BOOK OF ABSTRACT

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Our Vision

International Society of Environmental and Rural Development, ISERD

Recently, in developing countries, subsistence agriculture is being converted to export-oriented mono-culture, and the amounts of agricultural chemicals applied to the farmland are increasing every year. The applied chemicals in farmland cause serious environmental problems downstream such as eutrophication, unusual growth of aquatic plants, decrease in dissolved oxygen and accumulation of bottom mud in water resources. Also, there seem to be many cases in which people apply agricultural chemicals without understanding its impact to health and food safety. Therefore, it is necessary to promote and enhance understanding of sustainable rural development among local stakeholders including farmers.

Sustainable rural development aims to meet human needs while preserving the natural environment. As it should cover not only social and economic development but also natural environment conservation, no single organization can achieve sufficiently the aspirations of sustainable rural development. Collaboration among international, governmental and non-governmental organizations, together with the academe and scientific sector, is indispensable.

The knowledge and intelligence accumulated in universities and research institutions are also expected to make the programs facilitated by the international, governmental and non-governmental organizations more adequately implemented and meaningful to societal development. However, these cases especially those implemented locally have been scattered without having been summarized well or recorded in annals of academic or scientific societies.

So, the International Society of Environmental and Rural Development founded in 2010, aims to discuss and develop suitable and effective processes or strategies on sustainable rural development focusing on agricultural and environmental aspects in developing countries.

The ultimate goals of the society are to contribute to sustainable rural development through social and economic development in harmony with the natural environment, and to support the potential or capacity building of local institutions and stakeholders in the rural area with academic background.

It is expected the discussions made at the 16th ICERD among participants will create new collaboration for sustainable rural development.

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This conference was supported by Tokyo Convention & Visitors Bureau from 14 to 16 March, and partially supported from Kurita Water and Environment Foundation for the pre-event on 13 March, 2025.

Chairmanship in Each Scientific Presentation on 15 March 2025

- ORAL 1 PRESENTATION (Session 1: 10:30-12:00, Session 2: 13:00-14:30, and Session 3: 15:00-17:30)

Session 1							
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Chair	Dr. Marilou Montiflor	Chair	Prof. Reynro Herrera	Chair	Prof. Khoi Chau Minh	Chair	Prof. Barry Noller
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Session 2							
Room 1 (131)		Room 2 (132)		Room 3 (141)		Room 4 (142)	
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Session 3							
Room 1 (131)		Room 2 (132)		Room 3 (141)		Room 4 (142)	
Chair	Prof. Emmarie Rose Josue	Chair	Prof. Abu Noman Mohammad Atahar Ali	Chair	Prof. Jens Lowitzsch	Chair	Prof. Ligaya Leal
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							Dr. Lalita Siriwattananon

- ORAL 2 PRESENTATION (13:00-14:10)

Room 1 (111)		Room 2 (112)		Room 3 (211)		Room 4 (212)		Room 5 (213)	
Chair	Dr. Nuttapon Khongdee	Chair	Dr. Sinh Nguyen Van	Chair	Prof. Melissa Suganob	Chair	Dr. Somnath Ghosal	Chair	Prof. Reizl Jose
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	Dr. Andrea Dawan		Dr. Mild Hombrebueno		Dr. Lai Lanie Cungihan		Dr. Jin Andy		Dr. Nurhidayu Siti

- POSTER PRESENTATION (core time: 10:00-10:30 and 14:30-15:00)

Chair: Prof. Dr. Dieter Trautz

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Co-Chairs	Dr. Gerald Duza
	Dr. Christopher Mantillas
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	Dr. Ognen Onchevski

16th ICERD General Program from 13 to 16 March 2025

13 March 2025, Thursday (International Center 2F)	
10:00-15:00	Pre-Event (Guidance on Scientific Presentation (10:00-10:20) and Scientific Writing (13:00-13:20) are open to all reserved participants)
14 March 2025, Friday (International Center)	
13:00-18:00	Registration of Participants (International Center 1F)
14:00-16:00	ISERD Council Meeting (International Center 2F)
17:00-19:00	Welcome Party (International Center 1F)
15 March 2025, Saturday (International Center & Building 1)	
08:00-13:00	Registration of Participants (International Center 1F)
09:00-10:00	Opening Ceremony (International Center 2F)
10:00-10:30	Coffee Break (International Center 1F) & Core Time for Poster Presentation (Building 1)
10:30-12:00	Scientific Program - Session 1 (Oral 1, Building 1)
11:00-11:30	Special Session on 25 Years Anniversary of ERECON (Building 1 1F, Room 112) (ISERD Secretariat)
12:00-13:00	Lunch Time (International Center 1F)
13:00-14:30	Scientific Program - Session 2 (Oral 1 & Oral 2, Building 1)
14:30-15:00	Coffee Break (International Center 1F) & Core Time for Poster Presentation (Building 1)
15:00-17:30	Scientific Program - Session 3 (Oral 1, Building 1)
18:30-20:00	Banquet and Awarding Ceremony (International Center 2F)
16 March 2025, Sunday (from Tokyo University of Agriculture)	
09:00-12:30	Excursion Option 1 “Meiji Shrine & Harajuku Walking Tour” (T-A, Gathering in front of the Tokyo City Information Desk at 8:30)
09:30-11:30	Excursion Option 2 “Tour of the Martial Arts and Experimental Facilities at Tokyo University of Agriculture” (T-ISERD, Gathering in front of the 16th ICERD Reception Desk at 9:00)
13:10-16:40	Excursion Option 3 “Tokyo River Cruise & Hamarikyu Gardens” (T-C, Gathering in front of the Tokyo City Information Desk at 12:40)
13:30-17:00	Excursion Option 4 “TOKYO SKYTREE & Asakusa Walking Tour” (T-B, Gathering in front of the Tokyo City Information Desk at 13:00)

16th ICERD Scientific Program on 15 March 2025

Opening Ceremony (from 9:00 at International Center 2F)			
09:00-10:00	09:00-09:10	Welcome Remarks from Tokyo University of Agriculture	President of Tokyo NODAI, Prof. Dr. Fumio Eguchi
	09:10-09:25	Welcome Remarks from ISERD	President of ISERD, Prof. Dr. Mario T. Tabucanon
	09:25-09:30	Opening Remarks	Dean Prof. Dr. Hiroya Obayashi
	09:30-09:40	Reports from the Chair of the 16th ICERD Organizing Committee	Prof. Dr. Machito Mihara
	09:40-09:55	Introduction about ISERD Awards	Prof. Dr. Eiji Yamaji
	09:55-10:00	Program and Venue Guidance	Assoc. Prof. Dr. Narong Touch
Scientific Session (from 10:00 at Building 1)			
10:30-17:30	10:00-17:30	Poster presentation (core Time for Poster Presentation: 10:00-10:30 and 14:30-15:00)	
	10:30-12:00	Oral 1 presentation - Session 1	
	13:00-14:30	Oral 1 presentation - Session 2 / Oral 2 presentations	
	15:00-17:30	Oral 1 presentation - Session 3	
Banquet and Awarding Ceremony (from 18:00 at International Center 2F)			
18:00-20:00	18:00	Dinner/ Banquet	
	18:30-19:00	Japanese Lion Dancing Show	
	19:00-19:15	Ceremony for ERECON Awards with the acknowledgement of ISERD	Assoc. Prof. Dr. Kasumi Ito
	19:15-19:45	Awarding ceremony for ISERD Awards	For Award of Excellent Paper: Prof. Dr. Eiji Yamaji For Award of Excellent Poster Presentation: Prof. Dr. Dieter Trautz For Award of Sustainability Promotion: Prof. Dr. Barry Noller For Award of Outstanding Scientific Achievement: Assoc. Prof. Dr. Chuleemas Boonthai Iwai
	19:45-20:00	Invitation to NEXT ICERD Candidates	

Oral 1 Presentations: Session 1 (from 10:30 to 12:00 at Building 1)

	Room 1 (131)		Room 2 (132)		Room 3 (141)		Room 4 (142)	
	Chair Co-chair	Dr. Marilou Montiflor Dr. Ronnie Encarnacion	Chair Co-chair	Prof. Reynro Herrera Dr. Iman Raj Chongtham	Chair Co-chair	Prof. Khoi Chau Minh Dr. Kesinee Iamsaard	Chair Co-chair	Prof. Barry Noller Dr. Ivy Corazon Mangaya-Ay
	Code	**Title**	**Code**	**Title**	**Code**	**Title**	**Code**	**Title**
10:30-10:45	EM-16-07	Impact of Bagacay Mines on Heavy Metals Accumulation and Associated Health Risk of Fishes from Taft River, Philippines	AG-16-03	Assessing Adoption Patterns and Determinants of Sustainable Rice Cultivation in Central Northeast Thailand	EM-16-16	Development of erosion risk zones in the Skopje region, Republic of North Macedonia	RD-16-01	BIDANI Network Program: An Innovative Strategy of State Universities and Colleges of the Philippines towards Community Development
10:45-11:00	EM-16-95	Eutrophication Evaluation and the Estimation of Methane Gas Emission from Eutrophic Reservoirs	AG-16-42	Organic Production and Processing of *Centella asiatica* for Quality Herbal Raw Materials in Northeast Thailand	RD-16-04	The Impact of Artisanal and Small-Scale Gold Mining on Food Security of Rural Households in Tigray Region, Ethiopia	RD-16-46	Local eco- entrepreneurship in coffee farming communities in Sultan Kudarat, Philippines
11:00-11:15	RD-16-62	Organic Amendment Improved Soil Property and Water Usage Efficiency in Pomelo Orchards Affected by Drought and Salinity in the Mekong Delta	AG-16-51	Comparative Bio-Efficacy of Indigenous Weed-Derived Botanicals on the Fall Armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae)	EM-16-54	Influence of Pedological Characteristics and Land-Use Types on Soil Erodibility in Pared Sub-Watershed, Alcala, Cagayan, Philippines	EM-16-59	Sustainable Community Based Tourism: Case Study of the Tonle Bati Tourism Community in Cambodia
11:15-11:30	EM-16-21	Water Quality Assessment and Evaluation of Human Health Risk in Tributary Rivers of Lanao Del Sur, Philippines	AG-16-32	Efficacy of native plant extracts against root-knot nematode, Meloidogyne incognita: Innovative strategies for sustainable agriculture	IS-16-04	Evaluation of Tensile Strength of Tissue Culture-Derived Bamboos of VSU	RD-16-39	Rural Community Development through Non-Farm Employment Opportunity Creation: Scope and Perspective
11:30-11:45	EM-16-33	Faunal Biodiversity Assessment in Loboc Watershed under the Philippine Red Cross Greening and Disaster Risk Reduction Project in Bohol	AG-16-45	Evaluating Optimal Greenhouse Design for Tomato Cultivation in Central Luzon, Philippines: A Simulation-Based Approach	AG-16-90	Effect of Different Soil Management Practices on the Growth, Yield of rice and Soil Properties in The Mekong Delta of Vietnam	EM-16-79	The Applications of the Miyawaki Method to Enhancing Community Resilience in Thailand
11:45-12:00	EM-16-45	Water Yield Quantification in Logged Upper Muda River Catchment, Ulu Muda Forest Reserve	AG-16-52	Remote Sensing and GIS-Based Assessment of Evapotranspiration and Crop Water Productivity for Sustainable Agriculture in Sindh, Pakistan	AG-16-47	Synergistic Effects of Biochar and Plant Growth-Promoting Rhizobacteria on Coffee Seedling Development and Soil Carbon Dynamics	EM-16-57	Enhancing Community Perception on Agarwood from Lapnisan (*Aquilaria Species*) in The Philippines
12:00-13:00	**Lunch Break (at International Center 1F)**							

