy in Sri Lanka: A Review of ASMP Contribution to the Shrimp Industry in the Country

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Abstract

For more than a decade, up until 2016, the endemic white spot affected Sri Lanka's shrimp industry. But since 2017, the Ministry of Plantation Industries' Agriculture Sector Modernization Project (ASMP), which is supported by the World Bank, has made a substantial contribution to the growth of the sector as a whole. The purpose of this research is to evaluate ASMP's role in reducing the economic slowdown through actions made to enhance the entire value chain for the shrimp industry and to discuss about ASMP's contribution to developing a blue economy. The ASMP has approved a non-refunding "Matching Grant" of Rs 428 Mn for the development of the shrimp industry for the development of the industry, with a state-of-the-art nauplii facility, 15 hatcheries, 21 farmers, 3 high-density farming facilities, and a processing center. The ASMP streamlined a closed water circulation system to ensure the biosecurity of the farms and the technical support of the NAQDA institute for the farms that were depending on the Dutch canal for water resources. By establishing biosecurity measures in farms and hatcheries, the NAQDA standard-graded methods were adopted for ASMP sub-projects to upgrade all ASMP-granted shrimp hatcheries to a B+ grade. Thus, ASMP made a significant contribution to implementing a blue economy in Sri Lanka through its sub-projects. Consequently, ASMP granted farmers have contributed to around 1,500 Mt of shrimp production in 2021. Moreover, its nauplii centers and hatcheries continued to further contribute to the supply of nutritious food for the country and earn around Rs. 8,462 Mn by producing a record-breaking 14,415 Mt of shrimp production in 2021.

Keywords: ASMP, Economy of the country, Shrimp industry, Blue economy, Export earnings

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Abstract ID: ICBRITAE089

Reconstruction for Resilience and Sustainability: A Bibliometric Analysis

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Abstract

In addition to being essential for the recovery of communities, ensuring the availability of housing and infrastructure to enable services, the post-conflict and post-disaster reconstruction processes have significant impacts on current and future energy use, emissions, sustainability, and resilience. The purpose of this study was to review the research literature in relation to reconstruction for built environment resilience and sustainability.

A literature search was conducted for peer-reviewed articles (with no time restrictions) indexed in the Scopus database. This resulted in a total of 387 articles being identified. Bibliometric analyses were carried out including a time series analysis, an analysis of the different publication sources (journals, books, and conferences), countries of origin, keywords and co-authorship analysis.

With respect to the identified literature, it was found that only 10 articles were published between 1964 (the earliest article identified) and the year 2000 after which, the number of articles per year showed a general increasing trend to a peak of 36 articles in 2020. The publications with the highest number of relevant articles were found to be the International Journal of Disaster Resilience in the Built Environment (31 articles) followed by the International Journal of Disaster Risk Reduction (19 articles) and, in third place, Disasters (12 articles). The country analysis indicated that most research has been carried out by researchers affiliated to institutions in the UK, USA, and Australia. Keyword analysis revealed that post-disaster reconstruction and resilience themes were strongly dominant over sustainability and post-conflict reconstruction. Analysis of co-authorships showed the existence of distinct clusters of collaborating researchers with the largest and most productive group centred around the author D. Amaratunga.

The findings of this study provide researchers with a quantitative overview of the current state of reconstruction research and can be useful for identifying new and under-investigated areas in this field.

Keywords: Built environment, Post-conflict reconstruction, Post-disaster reconstruction, Resilience, Sustainability

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Abstract ID: ICBRITAE090

Can Lifecycle Thinking Lead to Burden Shifting and Incorrect Conclusions in Agro-ecosystems?

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Abstract

Life Cycle Assessment (LCA) is currently the best metric for assessing the environmental impact of production and consumption activities, due to its standardised. An objective of LCA and life cycle thinking is to prevent burden shifting, which is common when only looking at certain impacts or certain activities in the production and consumption of resources. However, this paper explores how burden shifting occurs due to the choices made. The functional unit can impact the outcome of the study. For food products it can be based on: (i) harvest weight, (ii) processed weight, (iii) calories, (iv) nutritional content, or (v) food consumed. All have their own system boundaries leading to different result. Using a functional unit based on weight of contained products, does not represent the true lifecycle. Food can remain within the packaging and create unaccounted for waste. Although weight can be the functional unit, research on how the consumer behaves is needed. This applies all along the supply chain from farm to fork. Without this we can end up underestimating the true impact of food storage, packaging and loss. Environmental LCAs only accounts for negative impacts leading to a biased outcome. For example, large monoculture farms are efficient at producing xkg of produce, compared to organic farms. However, the added eco-system services provided by organic farming are out of scope. This results in the ecosystem services not being considered. A more robust methodology is to use social LCAs and account for positive impacts as well. The other bias is consequential or attributional LCAs. An attributional LCA has in scope the need for products but does not account in soil quality whereas a consequential LCA would have soil degradation and promote a more sustainable policy towards agro-ecosystems.

Keywords: Ecosystem services, Life cycle assessment, Sustainable consumption and production

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Abstract ID: ICBRITAE091

Conference Sub Theme Eight
Agricultural Policies, Concepts and Strategies

Impact of the Organic Fertilizer Policy on Agrarian Societies in Sri Lanka: A case study of Mahaweli System C.

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Abstract

Public policy is a political process that concern the issues of a country and determines its future. The form, content, and the implementation of policy is significant in shaping the future of the public and the country at large. Organic Fertilizer Policy (OFP) which was introduced in the 2021 in Sri Lanka is one of the most significant policy decisions which affected the agriculture from the small-scale farmer to the national economy. This paper attempts to explore the impact of the OPF on the food security and the economic stability of the country. The research employed mixed method: 10 in-depth interviews, 6 FGDs, and a survey (125 respondents) to collect data in Giraduru Kotte of Mahaweli System C in Sri Lanka in 2022. It was revealed that the OFP has affected the agriculture of the area and the livelihood of the people. For example, number of acres cultivated has reduced and the yield has decreased from 22,110 to 14,538 metric tons with compare to the previous year, cost for inputs and machinery has increased, quality of the products has decreased, and as a result the income of the farmers declined. The direct impact of the policy was, it affected the livelihood of the people at the village level and to the country economy at large. It was identified that the lack of policy analysis in order to formulate policies based on scientific research, policy advise with all stakeholders, and the policy leadership to include the policy into the government agenda were the main causes for the failure and for the adverse effect. Hence, in order to establish sustainable policies which is also affect the entire country, it is strongly recommended to follow the steps of the policy cycle when formulating policies.

Keywords: Public policy, Organic fertilizer policy, Livelihood, Policy cycle

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Abstract ID: ICBRITAE092

Source Emission Air Quality Standards for Sanitary Landfill Sites in Sri Lanka

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Abstract

Solid waste management is a major issue that needs to be addressed around the world, and it should be prioritized. There are no standards in Sri Lanka to regulate source emissions from landfill sites. As a result, establishing a national emission standard for landfill sites is a critical and valuable requirement. This research was conducted to fill that gap. In March and April, the air quality at the Kirindiwela sanitary landfill site was assessed. Pollution parameters such as PM_{2.5}, PM₁₀, CO₂, NH₃, NO₂, and CO were investigated using a sensor-based air quality monitoring device 10 m away from the site to assess temporal variations and find correlations with different parameters. To find spatial variations in CH₄ concentrations of each cells of the respected sanitary landfill site a flame ionization detector with air-filled bags was used. A systematic review was conducted from 2000 to 2022 to recommend on source emission air quality standards for Sri Lankan sanitary landfill sites. When analyzing the site's air quality, the mean values for PM_{2.5}, PM₁₀, CO₂, NO₂, CO, CH₄ and NH₃ were 26.87±1.74(µg/m³), 41.28±2.36(µg/m³), 498.66±2.32ppm, 6.043±0.546ppb, 0.702±0.105ppm, 1.6168±0.0576ppm, respectively and below detection level. Using correlation analysis, a strong positive correlation between PM_{2.5} and PM₁₀ was discovered. Using a two-sample t test, spatial variations in CH₄ emissions in each cell of the landfill site were analyzed. There were no significant temporal variations in PM_{2.5} and PM₁₀ concentrations in the site. Except for PM_{2.5}, all greenhouse gas emissions and PM₁₀ were within acceptable limits according to the landfill-oriented gas air quality standards. To protect the nearby community and surrounding area, control measures to reduce PM_{2.5} concentrations must be implemented. Furthermore, proposed source emission air quality standards for sanitary landfill sites in Sri Lanka should be further improved.