Oral 1 Presentations: Session 2 (from 13:00 to 14:30 at Building 1)

	Room 1 (131)		Room 2 (132)		Room 3 (141)		Room 4 (142)	
	Chair Co-chair	Prof. Nourshamsia Barosa Dr. Tran Ba Linh	Chair Co-chair	Assoc. Prof. Nguyen Nghia Khoi Dr. Orawan Srisompun	Chair Co-chair	Prof. Ivan Minchev Dr. Roxanne Aguinaldo	Chair Co-chair	Prof. Binitha V Thampi Dr. Clarissa Juanico
	Code	**Title**	**Code**	**Title**	**Code**	**Title**	**Code**	**Title**
13:00-13:15	RD-16-27	A Participatory Rural Appraisal for Watershed Management in Northern Mindanao, Philippines: The Case of Alubijid Watershed	AG-16-75	Development of a Rice Transplanter-Mounted Map-Based Manual Variable Rate Boom Sprayer	AG-16-64	Monitoring Salt Stress Development in Rice Plants using Pocket Thermal Camera	RD-16-41	Prospect, Supply and Value Chain of the Coco Coir Agro-enterprise of the Castilla Development Cooperative (CADECO)
13:15-13:30	EM-16-53	Transforming Septic Tank Sludge into Agricultural Resources: A Pathway for Sustainable Development and Rural-Urban Synergy	ESD-16-21	Enhancing Agricultural Extension Through Automation: Evaluating the Functionality and Effectiveness of a Programmable Logic Controller and Arduino-Based Instructional Device	EM-16-74	Effects of Corncob Biochar and Urea Fertilizer on Ammonium and Nitrate Leaching in Sandy Soil	RD-16-37	Knowledge on Seaweed Utilization in Small Island Communities of Danajon Bank, Central Philippines: A Small-Scale Fisherfolk Perspective Amidst Covid-19 Pandemic
13:30-13:45	EM-16-75	Estimating Irrigation System Design Capacity using Historical Evapotranspiration and its Variability	AG-16-89	Optimizing Rice Production: A Study on the Effectiveness of System of Rice Intensification	AG-16-78	Using Soil Amendment in Improving Saline-Affected Soil Characteristics and Rice Yield in The Mekong Delta, Vietnam	EM-16-97	Flood Vulnerability and Risk Assessment of the Physical Assets of an Island Community in Brgy. Binuangan, Obando, Bulacan, Philippines
13:45-14:00	AG-16-15	Entrepreneurial Ecosystems in Agriculture: Leveraging Innovation for Climate Resilience and Sustainability	AG-16-92	Application of Plant Growth-Promoting Bacteria in the Management of Fungal Diseases and Activity of Enzymes Related to Resistance Stimulation in Cucumber	AG-16-91	Efficacy of Finished Organic Fertilizer from Biowaste Sources on the Growth, Yield of Lettuce (*Lactuca sativa*), and Soil Properties Under Field Conditions	AG-16-105	Social Networks at Work: The Mango Contractors of Pangasinan, Philippines
14:00-14:15	EM-16-18	Climate Risks Analysis for Enhancing Climate Resilient Agriculture in Caraga Region, Philippines	EM-16-43	Humic Acid Characterization as a Potential Green Fertilizer	RD-16-25	Enhancing Education and Child Protection in Rural Conflict Zones: A Case Study of the PEACE-PRO Project in Bangsamoro Autonomous Region in Muslim Mindanao	AG-16-10	Regulatory Reforms for Stabilizing Agricultural Food Prices in Bangladesh: Legal and Theoretical Solutions to Address Market Fluctuations
14:15-14:30	AG-16-40	Enhancing Climate Resilience and Coffee Nursery Management in Bukidnon: Empowering Indigenous Coffee Farmers through IoT-Based Technology and Capacity Building	AG-16-70	Effects of Crop Diversification on Weed Diversity and Beneficial Organisms in Organic Arable Systems	ESD-16-11	Integration of Skill Development Programs in Secondary Schools towards Education for Sustainable Development in Cambodia	ESD-16-12	Cross-Subject Learning with Local Nature and Environment in Thailand
14:30-15:00	**Coffee Break (International Center 1F) & Core Time for Poster Presentation (at Building 1)**							

Oral 1 Presentations: Session 3 (from 15:00 to 17:30 at Building 1)

	Room 1 (131)		Room 2 (132)		Room 3 (141)		Room 4 (142)	
	Chair	Prof. Emmarie Rose Josue	Chair	Prof. Abu Noman Mohammad Atahar Ali	Chair	Prof. Jens Lowitzsch	Chair	Prof. Ligaya Leal
	Co-chairs	Dr. Rowena Varela Dr. Tarek Ben Hassen	Co-chairs	Dr. Sylvester Badua Dr. Lloyd Tejano	Co-chair	Dr. Ma. Josephine Therese Emily G. Teves	Co-chairs	Dr. Adrian Jim Reyes Dr. Dia Noelle F. Velasco Dr. Lalita Siriwattananon
	Code	**Title**	**Code**	**Title**	**Code**	**Title**	**Code**	**Title**
15:00-15:15	ESD-16-10	Building Sustainable Futures: PNS Compliance in Organic Agriculture for Climate Resilience	AG-16-62	Management of Golden Banana Plantations in Sang Khom district Udon Thani province, Northeastern of Thailand	RD-16-48	Building an Inclusive Innovation Platform: Challenges and Lessons Learned from Selected Coffee Farmers' Associations in Sultan Kudarat, Philippines	RD-16-53	Understanding Resilience Needs and Livelihood Dynamics of Small-Scale Farmers and Fishers in Post-Typhoon Rai: Recommendations for Policy
15:15-15:30	AG-16-85	Environmental and Sociocultural Importance of Spondias Purpurea to Climate Resilient and Sustainable Agroecosystem in San Miguel Batangas Philippines	RD-16-47	Banglay at logta Molbog: The Role of Traditional Shifting Cultivation in Cultural Preservation among the Molbog of Balabac, Palawan, Philippines	AG-16-86	Integrated Crop-Livestock Systems as a Development Opportunity for Farmers: Case Study in Region IV-A, Philippines	EM-16-82	People's Evaluation of Paddy Landscape and Its Element
15:30-15:45	EM-16-01	Global Analysis of Urban PM2.5 Levels and Their Correlation with Aerosol Optical Depth Across 73 Major Cities	IS-16-06	Growth Areas of CALABARZON: Exploring the Possible Rise of Major Metropolises in the Philippines and Its Environmental and Social Implications	RD-16-03	Empowering Fisher folk Women Through Sargassum spp. Utilization and Management: Needs Assessment	EM-16-99	Evaluation of Environmental Factors Influencing Revocation of Bauxite Mine Development in the Solomon Islands
15:45-16:00	AG-16-16	Survival Strategies of Smallholders Engaged in Organic Farming Under Climate Change: A Case Study in Northeastern Thailand	ESD-16-24	The Rama Fishing Practice Towards Innovative Local Teaching Pedagogy	EM-16-41	Citizen Segments and Attitudes Towards Empowering Farmers for Sustainable Rural Management: Evidence from Five European Countries	EM-16-66	Impact of Grassland Contract Policy on Pastoral Social-Ecological Systems: An Empirical Analysis Based on the SES Framework
16:00-16:15	EM-16-77	Vulnerability Assessment of Communities to Climate Variabilities and Extremes in Cangaranan Watershed, Antique, Philippines	AG-16-17	Watermelon Peels and Rinds as a Food Preservative and Additive in Pork Longganisa (Sausage)	RD-16-42	Finding Their Voices: Building Organizational Capacities of Smallholder Coffee Farmers in Southern Philippines	EM-16-94	Exploring Non-economic Factors that Influence Farmers' Attitudes on Environmental Protection in Okinawa Prefecture, Japan
16:15-16:30	RD-16-40	Towards Sustainable Futures: Women Agrarian Reform Beneficiaries in a Climate-smart Agriculture	AG-16-54	Laying Performance of Japanese Quail (*Coturnix coturnix japonica*) Supplemented with Different Levels of Squash Meals	ESD-16-27	Hospitality and Cybersecurity Amid Conflict: Ethical Concerns for Securing Guest Data	EM-16-22	Tourist Perception and Willingness to Pay for Biodiversity Conservation at Nam Nao National Park, Thailand, as the ASEAN Heritage Park

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16:30-16:45	EM-16-19	Contribution of Local Protected Areas to the Protection of Natural Resources and Livelihood of Community Members in Northern Part of Cambodia	AG-16-24	Formulation of a Ketogenic Diet for Starter-Finisher Broiler Chicken (*Gallus gallus domesticus*): Its Effect on Growth Performance, Carcass, Visceral Yield and Quality	EM-16-42	Seasonal Land Cover Classification in Japanese Agricultural and Wetland Landscapes via Machine Learning and Multi-Source Sentinel Data	ESD-16-13	Assessment of Deforestation and Community Impact: Lessons from an Environmental Awareness Program in Siem Reap Province, Cambodia
16:45-17:00	AG-16-36	Vermicomposting Using Leguminous Plants as Bedding Materials for African Night Crawlers (*Eudrilus euginae*)	AG-16-27	Development of Optimized Pineapple Leaf Fiber Extractor	EM-16-29	Examining the Intersections of Marginalization through Natural and Anthropogenic Hazards in Kerala, India	RD-16-43	Synthesizing Antipolo Rizal Philippines' Cultural Heritage Through Multi-Generational Cognitive Mapping for Resident-Centric Development
17:00-17:15	EM-16-56	Experimental and Modeling Investigation of Bio-oil Hydrodeoxygenation to Produce Aviation Fuels	RD-16-16	Establishing A Viable Enterprise Using Free-Range Chicken Production Technology in Nueva Vizcaya, Philippines	EM-16-46	Assessment of the Biodiversity Status of a Highly Urbanized City: The Case of Manila City, Metro Manila, Philippines	RD-16-49	How well are smallholders engaged in rural development? Co-designing inclusive coffee value chain with farmers in southern Philippines
17:15-17:30	RD-16-50	Biomass Blending Approach: Availability and Potential of Agricultural Residues as Energy Source in Thailand			EM-16-85	Insect Diversity and Their Role in Agarwood Production in Leyte, Philippines	AG-16-99	Profitability and Economic Viability of Upscaled Mussel Hatchery Operations
18:00-20:00	**Banquet and Awarding Ceremony (at International Center 2F)**							

Oral 2 Presentations (from 13:00 to 14:10 at Building 1)

	Room 1 (111)		Room 2 (112)		Room 3 (211)		Room 4 (212)		Room 5 (213)	
	Chair Co-chairs	Dr. Nuttapon Khongdee Dr. Catherine Arradaza Dr. Andrea Dawan	Chair Co-chairs	Dr. Sinh Nguyen Van Dr. Jarupong Prasopsuk Dr. Mild Hombrebueno	Chair Co-chairs	Prof. Melissa Suganob Dr. Amparo Wagan Dr. Lai Lanie Cungihan	Chair Co-chairs	Dr. Somnath Ghosal Dr. Manuel Barquilla Dr. Jin Andy	Chair Co-chairs	Prof. Reizl Jose Dr. Narong Touch Dr. Nurhidayu Siti
	Code	**Title**	**Code**	**Title**	**Code**	**Title**	**Code**	**Title**	**Code**	**Title**
13:00-13:05	EM-16-26	Revitalizing Soils Through Carbon Restoration: Impact of Organic Amendments to Enhance Soil Productivity and Water Retention	AG-16-13	Discussion on Digital Agricultural Information Dissemination Systems in Tamil Nadu, India	RD-16-10	Impact Assessment of the Built Environment and Cultural Practices as Contributors to Disaster Preparedness and Recovery in Bicol Region	AG-16-82	Eco and Bee CPS: Integration of CPS into Traditional Beekeeping	EM-16-06	Managing Rural Extreme Rainfall and Flood Disasters from the Perspective of Social Resilience: A Case Study of Rural Hebei in 2023
13:05-13:10	AG-16-38	Changes in the Bulk Soil and Phosphate Solubilizing Microorganisms after Different Fresh Corn Grown with Short-Term Organic and Inorganic Fertilizer Application	AG-16-25	Impact of Transplanting Date Shifts on Rice Production in Rain-Fed Northeast Thailand	EM-16-28	Valuing The Role of Trees in Reducing Stormwater Runoff to Promote Urban Greening Towards a Sustainable City	RD-16-64	Consumer (Co-)Ownership in Renewables as a Learning and Empowerment Tool in The Asian Energy Transition: The Examples of Pakistan and India	AG-16-33	Assessment of Paddy Water Quality and Suitability in Leading Rice Producing Regions of Afghanistan
13:10-13:15	EM-16-39	Soil Degradation Patterns in Deforested and Forested Areas in the Municipality of Cobija, Pando Department, Bolivian Amazonia	IS-16-02	Factors Affecting the Intention to Use Mechanized Harvesters of Sugar Farmers in Tarlac Province	AG-16-35	Attitude of the Farmers Towards Climate -Smart Agricultural Practices the Case of Small-Scale Cattle Farming in Arusha Region, Tanzania	RD-16-13	Socio-economic Profile and Capabilities of Agricultural Extension Workers in Delivering Agriculture Extension Services in Iloilo, Philippines	EM-16-58	Comparison of Evapotranspiration Rates at Open Field Conditions and Agriculture Field Protected by Tree Shelter Belts in Ovche Pole
13:15-13:20	ESD-16-09	Effects of Vermicompost on Soil properties, Growth, Physiology and Yield of Chili Production under Moderately Saline Soil in Greenhouse Condition	EM-16-38	Assessment of Agricultural Land-use/Land-cover Change in the Diamphwe River Basin Using Sentinel-2 Imageries	EM-16-64	1.5-degree Lifestyles in Japan: A Key to Achieve Carbon Reduction Target	RD-16-26	Gender-Inclusive Partnerships for Sustainable Rural Development: Leveraging Technology and Community Engagement to Empower Women in Indonesia	EM-16-65	Hydrochemical and Isotopic Characteristics of Irrigation Channel Water in Oil Palm Plantation of Kuala Selangor, Malaysia
13:20-13:25	AG-16-49	Variation of Salinity Response in Known Drought-Tolerant Thai Maize Cultivars at Early Germination	RD-16-31	Sustainable Palm Oil Downstream Value Chain in Industrial Zones: Case Study in Riau Province, Indonesia	EM-16-91	Ecological Modelling on Forest Carbon Stocks in Mt. Apo Natural Park, southern Philippines: A Baseline Study	RD-16-32	The Role of Community-Led Initiatives in Sustainable Rural Tourism Development: A Case Study of Poncokusumo Village, Indonesia	EM-16-71	Estimation of Sediment Load of Iponan River, Philippines Using Empirical Equation and Swat+ Modeling

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13:25-13:30	RD-16-29	Evaluation on Soil Characteristics in Pineapple Farmlands in Moung Ruessei, Battambang Province, Cambodia	AG-16-63	Genome Characterization and Growth-Promoting Effects of Priestia sp. RMT 2 NF4 on Sweet Corn Seedling Vigor	EM-16-103	Implementation of Climate-Smart Village Through Soil and Water Conservation to Support Watershed Conservation	RD-16-36	Efficiency Assessment of Digital and 'Phygital' Food Retailers through Data Envelopment Analysis	EM-16-90	Evaluation of Low-cost ORP Sensors Based on Arduino for Monitoring Treated and Disinfected Water
13:30-13:35	EM-16-50	The Long-term Accumulation of Heavy Metal in Agricultural Soils and Bioaccumulation Risks for Medicinal Plant Cultivation	ESD-16-15	Adoption of Agricultural Practices and Technologies in SEARCA Theses and Dissertations	AG-16-30	Monitoring In Vitro Rumen Fermentation Characteristics and Feed Digestibility with Encapsulation Hermetia illucens Larvae Oil	RD-16-38	Rural Non-Farm Employment Opportunities in India: Past and Present Scenario	EM-16-102	Assessing the Impact of Environmental Influences on Water Quality Indicators in the Kemena River (2018–2022): A Multi-Location Graphical Analysis
13:35-13:40	EM-16-60	Baobab Seed (Adansonia digitata) Biochar as a Soil Amendment to Improve Soil Quality in Dodoma Region, Tanzania: A Review	EM-16-73	Integrating Resource Occupation and Sustainability in Agriculture through the Resource Time Footprint Indicator	AG-16-56	Effect of Seasons on the Quality of Fresh Semen in Thai Native Chickens Deang Dok Koon and Pradu Hang Dam	RD-16-57	How Have the Women's Roles in Community Forest Management Changed?: Cases of Two Cotu Ethnic Villages, Central Vietnam	EM-16-88	Investigating the Status of Lake Bito: Water Quality, Fish Communities, and Land Cover Analysis in MacArthur, Leyte, Philippines
13:40-13:45	EM-16-61	Effects of Coffee Pulp Biochar Application Rate and Particle Size on Soil Carbon Sequestration and Emissions	AG-16-76	Evaluation of Rice Production Changes from 2003 to 2023 in a Village in Khon Kaen, Northeast Thailand: II. Assessment of Present Rice Production Based on UAV and Smartphone Application	AG-16-60	Application of Low-Pressure Cold Plasma as a Pre-Treatment for Making Soybean Oil: Study on Pscychochemical	RD-16-60	Lived Experience: Exploring Social Life and Personal Relationships of Marileños in Brgy. Patubig Using Narratives and Images	AG-16-83	Phosphate Solubilization and Plant Growth-Promoting Properties of Photosynthetic Bacteria from Wetland and Hot Spring Areas
13:45-13:50	EM-16-67	Impact of Land Use Change on Land Desertification in the Farming-pastoral Ecotone in Northern China	AG-16-88	A Convolutional Neural Network Model for Precision Agriculture: Custom Dataset-Based Classification for Soybean-Weed Detection	AG-16-106	Multi-Attribute Evaluation of Modified Chrysanthemum Genotypes: Nutritional, Biological, and Consumer Preferences	ESD-16-23	Willingness and Perceptions Towards the Philippine Accounting Standard 41: The Case of Agritourism Farms in the Philippines	ESD-16-26	Biochar Application for Soil Health Enhancement and Compaction Reduction in Morogoro Region, Tanzania
13:50-13:55	EM-16-105	Effects of Formation of Plowsole Layer in Peat Farmland on Field Drainage	EM-16-72	The Potential for Producing *Aquilaria Cumingiana* (Decne.) Ridl. Seedlings by Vegetative Propagation Methods			ESD-16-20	Advancing Conservation Strategy Research to Support the Visayas State University's Core Programs in the Philippines		
13:55-14:10	**continue to poster presentation of Oral 2 (in the same room)**									

Poster Presentations (core time: 10:00-10:30 and 14:30-15:00 at Building 1)
Chair: Prof. Dr. Dieter Trautz

Agricultural Development & Climate Changes

Co-Chairs	Dr. Gerald Duza, Dr. Christopher Mantillas and Dr. Dina Magnaye
AG-16-66	A Comparative analysis of Anther Dehiscence and Pollen Viability of Rice Varieties under Two Heat Stress Conditions
AG-16-77	Evaluation of Rice Production Changes from 2003 to 2023 in a Village in Khon Kaen, Northeast Thailand I. 21 Years Trend Based on Satellite Data
AG-16-84	Development of a Lidar-Based Crop Growth Evaluation Method
AG-16-87	Evaluating the Impact of Biochar Application on Rice Growth in Paddy Soils with Different Soil Properties
EM-16-40	Current State of Vegetation at the Base of Street Trees Where Weeding is Taking Place, Fukuoka City
EM-16-55	Climate Change Impact on Surface Water Availability in Tinau River Watershed, Nepal
ESD-16-02	The Safe Rice Cultivation Promotion Project is a Particular Concern of Cargill Cares Project: A Case Study in Nakhon Ratchasima Province, Thailand
RD-16-05	Rice Supply Shocks and University Student Consumption Patterns in Japan
RD-16-56	Financial and Economic Viability of Milkfish Farms in Dumangas, Iloilo Using Earthen Pond Technology

Rural Development & Energy / Resources

Co-Chairs	Dr. Naoko Oka, Dr. Adcharaporn Pagdee and Dr. Melba Denson
AG-16-29	Gender Inclusiveness as Determinant for Sustainable Organic Agriculture Adoption
AG-16-102	Evaluating the Agronomic Performance of Pechay (*Brassica rapa subsp. chinensis*) in Biodegradable Pots Made from Agricultural Waste
EM-16-17	(Un)Making of Greenbelt Zone as Climate Icon in an Urban Expanse: A Cross-sectional Study
EM-16-23	Electricity Generation and Nutrient Recovery from Food Waste Using a Two-Chamber Microbial Fuel Cell without a Proton-Exchange Membrane
EM-16-24	Food Waste Disposal Using a Two-Chamber Microbial Fuel Cell Without Proton Exchange Membrane
EM-16-25	Steelmaking Slag Advantages in Methane Fermentation
EM-16-68	From Bountiful Seawaters to Condition of Excessive Depletion of Marine Resources
EM-16-104	Mapping Land Use Shifts in Nepal's Protected Regions: Insights for Biodiversity and Resource Management
ESD-16-25	Human Well-being and Personal Well-being in Remote, Isolated and Vulnerable Communities in Central Visayas, Philippines: The Case of the Island-Barangays of Bohol
RD-16-61	Assessing the Financial and Economic Viability of Artisanal Salt Production Methods: A Case Study of Miag-ao's Budbud and Guimaras' Tultul Salts
RD-16-63	Exploring the Path to Cooperative Enterprise in Madagascar: A Case Study of the Cooperative Fanamby

Soil Science & Food Innovation

Co-Chairs	Dr. Gemma Guigue, Dr. Reynold Dabi Tan and Dr. Edgar Castañares
AG-16-34	Product Design and Development of Coconut Flour and Co-Products in The Marshall Islands
AG-16-73	Effect of Heat Treatments on Cannabidiol (CBD) and Nutritional Value in Hemp Seed Tea Product
AG-16-80	Development of No Sugar Added-Osmotic Dehydrated Chinese Bitter Gourd
EM-16-30	Investigation of Copper Speciation in Swine Manure during vermicomposting by Synchrotron Approach
EM-16-31	Assessing Soil Carbon Sequestration in Salt-Affected Areas Managed with Vermicompost and Organic Waste Materials: A Geographic Information System Approach
EM-16-34	Characterization of Microplastics in Landfill Soil and Their Effects on Growth and Reproduction of Earthworms (*Eisenia foetida* and *Eudrilus eugeniae*)
EM-16-62	Development and Evaluation of Nutrient Loss in Novel Hybrid Granular Fertilizers for Sustainable Agriculture in Sri Lanka

EM-16-69	Study on Land Use Alterations Following Collaborative Land Use Planning for Sustainable Resource Management
EM-16-70	Assessment of Soil Health Under Different Land Uses (Forest, Ruzi Grass, and Cropland) in Xiengkhouang Province, Lao PDR
EM-16-96	Impact of Biochar Application on Soil pH and Electrical Conductivity in Andosol Under Avena sativa Cultivation