Keywords: Greenhouse gas, Landfill emissions, Sanitary landfill sites, Source emission air quality standards

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Abstract ID: ICBRITAE093

Asymmetric and Seasonal Effects of Precipitation and Temperature on Selected Vegetable and Dry Fish Prices in Sri Lanka

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Abstract

Sri Lanka is considered as one of the most vulnerable countries to the negative effects of climate change. In this context, over the last four decades, people in Sri Lanka have been experiencing different meteorological extremes of unprecedented frequencies, intensities, and durations of rainfall, drought etc. Further, such extremes affect to the country's food system, price fluctuations, dietary shifts, trade interdependence and environmental degradation. For these reasons, the impacts of adverse crop-growing conditions on supply and demand of foods are a common phenomenon. Out of the several meteorological parameters, changes in precipitation and temperature significantly affect the Sri Lankan agriculture sector. These two parameters directly influence the fruit and vegetable crops production and productivity of those crops. On the other hand, significant price fluctuation of vegetable and dry fish during year is therefore a common occurrence due to this situation. This study therefore attempted to analysis how precipitation and temperature affect the price of the selected commodities and to propose price forecasting model. Weekly prices of selected vegetables and dry fish varieties during last five year were collected from various secondary sources for the study. Graphical and seasonal indices based on moving average and different econometric models were employed for the analysis. Results clearly indicate that there is high correlation of prices of vegetables with the precipitation whereas price of dry fish is also highly correlated with both parameters. Prices of both vegetables and dry fish are vulnerable to asymmetric and seasonality nature of both parameters. However, the effect is often short term. When considering the sensitivity of prices of both commodities to the climate parameters, it is essential to adopt climate adaptation strategies for the price determinants in the sector to protect both farmers and consumers. Further, precipitation and temperature variation can be therefore considered as a signal for identifying the immediate price variation food items.

Keywords: Precipitation, Temperature, Price, Vegetables, Dry fish

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Abstract ID: ICBRITAE094

Strengthening University-Industry Collaboration in Agro-Industry Innovation in Sri Lanka

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Abstract

The national innovation system, which aims to disseminate new knowledge for economic and social advantages through the commercialization of products, services, processes, and other artifacts, includes the university sector as one of its key players. University-industry (UI) collaborations are vital for innovation in the current global economic competition. The Sri Lankan agro industry makes a significant contribution to the country's economy by ensuring food security; generate employment, and eradicating poverty in rural areas. The goals of this study were to determine the current state of UI collaboration for agro-industry innovation and evaluate global best practices in order to develop a model for UI partnership for agro-industry innovation. To achieve the goals a literature review and a questionnaire survey were executed. The questionnaire survey included 30 academics from 9 Sri Lankan universities and 60 industry representatives. The descriptive statistical techniques and purposive sampling method were used to examine the data. According to academic responses, the vast majority of them (80%) participated in collaborative agro industry innovation activities. The majority of those with industrial perspectives (67%) do not engage in collaborative efforts with universities for agro-industry innovation. Academic and industrial stakeholders claim that the country's current policies are insufficient to improve UI collaborations. The Knowledge Transfer Partnerships (KTP), business incubators, and innovation vouchers are examples of best practice models used globally. According to the investigation, Sri Lanka's level of university-industry collaboration in agro-industrial innovation was unsatisfactory. A Sri Lankan university industry collaboration model was proposed to strengthen UI collaborations for agro-industry innovation by gaining international experience.

Keywords: Agro-industry innovation, Knowledge transfer partnerships, University–industry collaborations

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Abstract ID: ICBRITAE095

Estimating Crop Water Requirement and Crop Coefficient of True Cinnamon (*Cinnamomum zeylanicum* Blume) at Initial Stages Using Simple Lysimeter and Pan Evaporation Approaches

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Abstract

True cinnamon (*Cinnamomum zeylanicum* Blume) is one of the important export agricultural crops in Sri Lanka. With growing demand, cinnamon cultivation is expanding to Dry Zone, where irrigation is needed. Although irrigation requirement is estimated commonly based on crop water requirement (Crop Evapotranspiration; ET_c) and crop coefficient (K_c), such values are not yet estimated for true cinnamon. Therefore, this study was done to estimate these values of cinnamon at initial stage of field establishment at the Cinnamon Research Station, Matara, Sri Lanka. The study was conducted using vegetatively propagated Sri Gemunu (GR), Sri Wijaya (WR) cultivars and seedlings of true cinnamon (NR). Those cultivars were used as three treatments in simple Lysimeter. Except the cultivar, all other conditions were same across treatments and they were arranged in CRD. One Lysimeter unit was taken as one replicate and 15 replicates were used for each treatment. ET_c was estimated using crop water balance method with Lysimeter data. K_c was estimated adopting the method available in scientific literature. GR had the highest average ET_c (3.09 mm day⁻¹) and NR had the lowest (2.69 mm day⁻¹). Total leaf area at the end of the study period for GR, WR and NR were 950.23, 595.11, and 343.13 cm², respectively. The higher ET_c of GR is possibly due to its larger leaf area. The average K_c values ranged from 1 – 1.5 (WR = 1.41, GR = 1.50 and NR = 1.34). These findings will provide basic information to plan to expand of cinnamon cultivation into drier areas by applying water more precisely and efficiently.

Keywords: Crop coefficient, Crop water requirement, Evapotranspiration, Lysimeter, True cinnamon

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Abstract ID: ICBRITAE096

The Impact of Climate Change and Variability on Household Food Security in the Smallholder Farming Sector in the Dry Zone of Sri Lanka: A Case of Hambantota District

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Abstract

Agriculture yields are projected to suffer from climate change, especially in dry regions of the country where crop production is heavily dependent on climatic factors like temperature and rainfall. There is scarce scientific evidence on how climate change dynamics affect the food security of farming households in dry regions, particularly at the household level. In this study, determinants of food security, variation of annual temperature and rainfall over the past three decades, adaptation and coping strategies adopted by households were investigated. Data were collected using structured interviews with 240 randomly selected farmers. Coping strategy index and food consumption scores were employed to analyse the data using descriptive statistics and multiple regression. The maximum and minimum average temperature in the region has increased while rainfall has been rapidly declining during the previous three decades. According to the minor and major irrigation type of the study location, the food consumption score and diversity of the foods consumed are at low and moderate level respectively. A sizable proportion of farmers in the study locations have been following climate-smart farming practices such as growing low-water consuming varieties and growing drought-resistant varieties. The climate change adaptation efforts of farmers are affected by factors such as age, education, land size, agriculture income, and total income. Other coping strategies consisted of relying on less preferred, less expensive, and less nutritious food. These findings call for actions by policymakers and local service providers to strengthen and facilitate climate change adaptation practices at the farm household level.

Keywords: Climate change, Climate-smart practices, Coping strategies, Household food security.

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Abstract ID: ICBRITAE097

Policy and Legislative Background Applicable to Tropical Agroecosystems Resilience in Sri Lanka

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Abstract

Tropical agriculture plays a significant role in the global food supply being the lifeline for humans and species. Nevertheless, it is frequently subjected to several shocks posed by mankind and natural phenomena. Along with these shocks and the rising population context, food security has become prominent, hence the resilience of tropical agroecosystems.

Sri Lanka is no different from other tropical countries which frequently face challenges on tropical agroecosystems. Restoring the resilience of the tropical agroecosystem is extremely important to Sri Lanka since it contributes to the country's food supply. Agricultural sector contributes to 24 per cent of employment, 7 per cent of the Gross Domestic Product and 22 per cent of total exports. Agriculture occupies nearly 45 per cent of the total land area in the current context. Hence, tropical agriculture and its resilience become a priority within the present development agendas. For resilient agriculture, sound policies and legislations provide guidance in designing correct and supportive programmes and practices. Hence, this study investigates current policy and legislative background relating to tropical agroecosystems and resilience in Sri Lanka. The study conducted a documentary review within the global and Sri Lankan contexts.