Water Environment / Management	
Co-Chairs	Dr. Claire Marie Castillo, Dr. Jesrelljane Amper, Dr. Gebreselassie Sebhatleab and Dr. Ognen Onchevski
AG-16-57	Impact of Dietary Changes on Nitrogen Load of Kasumigaura Watershed
AG-16-58	Data-Driven Techniques for Identification of Factors Affecting Hydroponic Tomato: A Case Study of Hino City
AG-16-68	Virtual Land and Water Flows through International Trade of Maize: A Global Level Analysis
EM-16-47	Eutrophic Condition of Urban Lakes in Vientiane Metropolis, Laos
EM-16-48	The Sustainable Use of Freshwater Lens in the Yumi-Hama Peninsula, Japan: Effects of Precipitation on Groundwater Level Fluctuations
EM-16-51	Water Quality Characteristics of the River Using by Grazing Livestock
ESD-16-06	Factors of Influencing Household Water Supply Contracts in Jakarta
IS-16-03	Feasibility of Low Water Level Management in Irrigation Ponds: Focusing on Baseflow and Water Storage Recovery Periods in Oro River Basin, Tottori
IS-16-05	Evaluation of Flood Mitigation Functions in Paddy Fields Using Alternative Dry and Wet Irrigation

Special Session on 25 Years Anniversary of ERECON (ISERD Secretariat)

Report 1	A Quarter Century of International Development Cooperation at the Institute of Environmental Rehabilitation and Conservation (ERECON): Achievements and Future Challenges towards ESD
Report 2	Structure and Financial Characteristics of ERECON Institute: Extension and Research Integration
Report 3	Challenges on Sustainable Forest Management in Cambodia
Report 4	Challenges on Community Development through School Construction and Renovation in Cambodia

Campus Map

Open Hour

Cafeteria Suzushiro
Lunch hour 11:00-14:00

NODAI CO-OP
Open 10:30-15:00

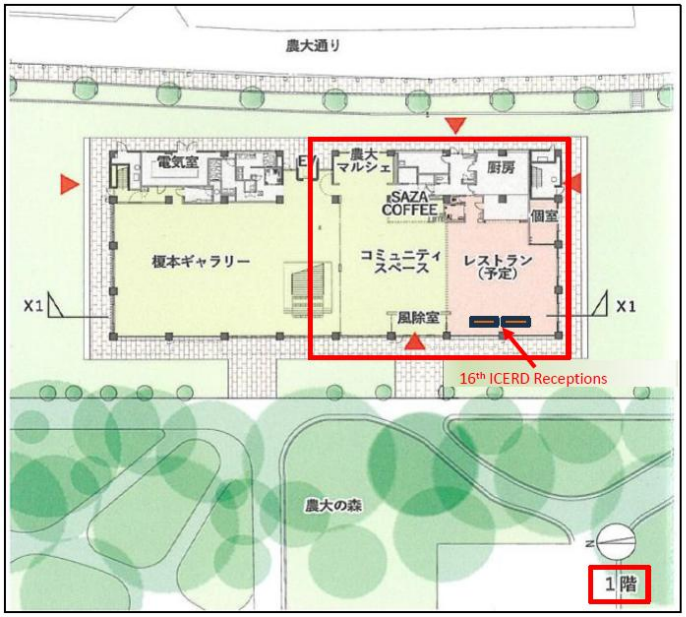
7-Eleven
Open 8:00-18:00(July22-Aug6) except for Sun.

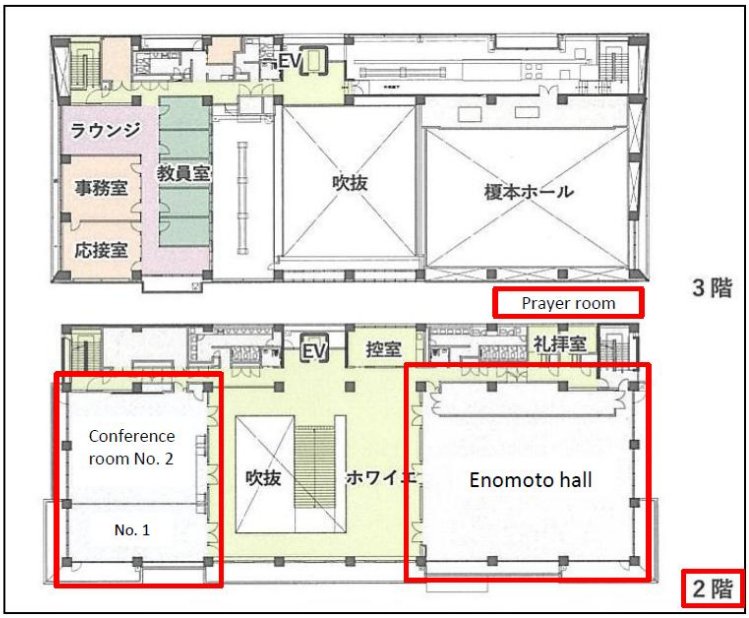
You can withdraw JPY from ATMs at 7-Eleven

NEW

★ NODAI Science Port (Research Laboratories Building)
1 NODAI Academia Center (Main Library, Administration and University Offices) Admissions center on 1 st floor.
2 Bldg. 1 (Lecture Halls)
3 Main Gate
4 Kyodo Gate
5 Chitose Gate
6 Sakuragaoka Gate
7 Youga Gate
8 Centennial Hall Cafeteria "Green"
9 Bldg. 18 Cafeteria "Suzushiro"
10 Tokiwamatsu Student Main Hall (Alumni Rooms, NODAI CO-OP, 7-Eleven,
11 Tokiwamatsu Student Hall (Club Rooms)
12 Tokiwamatsu Hall Dojo
13 Baseball Field
14 Athletic Field
15 Sakuragaoka Arena (Gymnasium, Training Room)
16 Tennis Courts
17 Greenhouses
18 Bldg. 16 (Health and Wellness Center)
19 Bldg. 12 (Food Processing Center)
20 Hockey Field
21 Food and Agriculture Museum · Biorium·Cafe "egg"
22 Green Academy Hall (Life long Education)
23 Sakuragaoka Dormitory, Wakakusa Dormitory

NODAI International Center Floor Map





Building No. 1 Floor Map

2nd Floor

Oral 2 - Room 3 Oral 2 - Room 4 Oral 2 - Room 5

211 212 213

221 222 223 224 225 EV EV EV EV

掲示板

231 232 233

ヘルプカウンター

Poster presentation after 5 minutes oral presentation in Oral 2 from 13:00 to 14:10 on 15 March

241 242 243 244

1st Floor

Oral 2 - Room 1 Oral 2 - Room 2

111 112 113

担架 車イス HCWC

Oral 1 - Room 1 Oral 1 - Room 2

131 132

掲示板

学生掲示板

EV EV EV EV

ヘルプカウンター

Poster presentation

AED

Poster presentation

Poster presentation core time: from 10:00-10:30 and 14:30-15:00

掲示板 掲示板

141 142

Oral 1 - Room 3 Oral 1 - Room 4

AG-16-03

Assessing Adoption Patterns and Determinants of Sustainable Rice Cultivation in Central Northeast Thailand

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Abstract

The paper analyzes the adoption patterns and determinants of sustainable rice farming practices in Central Northeast Thailand. Data were collected from 109 farmers using a structured questionnaire that covered household characteristics, farming practices, economic awareness, and challenges in rice cultivation. A multistage sample was employed. Results from descriptive statistics and stepwise regression analysis indicated a significantly high level of adoption for manure application with 89.91% while climate-smart/precision agriculture practices experienced minimal levels of adoption (9.17%). The results reveal the great value of local institutions supporting adoption, especially farmer group participation as 93.75% of high adopters were members of such organizations. They also strengthen ties with other agricultural service providers, including input suppliers and extension agents in the area, becoming a driver of sustainable practices. Risk-loving farmers also made up an important part of the high-adoption group (56.25%). Economic awareness emerged as a key factor, with higher awareness being strongly associated with a greater likelihood of adoption. This was evidenced by a high average Likert score of 4.41 for economic awareness among top adopters. The regression analysis indicates that farmer-specific factors, such as participation in farmer groups and economic awareness, positively influence adoption, while, in contrast, risk aversion significantly decreases the likelihood of adoption. Moreover, pest and weed problems are a major impediment to the adoption of sustainable practices. These findings have direct implications for developing local institutional support and addressing agronomic constraints in promoting sustainable rice farming practices if non-economic factors are to facilitate the adoption of environmentally friendly alternative water management options.

Keywords: sustainable rice farming, adoption patterns, central northeast Thailand, farmer group participation, agronomic challenges

AG-16-10

Regulatory Reforms for Stabilizing Agricultural Food Prices in Bangladesh: Legal and Theoretical Solutions to Address Market Fluctuations

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Abstract

This study examines the pressing issue of agricultural food price instability in Bangladesh. It begins by highlighting how recent price increases are influenced by market manipulation, inefficiencies in supply chains, and external economic factors. The study further explores how climate-related challenges, such as floods, droughts, and changing weather patterns, are worsening these vulnerabilities, leading to more frequent price fluctuations in agricultural products. The paper evaluates the current regulatory framework governing the agricultural food supply chain, focusing on key laws like the Production, Storage, Transfer, Transportation, Supply, Distribution, and Marketing of Food Products (Prevention of Prejudicial Activity) Act, 2023, the Agricultural Marketing Act of 2018, the Competition Act of 2012, and the Consumer Rights Protection Act of 2009. The research identifies significant enforcement issues, including the lack of coordination among regulatory bodies, corruption, the influence of market syndicates, and consumer indifference, which all contribute to the ongoing price instability. A qualitative methodology was used, involving content analysis of legal frameworks, scholarly articles, and media reports, to assess the effectiveness of the current regulations. The study recommends adopting a more responsive regulatory approach, one that encourages initial persuasion but can escalate to stricter enforcement, such as applying severe penalties for non-compliant businesses. Additionally, the paper discusses recent political changes in Bangladesh, where a new interim government has replaced the previous one after large-scale student protests. Despite high hopes for reforms, food prices have remained unstable, pointing to deeper systemic issues that require reform beyond political shifts, especially considering the growing threats created by climate change.

Keywords: agricultural food, agri-food price, supply chain regulation, climate change, Bangladesh

AG-16-13

Discussion on Digital Agricultural Information Dissemination Systems in Tamil Nadu, India

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Abstract

Agricultural information dissemination systems play a key role in farmers' decision-making. Much emphasis has recently been placed on agricultural modernization through digitizing agricultural services in Tamil Nadu`s agricultural sector. Studies point to various facilitating factors related to the availability and accessibility of digital agricultural information dissemination systems. However, only 18% of the farmers in Tamil Nadu have registered with the Uzhavan app, a key digital agricultural information dissemination service. The other 82% have not registered for the service. Therefore, the objective of the current study was 1) to examine the evolution and institutional framework of agricultural information dissemination system (extension & advisory services, weather-based agro advisory services, and market-based agro advisory services), 2) to analyze facilitating and hindering factors of different digital agricultural information dissemination systems, 3) to identify challenges facing the farmers in the study area. Apart from secondary data, primary data was collected for the study through semi-structured interviews with 30 farmers in Chengalpattu district, Tamil Nadu. The result showed that there was a lack of an ideal institutional design for disseminating digital agricultural information in equitable and affordable ways. Lack of awareness, institutional trust, gender and socio-economic gap in access, lack of contextualized content, and cost of access were identified as some challenges to accessing digital agricultural information. Therefore, in the future, it is necessary to identify and incorporate factors responsible for equitable and affordable dissemination of digital agricultural information.