The study revealed that there are strong policies developed in Sri Lanka for agricultural development and are mainly coordinated by the Ministry of Agriculture. There are 21 institutions functioning under the Ministry which work for the betterment of agriculture and agroecosystem resilience in Sri Lanka. Nevertheless, some recent agricultural policies demonstrate issues relating to agricultural policy formulation and implementation in Sri Lanka. Recent policy on organic fertilizer and prohibition of chemical fertilizer made a catastrophic impact on Sri Lankan agricultural policy. Such incidents highlight how important of formulation and implementation of sound policies and legislations are for a resilient agroecosystem to a country's food security and livelihood.

Keywords: Tropical agroecosystems, legislations and policies, resilience, Sri Lanka

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Abstract ID: ICBRITAE098

Social Impact of Investment on Research, Innovation, and Commercialization: A Case Study on the Cinnamon Research Projects.

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Abstract

Investment in university research, cooperation between academia and industries, and commercialization are seen as crucial drivers of economic development. Yet, the social and economic returns are questionable. The purpose of the study was to look at how university research, innovations, and commercialization affect society. This insight ushers in a brand-new performance indicator. Six government-funded university research projects on the cinnamon sector were the subject of the case study approach. Both conventional performance indicators financial expenditure in research and development and outputs, such as patents, licenses, publications, etc. and modern performance indicators the development and utilization of research-based human capital (RBHC) were taken into account in the study. It emphasizes the investment made in university research. The study is supported by both quantitative and qualitative data. Researchers' salaries, research infrastructure, and other expenditures were vital elements, whereas publications, patents, copywriting, and trademark numbers were important outputs. RBHC, on the other hand, was assessed by increasing the stock of useful knowledge (student and researcher research experience, formation of networks and stimulation of social interaction, improvement of the capacity for scientific and technological problem-solving), as well as by establishing new enterprises. Researchers, graduate students, universities, and society at large all profited from RBHC. Significant return is defined as the increase in human capital value achieved via post-graduate and young staff training programs. Critical accomplishments of RBHC were noted as capacity building of cinnamon value chain players, industry spin offs, new products, and proceed developments. a stronger focus on commercialization, more connections between academia and industry program customization to the specific strengths of the region or industry and monitoring of graduate student outcomes.

Keywords: Research based human capital, social impact, University research

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Abstract ID: ICBRITAE099

Problem-Based Learning and Co-Creation: An Experience with Undergraduates of Agricultural Sciences

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Abstract

Due to the very competitive world in which universities operate, they must create distinctive strategies that emphasize the educational experience of their students. Collaboratively creating inventive kinds of value, also known as co-creation, enables students and lecturers to interact and utilize students' diverse expertise to produce more integrated and superior results than would be possible if only one group sought to meet the demands of the other alone. In this context, while highlighting teaching and learning as collaborative processes, this study aimed to introduce an innovative teaching and learning method: co-creation with undergraduates and developing nature-inspired solutions to mitigate the food crisis, evaluate student feedback, and propose an innovative teaching tool. The data were collected via an online questionnaire (n=120) and two focus group discussions (n=25) with undergraduates. Student participation was significant in presenting their solutions, questioning and answering, exploring, practicing, and developing the solutions, analytical skills, and applications. As per the results, the students were able to develop innovative, practical solutions to alleviate the current food crisis, and they preferred co-creation over the traditional lecture method. Student participation was poor in most of the online lectures, discussions, and webinars. It was evident that a student can improve the learning process through knowledge and experience sharing, which are two main indicators of co-creation.

Keywords: Co-creation, Creative thinking, Higher education, Innovation

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Abstract ID: ICBRITAE100

Emphasis Given to Climate Change, Sustainability, and Environmental Issues in Subject Benchmark Statements Recommended for Undergraduate and Postgraduate Programmes of Sri Lanka

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Abstract

Subject Benchmark Statements (SBS) are an important component of higher education quality assurance. SBSs explain the characteristics of a certain subject/discipline as well as the competencies that a graduate is expected to acquire after successfully completing a program in that subject. SBSs are designed after extensive stakeholder consultation. The Sri Lanka Qualification Framework (SLQF) requires all programs offered by state-sector higher education institutions to be aligned with the most appropriate SBS or SBSs. This study reviewed all (38) SBSs declared by Sri Lanka's Quality Assurance Council (QAC) to assess the emphasis given in those SBSs on sustainability, climate change, and environmental issues. The level of emphasis was determined by reviewing the scopes, goals and objectives, compulsory and optional/supplementary areas of study, and the key competencies as prescribed in the subject benchmark booklets published by the QAC. There was no discussion of any of the above three global problems in twenty-two SBSs including political science, philosophy, management studies, education, economics, and history. Physics and Zoology received some emphasis in comparison to Chemistry and Botany. Sixteen SBSs placed varying levels of emphasis on these issues. Discipline Agriculture was identified as the SBS with the highest emphasis on those concerns. SBS of Agriculture identifies the delivery of knowledge and skills to establish and manage socially acceptable, economically feasible, and environmentally friendly agricultural enterprises as a specific goal of the programs, stipulates environmental sciences as an optional subject, and suggests paying attention to environmental, socioeconomic, and sustainability, and environmental impact issues. A notable level of emphasis was also seen in the SBSs of Food Science and Technology, Forestry, Chemical and Process Engineering, and, Civil engineering. SBSs of Microbiology, Physics, Veterinary Medicine and Animal Science have also given limited or indirect references. According to this investigation, many SBSs have not placed a high priority on internationally relevant concerns such as sustainability, climate change, and the environment. The study also highlights the benefits of focusing an adequate amount of attention on such topics in SBSs.

Keywords: Quality assurance in higher education, SLQF guidelines, Subject benchmark statements

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Abstract ID: ICBRITAE101

Building Resilience in Tropical Agro-ecosystems (BRITAE) Project



The BRITAE project is a collaborative research project between five Sri Lankan universities and four European Union universities. The project proposal was successful in securing a highly competitive and prestigious international research grant under the Erasmus+: Higher Education - International Capacity Building - Joint Projects grant scheme of the Education, Audiovisual and Culture Executive Agency of the European Union. The BRITAE project involves five Sri Lankan partner universities: University of Ruhuna (UOR) which is the leading university, University of Colombo (UOC), University of Moratuwa (UOM), University of Sri Jayawardenepura (USJP), and Sabaragamuwa University of Sri Lanka (SUSL). The project also includes four European partner universities: Huddersfield University, UK (HUD), University of Central Lancashire, UK (UCLan), Tallinn University of Technology, Estonia (TUT), and Vilnius Gediminas Technical University, Lithuania (VGTU).

The education sector is vitally important for social and economic development of Sri Lanka (Region 6) and distinguished education in engineering and engineering trends is a key priority (Category A) in Asia. This priority covers environmental protection technology, including solutions relevant to food security and climate change. The BRITAE project is aimed at developing joint curricula modules on building resilience in tropical agro-ecosystems for Sri Lankan universities. The objective is to increase the capacity of these universities to modernize their education systems, enhance the quality and relevance of education for students in accordance with global market needs, and promote international cooperation.

The project aims to develop a comprehensive approach to building resilience in tropical agro-ecosystems by bringing together expertise from different fields, including agriculture, ecology, and social sciences. The joint curricula modules will be designed to provide students with the knowledge, skills, and competencies needed to address the challenges faced by agro-ecosystems in tropical regions. This will include developing an understanding of the complex interactions between natural and social systems, identifying innovative solutions to improve agricultural practices, and promoting sustainable development.

The BRITAE project is expected to contribute to the sustainable development of Sri Lanka's agricultural sector by equipping students with the necessary knowledge and skills to address the challenges faced by farmers and rural communities. The project will also promote international cooperation and collaboration between Sri Lankan and European universities, facilitating the exchange of knowledge and best practices in the field of agriculture and sustainability.

For more information visit: <https://www.britae.lk/>



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ISBN 978-624-5746-54-5



978-624-5746-54-5