Keywords: digital agriculture, information dissemination, Tamil Nadu, effectiveness, challenges

AG-16-15

Entrepreneurial Ecosystems in Agriculture: Leveraging Innovation for Climate Resilience and Sustainability

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Abstract

Agriculture is one of the sectors most vulnerable to climate change, and enhancing its resilience is critical for global food security and sustainable development. This paper examines the role of entrepreneurial ecosystems in agriculture as a transformative force to build climate resilience. By fostering innovation and supporting agripreneurship, entrepreneurial ecosystems in agriculture can help communities adapt to and mitigate the risks posed by climate change. This research highlights the interconnections between entrepreneurship, policy frameworks, and agricultural innovation in creating sustainable solutions that enhance resilience. The study explores how key elements of entrepreneurial ecosystems—such as access to finance, supportive regulatory environments, infrastructure, and knowledge-sharing networks—can empower agricultural entrepreneurs to develop climate-smart technologies and practices. Moreover, the paper delves into the role of government and policy in creating enabling environments for agricultural entrepreneurs. It provides insights into how targeted interventions can support small and medium agribusinesses to thrive, while also contributing to broader sustainability goals. Policy recommendations include enhancing access to green finance, improving rural infrastructure, and fostering public-private partnerships to scale innovative agricultural practices. By focusing on the entrepreneurial ecosystem's capacity to drive innovation in agriculture, this paper offers a pathway toward building climate-resilient communities. It underscores the importance of cross-sectoral collaboration to ensure that agricultural innovations contribute not only to economic growth but also to long-term sustainability and climate adaptation.

Keywords: entrepreneurial ecosystems, climate resilience, agriculture, innovation, sustainability, policy insights

AG-16-16

Survival Strategies of Smallholders Engaged in Organic Farming Under Climate Change: A Case Study in Northeastern Thailand

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Abstract

This study aims to investigate the survival conditions of smallholders engaged in organic farming in Northeastern Thailand, focusing on effective group management and their capacity to distribute organic vegetables to large-scale markets, particularly modern trade retailers. Data were collected using qualitative research methods, including in-depth interviews, non-participant observation, and focus group discussions. Key informants were purposefully selected, consisting of a leader from an organic farming group, 20 smallholders, and 3 business operators/retailers. The data were analyzed using triangulation to ensure reliability and employing content analysis. The findings indicate that seasoning and climate change are critical factors affecting the survival of smallholders. The top three conditions influencing their survival and well-being, in order of priority, are water resources, investment capital, and weather conditions. Smallholders can partially control water resources through investments and support from government agencies. Similarly, investment capital is within their control, as they can distribute their products to suppliers and sell directly to consumers. However, the challenge of extreme heat is particularly difficult for them to manage, as it largely remains beyond their control, despite being ranked third. Consequently, the conditions that small-scale farmers wish to improve are prioritized as weather conditions, investment capital, and knowledge and skills related to adaptation and recovery from damage caused by unpredictable weather. Historically, they have employed a strategy of diversifying their options by producing various types of organic foods. This approach aims to mitigate risks and sustain relationships with partners in the supply chain. This study posits that mechanisms designed to enhance smallholders' adaptation and recovery from current climate change challenges should include the dismantling of barriers associated with disciplinary constraints. The development of solutions should involve the co-creation of knowledge that integrates scientific, social scientific, and local knowledge. This process should incorporate diverse perspectives and concepts from multiple stakeholders at various levels.

Keywords: smallholders, organic farming, climate change, Thailand

AG-16-17

Watermelon Peels and Rinds as a Food Preservative and Additive in Pork *Longganisa* (Sausage)

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Abstract

Food products in the Philippines mostly use synthetic preservatives, including the curing powder for pork *longganisa* (sausages) (PL), a type of cured meat widely consumed. Currently, there is an emerging trend to look for natural alternatives to further increase the nutritional value of food while ensuring its stability during storage. In Sibalom, Antique, 41.9% or 11,250pcs. of watermelons are surveyed to be rejected and left on the field to rot after harvest. The development of these rejects as a food preservative and additive from the rinds and peels of red-fleshed "*Sweet 16"* (RF16) and yellow-fleshed "*Sweet Gold"* (YFSG) watermelons was conducted. The peels and rinds oven-dried at 60^{o}C were powdered and added at 6% to the PL. A positive control (PC) using Prague powder and a negative control (NC) were used alongside the treatments. The results of the sensory evaluation on day 16 showed a significant difference in terms of the odor between the PC, RF16, and YFSG. No significant differences were found between the color, texture, and flavor of all samples. The free fatty acid of the PC and NC increased on day 27, while it decreased for RF16 and YFSG, suggesting better shelf-life stability. When analyzing its nutritional content, no significant differences were observed in the moisture content of all samples, while the crude fat did not differ between YFSG and PC. Crude protein was highest in PC, while the crude fiber of YFSG and RF16 were significantly higher and even increased on day 27. The use of the watermelon rinds and peel powders from the rejects was comparable to the commercial preservative as it further improves the nutritional content and shelf-life stability of the pork *longganisa*, promoting a circular food system that can also be introduced to a wide variety of food products.

Keywords: food preservative, food additive, watermelon rejects, peels and rinds, food losses

AG-16-24

Formulation of a Ketogenic Diet for Starter-Finisher Broiler Chicken (*Gallus gallus domesticus*): Its Effect on Growth Performance, Carcass, Visceral Yield and Quality

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Abstract

A study was conducted to address the issue of fatty carcasses in broiler chickens. The effect of feeding a ketogenic diet in reducing abdominal and visceral fat and its effect on growth were investigated. The purpose is to get the majority of one's caloric intake from protein and fat, with fewer calories coming from carbohydrates. One hundred twenty-eight (128) three-week-old, straight-run broiler chicks were assigned with the following diets: Control (commercial ration), Lipid-based ration, Protein-based ration, and Fiber-based ration in a Randomized Complete Block Design (RCBD) with cage location as blocking factor. Data were analyzed using Analysis of Variance (ANOVA) in RCBD of SAS v.9. and differences among treatments were determined using Tukey's Honestly Significant Difference Test (HSD) and declared significant at α=0.05. Results showed that Control had the best growth performance - Voluntary Feed Intake (VFI), Weight Gain (WG), Average Daily Gain (ADG), and Feed Conversion Ratio (FCR) while the Fiber-based ration performed the least. The Control also had the highest dressing percentage (DP) while abdominal fat was lowest in the Fiber-based ration. Additionally, visceral fat was lowest in both the Lipid-based ration and Fiber-based ration. The Protein-based ration was the most cost-efficient ketogenic-based diet. The underwhelming growth performance of the ketogenic diet can be attributed to its poor digestibility brought by the combination of raw materials with subpar quality compared to commercial feed formulations that often utilize premium-grade ingredients. These findings suggest that while ketogenic diets can influence carcass composition, further optimization is needed to improve growth performance and cost-effectiveness in broiler chickens.

Keywords: broiler, fatty carcass, growth, ketogenic diet

AG-16-25

Impact of Transplanting Date Shifts on Rice Production in Rain-Fed Northeast Thailand

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Abstract
Northeast Thailand, hosting 60% of the nation's rice paddies, is a crucial rice-producing area. Over 90% of its fields are rain-fed, making them highly vulnerable to climate variability. Studying climate change impacts on rice cultivation and proposing adaptation strategies is essential. One strategy is shifting the transplanting date (TPD), which can help avoid extreme summer temperatures or increase water availability. Many studies show that shifting TPD can improve rice yields, but in rain-fed systems, harvest area is equally vital due to water limitations. Thus, this study examined the difference between the effect of shifting TPD when assessed by unit yield and total rice production. This study developed a model to estimate both crop growth and harvest area, determining TPD based on free water levels remaining above a set threshold for three consecutive weeks. The threshold was set at 12.9 mm, with a field capacity of 200 mm for sandy soil. The model was calibrated from 2007 to 2016 and validated from 1997 to 2006. The accuracy during the calibration and validation period, evaluated using correlation coefficients between observed and estimated production, was 0.93 and 0.88, respectively. To find the optimal TPD for maximizing unit yield and production, this threshold was changed in 5mm increments from -5mm to +25mm. 13 of 20 provinces showed different TPD in production-based and unit yield-based optimization. Specifically, in 10 provinces, optimal TPD for unit yield occurred earlier than for total production, while in 3 provinces, it occurred later. For instance, Buri Ram's optimal TPD for unit yield was 22nd May, while for production it was 16th June. This result indicates that the impact of climate change adaptation strategies should be assessed based on total rice production rather than unit yield alone.

Keywords: climate change adaptation, rain-fed rice cultivation, production model

AG-16-27

Development of Optimized Pineapple Leaf Fiber Extractor

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Abstract

Pineapple (*Ananas comosus L.*) leaves yield fibers that can be hand-woven into valuable pineapple cloth. These fibers have been rediscovered with designers' desire to produce sustainable materials. According to the Philippine Fiber Development Authority (PhilFIDA), quality fibers are extracted by hand scraping. This method, however, is tedious, and the capacity of hand-scrappers in Aklan, Philippines, is only 250-300 leaves per day. Hence, this research aims to develop two optimized pineapple leaf fiber extracting machines, a foot-lever-operated (P1) and an electric-powered (P2) machine. P1 comprised a scraping blade assembly, a driving means, a discharge unit, a support frame, and a thorn remover. In addition to those components, P2 comprises a press-scraper roller assembly, feeding hoppers, and a driving means. The machines have been optimized in terms of scraping blade's angle, blade bevel angle, and steel spring force using the Design of Experiments and the Analysis of Variance. The machines were evaluated in terms of scraping time, fiber recovery, and fiber quality. Results showed that the average extraction time using the P1 and P2 were 0.93 and 0.18 minutes per leaf, or 518 and 2,618 leaves per day capacity, respectively. Using P1 resulted in a fiber recovery of 0.75 g/leaf, while P2 gave 0.69 g/leaf fiber recovery, which is greater than the total fiber recovery of 0.681 g/leaf by manual scraping, according to PhilFIDA. The fibers extracted using the machine are finer and have higher tensile and breaking strengths. The transfer of the machines to their intended users, the leaf scrapers, has the potential to increase their productivity and income significantly. This, in turn, could lead to a substantial increase in the production of pineapple leaf fibers for hand-woven fabrics, thereby benefiting the textile industry and fostering economic growth in the region.

Keywords: drying, biomass furnace, dried fish, heating system efficiency, moisture content

AG-16-29

Gender Inclusiveness as Determinant for Sustainable Organic Agriculture Adoption

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Abstract

Women comprise 43% of the global agricultural labor force, making agriculture a large sector for women's employment. Women lag behind men in land holding and access and control over key agricultural resources. Despite these, they contribute to more than 50% of the food grown worldwide. Their role in securing food for the family through organic agriculture should be made visible. Moreso, organic agriculture is an effective mitigation and adaptation strategy for climate change. Hence, this paper highlights the role of gender in successful organic agriculture (OA) adoption. Survey interview was administered to 180 organic agriculture practitioners from: Tublay, Benguet and Sabtang, Batanes in Luzon Island; Dao, Capiz, and Victorias City, Negros Occidental in the Visayan Islands; and Braulio E. Dujali, Davao del Norte and Sta. Josefa, Agusan del Sur in Mindanao Island. Descriptive statistics was used to analyze data. Practitioners have a high educational level, available family labor, bigger landholding, more organic farming experience, and are affiliated with farmers' organizations. The lack of these socio-demographic characteristics constrained farmers to adopt an innovation. Reasons for conversion were health and economic benefits, and environmental concerns. Gender differential roles of farmers on access and control over agricultural resources and benefits, farm labor, and decision-making, depends on major enterprise and household dynamics. The island group and site-specific gendered differences are critical for equal access and control of key agricultural resources. Farm labor was determined by gender-differentiated farming activities. Technological constraints and solutions identified vary by gender and site. Variances on the different roles they play in OA adoption should be integral in the design and implementation of gender-inclusive organic agriculture programs in the country.

Keywords: adoption, gender, inclusiveness, organic agriculture

AG-16-30

Monitoring In Vitro Rumen Fermentation Characteristics and Feed Digestibility with Encapsulation Hermetia illucens Larvae Oil

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Abstract

Oil from *Hermetia illucens* larvae can potentially increase energy in cattle's feed. However, the use of oil has negative impacts on cattle, such as degrading rumen and causing toxicity to rumen microbes. Therefore, it is necessary to protect the *Hermetia illucens* larvae oil by encapsulation method. Therefore, this study aimed to investigate the effect of *Hermetia illucens* larvae oil encapsulation on in vitro rumen fermentation characteristics and digestibility. This research used a completely randomized design including a 2×4 (+1) factorial treatment, where the first component included the treatment of unprotected and encapsulated *Hermetia illucens* larvae oil, the second factor included product levels at 2, 4, 6, and 8% of dry matter (DM), and the additional control was a negative control. After incubation, encapsulated Hermetia illucens larvae oil significantly increased ($p<0.05$) rumen digestibility parameters, with the highest results being negative control and encapsulated *Hermetia illucens* larvae oil 2 and 4% (49.39, 50.75, and 48.33%, respectively). Encapsulated *Hermetia illucens* larvae oil significantly ($p<0.05$) decreased total volatile fatty acids, with the lowest results being encapsulated *Hermetia illucens* larvae oil at 2, 6, and 8% (95.98, 92.96, and 97.76 mM, respectively). *Hermetia illucens* larvae oil significantly ($p<0.05$) decreased methane parameter, the lowest methane value was in encapsulated *Hermetia illucens* larvae oil 2, 4, 6, and 8% (10.12, 11.02, 9.95 and 12.37 mM, respectively). However, encapsulated *Hermetia illucens* larvae oil had no effect ($p<0.05$) on total ammonia-nitrogen (NH 3 -N) and pH. These findings highlight the promise of encapsulated *Hermetia illucens* larvae oil as a feed additive, but further in vivo, research is necessary to confirm its efficacy and to explore its full potential in reducing methane production and optimizing rumen function.

Keywords: *Hermetia illucens*, encapsulation oil, supplementation oil, fat improvement

AG-16-32

Efficacy of Native Plant Extracts Against Root-Knot Nematode, *Meloidogyne Incognita*: Innovative Strategies for Sustainable Agriculture

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Abstract

Root-knot nematode, *Meloidogyne incognita*, affects a wide range of crops and poses a significant threat to food security worldwide. Sustainable agricultural management is a key strategy for developing our society, and biological techniques for controlling M. incognita are recommended for ensuring clean and green food production. To achieve this goal, we aim to use native plant extracts as a replacement for synthetic nematicides in controlling M. incognita, prioritizing their use to benefit our soils in agriculture. We conducted in-vitro and microcosm experiments to assess the nematicidal activity of water extracts of *Derris elliptica* (5%), Neem leaves (5%), *Eucalyptus* leaves (5%), Bidens pilosa leaves (5%), Melaleuca leaves (5%), Lantana camara leaves (5%), Annona glabra leaves (12.5%), A. glabra seeds (12.5%), fluopyram (0.17%) as a positive control, and distilled water as a negative control. The mortality rate of second-stage juveniles (J2) was recorded at 24, 48, and 72 hours after inoculation (hai). The mortality rate of J2 was 12.5% in A. glabra seeds and 100% in neem leaf extracts at 24 hai, which was comparable to that in fluopyram. Extracts from D. elliptica, A. glabra leaves, and Melaleuca leaves showed high effectiveness at 48 hai, with J2 mortality rates ranging from 74% to 90%, compared to the negative control. Further tests with A. glabra leave and seed extracts were conducted to evaluate their ability to inhibit M. incognita infection in tomato and cucumber plants. These extracts significantly reduced the number of galls on the roots of tomato and cucumber and increased the number of plant leaves, shoot biomass, and root length in tomato plants. This study highlighted that native plant extracts can serve as an effective alternative to chemical nematicides, reducing the reliance on toxic compounds while effectively controlling nematode populations.

Keywords: biological control, management, Mekong delta, pathogens, suppression

AG-16-33

Assessment of Paddy Water Quality and Suitability in Leading Rice-Producing Regions of Afghanistan

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Abstract

Access to clean and safe water is crucial for the success of agriculture, particularly in paddy fields. However, little is known about the water quality in paddy fields in Afghanistan. This study aims to evaluate the water quality with the aid of paddy water quality indices (PWQI) and assess its impact on crop growth and productivity. Throughout Afghanistan's leading paddy regions, homogenous samples were taken from the inlet, middle, and outlet of paddy fields in eight districts namely Kama (KM), Mihtarlam (ML), Khas Kunar (KK), Sholgara (SG), Khwaja Ghar (KG), Kunduz (KD), Puli Khumri (PK), and Guzara (GZ). The investigated hydro-chemical characteristics include pH, EC, TDS, free chlorine, and total hardness, cations (K, Mg, Ca, Na), nutrient (water clarity indices (SS) and, organic matter indices (DO, COD). The PWQIs used in this study include salinity hazard, sodium adsorption ratio (SAR), Kelly's ratio (KR), soluble sodium percentage (SSP), and magnesium hazard (MH). Results reveal a range of water conditions, from "excellent" salinity levels in the majority of areas to "doubtful" SAR values in a few places. This highlights the localized hazards of soil salinization and decreased productivity if unchecked. Advanced statistical analysis, such as PCA, correlation mapping, and clustering heatmap, showed significant water chemical profiles that are closely related to the natural circumstances and agricultural practices of each location, highlighting the need for specialized strategies. These findings reveal practical ways to improve water resource management and support food security in the face of mounting climate change demands, making them crucial for rice farmers, agronomists, and policymakers.

Keywords: paddy water resources, hydro-chemical parameters, paddy water quality, Afghanistan

AG-16-34

Product Design and Development of Coconut Flour and Co-Products in the Marshall Islands

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Abstract

Coconut flour is a product made from defatted, dried, and blended white pulps of coconuts, which is widely considered a superfood due to its high fiber contents, and it is also gluten-free. This research project is intended to highlight the potential of local production of coconut flour in the Republic of the Marshall Islands (RMI), with the use of kitchen laboratory trials and in-house sensory analysis for consumer preference purposes. It would also consider its importance in and contribution to food and nutrient security, as well as income generation in both rural and urban areas. As a value-added product, an additional part of the research is the food application of coconut flour in baking that is intended for extension to the local communities, through cooking demonstration of coconut cookies that are made from 100% coconut flour (no wheat flour). This is essential in providing nutritious foods or snacks while controlling the heavy reliance on imported ultra-processed food products, which usually leads to non-communicable diseases in the RMI and the Pacific region, coupled with the possibility of production discontinuations and interruptions. Moreover, the research also explores the verification of food safety of the final co-products, based on the process flow used and the good hygienic practices controls that are practiced and observed during the kitchen laboratory trials. The process flow that was considered and explored in this research was previously mentioned in a study on coconut flour production that established the critical limits of the oil and water content of the product at 35-46% and 2.5-3.0%, respectively (Bawalan, 2000). However, there are possibilities of a few adjustments to reflect the use of different species of coconut, different types of equipment, and most importantly the incorporation of traditional knowledge on local food production for coconut. The study also explores the possibility of producing and promoting virgin coconut oil as a co-product of coconut four, and both products are of interest in the RMI given the novelty and the existing export/trade of copra on the island.

Keywords: coconut palm, coconut flour, organic foods, local food production.

AG-16-35

Attitude of the Farmers Towards Climate -Smart Agricultural Practices the Case of Small-Scale Cattle Farming in Arusha Region, Tanzania

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Abstract

Cattle farming has a significant contribution to the development of the agricultural sector in Tanzania, mainly practiced by smallholder farmers and it plays a vital role in the livelihood of the majority of people. However, productivity remains low, and cattle farming is among the main contributors to greenhouse gas emissions in the country which cause climate change. Despite the benefits of climate-smart agricultural (CSA) practices in increasing agricultural productivity, climate change resilience, and mitigating greenhouse gas emissions, adaptation of CSA practices in cattle farming is still low among farmers. Attitude can influence the adaptation decision-making of a farmer about CSA practices. This study aimed to assess the attitude of the farmers towards CSA practices in cattle farming. The selected CSA practices for this study were fodder conservation, rainwater harvesting, zero grazing, manure management, rotational grazing, and improved cattle breeds. The study was conducted in the Monduli district of the Arusha region. Both primary and secondary data were used in the study. Primary data was collected through a semi-structured questionnaire survey administered to 270 farmers. Descriptive statistics and principal component analysis (PCA) were used for data analysis. The findings from descriptive statistics indicate that farmers have a positive attitude about the importance of CSA practices in productivity, climate resilience, environmental sustainability, and education concerning CSA practices. While the farmers have a negative attitude toward the expense and inadequate resources to implement CSA practices. The PCA results show that the factors that influence the attitude of the farmers towards CSA practices are difficulty in the implementation of a practice, perceived benefits, and knowledge about CSA practices. Therefore, the government needs to increase education access to smallholder farmers about CSA practices through extension services and the provision of agricultural input subsidies to support the implementation of CSA practices in cattle farming.

Keywords: climate-smart agriculture, cattle farming, attitude, principal component analysis

AG-16-36

Vermicomposting Using Leguminous Plants as Bedding Materials for African Night Crawlers (*Eudrilus euginae*)

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Abstract

This study investigates the efficacy of four different leguminous plants – ipil-ipil (*Leucaena leucocephala*), kakawate (*Gliricidia sepium*), malunggay (*Moringa oleifera*), and kudzu (*Pueraria montana*)–as bedding materials in the vermicomposting of organic waste using African Night Crawlers (*Eudrilus euginae*). The research aimed to evaluate the impact of these plants on the yield, recovery rate, and biomass of compost produced. After a 50-day anaerobic and aerobic decomposition period, kudzu yielded the highest vermicompost at 6.45 kilograms, followed closely by ipil-ipil and malunggay, while kakawate demonstrated the lowest yield. Similarly, kudzu achieved the highest recovery rate of 64.5 kilograms, significantly outperforming kakawate. Regarding the biomass of African Night Crawlers, ipil-ipil was found to support the most substantial growth at a mean of 167.99%. Statistical analyses, including ANOVA (Analysis of Variance) and Duncan's Multiple Range Test (DMRT), confirmed significant differences among treatment groups, indicating that the choice of leguminous plant significantly influences vermicomposting outcomes. These findings underscore the potential of leguminous plants, particularly kudzu and ipil-ipil, as effective bedding materials in vermiculture, contributing to sustainable waste management practices and enhancing compost quality. This research is foundational to optimizing bedding materials in vermicomposting systems in various ecological contexts.

Keywords: vermicomposting, Leguminous plants, African Night Crawlers, biomass, compost quality, sustainable waste management

AG-16-38

Changes in the Bulk Soil and Phosphate Solubilizing Microorganisms after Different Fresh Corn Grown with Short-Term Organic and Inorganic Fertilizer Application

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Abstract

The impact of different fertilizer applications on crop growth, soil health, and microbial communities is critical for sustainable agriculture. The positive interactions between crop roots and their associated microbiomes are essential for improving nutrient availability and promoting plant growth. Therefore, this study aims to investigate the changes in bulk soil chemical properties and the diversity of phosphate-solubilizing microorganisms after growing three fresh corn under short-term applications of vermicompost, black soldier flies, and inorganic fertilizers. Soil samples were collected after purple waxy, pink waxy, and sweet corn were grown for soil chemical analysis, phosphate-solubilizing microorganism isolation, and capacity. The capacity to solubilize mineral phosphate was quantitatively evaluated on insoluble $AlPO_4$, Ca_3 $(PO_4)_2$, and $FePO_4$ in the National Botanical Research Institute's Phosphate medium through a spectrophotometer. The indole acetic acid capacity of the isolates was also determined. The results showed that organic and inorganic fertilizers can maintain the ear-fresh weight of three fresh corn varieties and tend to increase some soil chemicals after growing. Application of inorganic fertilizer (F4) and black soldier flies mixed with inorganic fertilizer (F3) resulted in the highest ear fresh weight, with 6,291.30 and 5,887.40 kg ha^{-1}, respectively. Moreover, soil pH, P, and Cu tend to increase, while Zn and Cr decrease. The results showed that one PSF isolate was found from the bulk soil of sweet corn under no fertilizer application and two PSF isolates were found from bulk soil of purple waxy corn under vermicompost, and inorganic fertilizers application. However, these PSF isolate potentials were not significant differences in $AlPO_4$ and $FePO_4$ solubilizing. Only two PSF isolates from bulk soil of purple waxy produced IAA hormone between 462.81-562.81 mg l^{-1}. In addition, three PSF isolates were similar to the type strain of Candida tropicalis.

Keywords: auxin, fresh corn, indole acetic acid, isolation, microbial, soil chemical

AG-16-40

Enhancing Climate Resilience and Coffee Nursery Management in Bukidnon: Empowering Indigenous Coffee Farmers through IoT-Based Technology and Capacity Building

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Abstract

The Philippine coffee industry has faced decreasing yields and increasing reliance on imports. Climate change exacerbates these difficulties, particularly for small-scale coffee farmers who lack the resources and infrastructure to adapt to changing weather, pests, and diseases. Internet of Things (IoT) technologies present a promising solution for coffee farmers as a tool to monitor environmental conditions, improve crop health, and optimize resource use. However, effective adoption of IoT technology in coffee farming requires targeted capacity-building to equip farmers with essential knowledge, skills, and a positive attitude toward adoption. A Training Needs Assessment (TNA) was conducted with 40 farmer participants across two Bukidnon farming communities. The TNA evaluated current knowledge, skills, and attitudes in five key areas: IoT familiarity, nursery management practices, biofertilizer and soil management technologies, pest and disease detection, and openness to new techniques. The TNA revealed that 60% of farmers were unfamiliar with IoT, and although 50% were aware that IoT can be used for agricultural purposes, only 8% had operated any IoT device. Additionally, there is variability in knowledge and application of nursery management practices, with only 50% of farmers regularly implementing them, while 40% were unfamiliar with various management techniques. Moreover, 48% of the participants were unfamiliar with microbial fertilizers, 30% were unsure about the importance of nutrient management, and 70% had never conducted soil or leaf testing. Although 90% of farmers recognized the importance of early pest and disease detection, 78% had never used any technology for these purposes. Lastly, while 67% of farmers had applied some interventions for seedling quality, only 25% were familiar with the seedling hardening process. Based on these findings, the majority of the farmers have inadequate knowledge and skills to currently implement IoT technologies in coffee seedling production. Hence, a comprehensive training program was recommended to bridge these gaps.

Keywords: coffee production, IoT, TNA

AG-16-42

Organic Production and Processing of *Centella asiatica* for Quality Herbal Raw Materials in Northeast Thailand

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Abstract
This research aimed to investigate the production and processing of *Centella asiatica* in an organic farming system in the northeastern region of Thailand. The traditional and recommended cultivation methods of *Centella asiatica* under an organic production system on farmers' farms in Mahasarakham Province were compared from June 2023 to June 2024. The yield and triterpenoid glycosides, madecassoside, asiaticoside, madecassic acid, and asiatic acid of the two methods were assessed. The result reveals that the average fresh weight of the recommended cultivation method was 6,912.5 kg/ ha, while the traditional cultivation method was 4,456.25 kg/ha (The average yield of *Centella asiatica* in Thailand is about 5,000-11,181.25 kg/ha). In terms of secondary metabolites, the total triterpenoid glycosides of the recommended cultivation method were 5.04%, on the other hand of cultivation method was 3.98% (Thailand herbal standard is no less than 2%). The result indicated that the recommended cultivation method had a higher yield (55.2%) and secondary metabolite (26.63%) than the traditional cultivation method. Nevertheless, the raw material from the experiment met the standard that can be used in Thai herbal tea. It can also be processed into *Centella asiatica* extracts for use as an ingredient in the cosmetic industry. This study provides guidelines for the organic production and processing of *Centella asiatica* to obtain high-quality, safe herbal raw materials for use in the food, supplement, beverage, pharmaceutical, and cosmetics industries.

Keywords: *Centella asiatica*, organic Thailand, herbal, food safety

AG-16-45

Evaluating Optimal Greenhouse Design for Tomato Cultivation in Central Luzon, Philippines: A Simulation-Based Approach

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Abstract

The Philippines is exploring the adoption of smart greenhouses to improve food production and climate resilience, yet their utilization remains suboptimal due to limited knowledge of climate management design. The high costs of climate control equipment further highlight the need for determining an optimal greenhouse design that balances productivity and economic viability. This study aimed to identify the most effective greenhouse design for tomato cultivation in tropical climates. An adaptive greenhouse climate-crop model was used to simulate conditions for one year (2023) in five locations across Central Luzon, Philippines–Angeles City, Camiling, Limay, Maria Aurora, and Pantabangan–spanning elevations from 8.7-315.9 m. Three greenhouse designs were evaluated: open (natural ventilation), closed (mechanical cooling and CO_2 injection), and semi-closed (a combination of natural ventilation, mechanical cooling, and CO_2 injection). Each design was assessed for energy use and crop yield under current climate conditions to identify the optimal balance between resource efficiency and productivity. Results showed that closed greenhouses provided the highest crop yields, with yields ranging from 54.01-115.56 kg m^{-2} across locations, representing a 43-127% increase over open greenhouses. However, closed greenhouses also required the most energy, with usage ranging from 554.73- 803.82 MJ m^{-2}, highlighting a significant trade-off between productivity and energy costs. Semi-closed greenhouses offered a balance, achieving crop yields between 48.6-70.35 kg m^{-2}, a 28- 85% increase over open greenhouses, with energy consumption in the range of 376.13-684.28 MJ m^{-2}. Open greenhouses, while energy-free, showed considerably lower yields across all locations, with yields ranging from 30.89-37.96 kg m^{-2}. Findings indicate that while closed greenhouses maximize crop production, semi-closed designs offer a more sustainable and economically viable solution, particularly in tropical regions with high energy costs.

Keywords: smart greenhouse, climate-crop model, Central Luzon, greenhouse design, energy efficiency

AG-16-47

Synergistic Effects of Biochar and Plant Growth-Promoting Rhizobacteria on Coffee Seedling Development and Soil Carbon Dynamics

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Abstract

Nutrient bioavailability limitations in agricultural soils significantly constrain crop productivity. While biochar amendments show promise in soil amelioration and Plant Growth-Promoting Rhizobacteria (PGPR) enhance nutrient mobilization, their combined effects remain understudied. This study investigated the impact of integrated biochar-PGPR applications on Coffea arabica L. seedling growth and soil carbon dynamics under controlled greenhouse conditions at Chiang Mai University, Thailand. The experimental design comprised five treatments: (i) control, (ii) PGPR alone, (iii) PGPR with 1% biochar, (iv) PGPR with 2% biochar, and (v) PGPR with 3% biochar. Multiple parameters were assessed, including soil physicochemical properties, plant morphological characteristics, and soil biological indicators. Results revealed statistically significant ($p < 0.05$) enhancements in plant growth parameters and photosynthetic pigment content across treatments. The 3% biochar-PGPR treatment yielded the highest chlorophyll concentrations: chlorophyll a (8.43 mg kg^{-1} fresh weight), chlorophyll b (12.67 mg kg^{-1} fresh weight), and total chlorophyll content (11.16 mg kg^{-1} fresh weight). Soil microbial activity indicators demonstrated optimal responses at 1% biochar-PGPR treatment, with soil microbial respiration reaching 0.0718 mg C g^{-1} soil day^{-1}. This treatment combination also elicited peak values for dissolved organic carbon (34.3030 mg C g^{-1} soil day^{-1}) and microbial biomass carbon (13.20 mg C g^{-1} soil day^{-1}), indicating enhanced soil biological functionality and organic matter dynamics. The findings suggest a concentration-dependent response pattern, where lower biochar doses (1%) optimized soil biological parameters while higher concentrations (3%) maximized plant physiological responses. The combined application of PGPR and biochar demonstrates significant potential as an environmentally sustainable approach for enhancing crop yield and soil management in agricultural systems.

Keywords: biochar, plant growth-promoting rhizobacteria, coffee seedlings, soil carbon dynamics, sustainable agriculture

AG-16-49

Variation of Salinity Response in Known Drought-Tolerant Thai Maize Cultivars at Early Germination

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Abstract

Northern Thailand is ideal for cultivating maize. However, the monoculture of maize in this area has had various negative consequences. The northeast is the second largest area for maize agriculture, although it has a considerable number of salt-affected soil areas, which may affect maize planting using direct seedling methods. Several maize cultivars in Thailand have been improved for drought tolerance or other desirable agronomic traits, but not for salinity tolerance. Therefore, this research aims to study the salinity response of some Thai maize cultivars, known for drought tolerance, at germination. The seeds of six maize cultivars, including Nakhon Sawan (NS 3), NS 5, Tak Fa (TF) 4, TF 7, TF 2, and Suwan (SW) 5731, were germinated on germination paper and then subjected to salinity with 120 mM NaCl for seven days. After that, final germination percentage (FGP), root length (RL), shoot length (SL), seedling vigor index (SVI), and seedling evaluation were observed. Moreover, seed water uptake was determined by imbibed in 0 and 120 mM NaCl for 24 h intervals until 120 h. The results showed all cultivars under 120 mM NaCl had significantly decreased root length, shoot length, and seedling vigor when compared to the control group. The FGP of the drought-tolerant NS 3 and TF 7 was not significantly affected by salinity. However, their normal seedling percentages were reduced. Surprisingly, the TF 2 cultivar, with an unknown degree of drought tolerance, showed no significant reduction in its normal seedling percentage under salt stress. Additionally, NS 5 had the lowest reduction of seed water uptake during 72 h, but NS 3 showed the highest decline under salinity. To summarize, drought-tolerant maize cultivars varied in their response to salinity during seed germination, and some of them tended to tolerant salinity.

Keywords: drought tolerance, imbibition, salt stress, salt tolerance, Thailand maize cultivar

AG-16-51

Comparative Bio-Efficacy of Indigenous Weed-Derived Botanicals on the Fall Armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae)

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Abstract

This study assessed the bio-efficacy of indigenous, weed-derived botanical insecticides, the *Lantana camara, Chromolaena odorata,* and *Hyptis suaveolens*—against the fall armyworm (*Spodoptera frugiperda*), a major agricultural pest. The botanical insecticides were tested for their effects on larval mortality, lethal concentration (LC_{50}), pupation, and adult viability, compared to a synthetic insecticide. Results show that carbosulfan produced significantly higher mortality rates (>90%) within 48 hours. ANOVA analysis ($p < 0.05$) confirmed significant differences between treatments. Among the weed-derived botanicals, *L. camara* and *H.suaveolens* exhibited the highest efficacy, achieving 85% mortality at a concentration of 200 mg/L, while *C. odorata* showed the lowest mortality rate at 60%. The LC_{50} values further indicated that *L. camara* and *H. suaveolens* were the most potent botanicals; however, these botanicals required higher concentrations compared to carbosulfan. ANOVA results confirmed significant differences between botanical treatments and carbosulfan ($p < 0.05$). Regarding pupation and adult viability, *L. camara* and *H. suaveolens* demonstrated a significant reduction in pupation and adult emergence rates, indicating developmental disruption in fall armyworm. These findings suggest that *L. camara* and *H. suaveolens* are viable, weed-derived botanical alternatives for integrated pest management (IPM) programs, offering an eco-friendly solution that may reduce reliance on synthetic insecticides. The study elucidates the potential of indigenous, weed-derived plants in sustainable pest control strategies, with further field studies recommended to validate laboratory efficacy.

Keywords: bio-efficacy, botanical insecticides, carbosulfan, fall armyworm, weed- derived

AG-16-52

Remote Sensing and GIS-Based Assessment of Evapotranspiration and Crop Water Productivity for Sustainable Agriculture in Sindh, Pakistan

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Abstract

This study leverages remote sensing data from EEFlux and field data to calculate actual evapotranspiration (ETa) for rice and wheat crops in the canal command areas (CCAs) of Sindh Province, Pakistan. Five sub-CCA regions were selected to represent the diversity within these irrigation zones. Seasonal ETa datasets were developed for both Kharif (rice) and Rabi (wheat) cropping seasons across growth stages: initial, development, mid-season, and late season, spanning from 2020 to 2022. Ground truthing validation, with over 1,800 field points, showed high accuracy in estimating seasonal ETa. Results revealed distinct spatial and temporal Eta patterns, with rice showing higher ETa in Pat Feeder and Begari Canal, while wheat showed moderate ETa across Dadu and Rice Canal. For instance, the water balance indicated significant deficits in the Desert Canal and Dadu Canal during Kharif, while the Begari Canal and Rice Canal showed a relative surplus in Rabi. Climate resilience zones, categorized by ETa levels, highlighted that areas like Pat Feeder and Desert Canal were more susceptible to water stress, indicating lower resilience. The ETa results provide an in-depth analysis of crop water requirements and were incorporated into a Google Earth Engine (GEE)-based dashboard, enabling dynamic data visualization for researchers, farmers, and the Sindh Irrigation Department to support efficient water management. Climate resilience zones, derived from ETa data, were integrated into the dashboard to highlight areas with varying resilience for each crop across the study regions. Additionally, water balance assessments for the sub-CCAs identified water sufficiency and deficit areas, offering critical insights for optimized water allocation. This developed tool has the potential to enhance agricultural productivity and resilience by promoting informed water resource management in the Sindh canal command areas. These insights support researchers, farmers, and the Sindh Irrigation Department in efficient water allocation, targeted climate adaptation, and sustainable water management, making this tool vital for advancing climate-resilient agriculture in Sindh's canal command areas.

Keywords: evapotranspiration, climate resilience, google earth engine, remote sensing, geographic information system

AG-16-53

How safe is "moron"? An Indigenous Food from Leyte, Philippines

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Abstract

Cultural heritage is not only reflected in traditions and lifestyle but also its unique food. ''Moron'', an indigenous food, has been a staple of Leyte, Philippines food industry for over two decades. Made with locally abundant ingredients like sticky rice, coconut milk, sugar, and tablea (native chocolate), traditionally wrapped in banana leaves and often given as a "pasalubong" by both locals and tourists. The study investigated the microbiological quality and safety of "moron". Product sampling and environmental sampling were conducted in selected food business operators (FBOs). Results were compared to the standards set by the FDA Philippines. Analyses indicated satisfactory results for finished products test for Bacillus cereus (2.30 to 2.41 log CFU/g), *E. coli* (after initial detection, < 1.00 log CFU/g), coliforms (2.41 to 4.15 log CFU/g) and Staphylococcus aureus (<1.00 to 2.40 log CFU/g). Potential contamination risks were identified for *E. coli*, found on food contact (<1.00 to 2.48 log CFU/g) and non-food contact (2.43 to 2.46 log CFU/g) surfaces, while Staphylococcus aureus was present on food (4.40 log CFU/g) and non-food contact (4.15 log CFU/g) surfaces in one FBO. *Staphylococcus spp.* Was found in both products and on tested surfaces (2.40 to> 6.34 log CFU/g). *Salmonella spp.* Tested positive in all finished products and on tested surfaces, across all FBOs. Further investigation traced the source of contamination in banana leaves. The supplier's wilting process lacked proper sanitation measures, potentially introducing the bacteria onto the banana leaves. The yeast, mold, and aerobic plate counts in finished products met the standards; water quality testing also met the standards while air quality testing revealed unsatisfactory levels of airborne microbes (2565 to 4314 CFU/m^3), across all FBOs. These findings highlight the need for improved hygiene practices, stricter supplier controls, and proper sanitation of banana leaves to ensure the safety of the product.

Keywords: food safety, indigenous food, "moron", microbiological analysis, banana leaves

AG-16-54

Laying Performance of Japanese Quail (*Coturnix coturnix japonica*) Supplemented with Different Levels of Squash Meals

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Abstract

The study aimed to evaluate the laying performance of Japanese quail (*Coturnix coturnix japonica*) when fed with varying levels of squash meal supplementation. A total of sixty quails, consisting of forty-eight ready-to-lay females and twelve males, were organized in a Complete Randomized Design (CRD) with four treatments, each replicated three times. Each replication included four female quails and one male quail. The experimental treatments were structured as follows: Treatment 1 (1000g of commercial ration), Treatment 2 (900g commercial ration + 100g squash meal), Treatment 3 (800g commercial ration + 200g squash meal), and Treatment 4 (700g commercial ration + 300g squash meal). The key parameters observed included hen-day/hen-house egg production, average daily feed intake, feed conversion efficiency, body weight gain, feed cost per dozen eggs, and return above feed cost per dozen eggs. The data were analyzed using one-way analysis of variance (ANOVA), revealing notable trends in laying performance. While average daily feed intake, feed conversion efficiency, and body weight gain showed no significant differences across the treatments, key laying performance indicators, namely hen-day egg production and hen-house egg production, exhibited highly significant differences. Additionally, feed cost per dozen eggs and return above feed cost per dozen eggs produced showed significant differences, favoring certain treatment groups. These findings suggest that Treatment 2, which incorporated 100g of squash meal into the quail's diet, provides an effective supplement. This treatment emerged as optimal due to its balance of local availability, low production cost, and nutritional benefits that support enhanced egg production in quails. Thus, supplementing commercial rations with 100g of squash meal offers a practical and economical strategy for improving egg yield in quail farming.

Keywords: Japanese quail (*Coturnix coturnix japonica*), squash meal, laying performance, squash peel, squash seeds

AG-16-56

Effect of Seasons on the Quality of Fresh Semen in Thai Native Chickens Deang Dok Koon and Pradu Hang Dam

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Abstract

This study aimed to investigate the impact of seasonal variations on the quality of fresh semen in two Thai Native chicken breeds: Deang Dok Koon (DDK) and Pradu Hang Dam (PD). A 3x2 factorial experiment was employed in a completely randomized design (CRD). The factors considered were season (summer, rainy, and winter) and breed (DDK and PD). Twelve roosters per breed (aged 1 year) and 40 commercial laying hens were included in the study. All birds were housed in open-air conditions. Semen was collected twice weekly over 24 weeks. The total collection was 48 times. Fresh semen quality was evaluated for mass movement, sperm progressive motility, sperm concentration, sperm viability, and fertility. The results indicated no significant interaction between season and breed. While the season did not influence mass movement or sperm progressive motility, it significantly affected sperm concentration, sperm viability, and fertility. Winter exhibited the highest sperm concentration (4.51 $x10^9$ sperm/mL), followed by summer (4.16 x 10^9 sperm/mL) and the rainy season (3.82 x 10^9 sperm/mL). Summer had the lowest sperm viability (93.45%), whereas rainy (95.49%) and winter (95.22%) showed similar levels. Fertility rates were highest in the winter (86.81%) and the rainy season (85.88%), with summer (77.99%) showing the lowest. Breed had a significant effect on mass movement, sperm progressive motility, sperm concentration, and sperm viability, but not on fertility. Overall, seasonal variations significantly influence fresh semen quality, with winter providing optimal conditions for semen quality compared to summer and rainy seasons. PD breed exhibited superior semen quality compared to DDK.

Keywords: fresh semen, Thai native chicken, season, semen quality

AG-16-57

Impact of Dietary Changes on Nitrogen Load of Kasumigaura Watershed

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Abstract

Recently, dietary change has been increasingly recognized as a viable strategy to reduce nitrogen pollution. This is because animal-based proteins result in significantly higher nitrogen load compared to their plant-based alternatives. In Japan, there has been a rise in animal-based food consumption in recent decades, which could have detrimental effects on water quality. However, dietary changes are rarely considered in watershed environmental conservation. Given Japan's low food self-sufficiency of 38%, shifting diets could improve both domestic and international water quality. Therefore, this study aimed to evaluate whether dietary changes among the population in the Kasumigaura watershed, a chosen target area, could result in nitrogen load reduction and water quality improvement. Kasumigaura watershed covers a third of Ibaraki prefecture with an area of around 2,157 km^2. Due to its shallow average depth of 4 meters and intensive agricultural production, this lake is prone to eutrophication caused by nitrogen pollution. Firstly, nitrogen load from each point source and non-point source was quantified by examining various nitrogen flows, using land-use data to capture the contributions from different sources. This analysis incorporated food production-related anthropogenic nitrogen, from crops and livestock. The estimated nitrogen load in 2020 was around 4 635,5 tons/year and it was a reasonable value compared with the previous research. Then, the impact of the current Japanese diet on the nitrogen load has been investigated, followed by an analysis of how alternative dietary scenarios could alter its impacts. The results suggest that the reduction of animal proteins has significantly lowered the nitrogen load of the population in the watershed, therefore offering a promising approach to improving water quality.

Keywords: nitrogen pollution, water quality, dietary change, eutrophication, Kasumigaura watershed

AG-16-58

Data-Driven Techniques for Identification of Factors Affecting Hydroponic Tomato: A Case Study of Hino City

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Abstract

Hydroponic greenhouses are a better solution to the increasing demand for food and nutrition for the global human population. However, agriculture is influenced by complex relationships between multiple variables, especially in controlled environments, making it challenging for farmers to identify essential factors and manage optimal conditions for higher crop yields. Data-driven decision-making is a better solution to overcome this challenge. The main objective of this study is to use data science methods to identify the essential factors affecting a hydroponic tomato farm in Hino City, Tokyo. Specifically, this study identified essential microclimatic and hydroponic factors that affect tomato yield. Furthermore, this study also compared the application of linear multiple regression and random forest regression methods to identify the essential factors of tomato harvest. Using data sensors installed in the farm, microclimatic data (temperature, CO_2 levels, humidity, and cumulative solar radiation), farm records of hydroponic data (electrical conductivity, pH, and water amount per plant), plant growth records, and tomato harvest data from three crop cycles (November 2021 to July 2024) were used in this study. Using an eleven-day window based on the average internode growth period, the moving average method was applied to smooth the data during preprocessing. The random forest regression model outperformed with a higher R^2 value of 0.92, whereas the linear model had a lower R^2 value of 0.31. Both models identified temperature, electrical conductivity supply, and the amount of water per plant as significant factors affecting tomato yield. Electrical conductivity showed a negative correlation, and the water amount per plant and temperature showed a positive correlation, highlighting the importance of maintaining elevated levels for higher yields. This study provides practical insights into essential yield-influencing factors and supports the implementation of customized management practices through data-driven decision-making, empowering small-scale farmers to increase productivity.

Keywords: Japan, machine learning, random forest regressor, smart agriculture, yield optimization

AG-16-60

Application of Low-Pressure Cold Plasma as a Pre-Treatment for Making Soybean Oil: Study on Pscychochemical

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Abstract
This study assesses the efficacy of low-pressure cold plasma (LPCP) as a pre-treatment method to improve soybean oil extraction and quality, emphasizing essential oil physicochemical and bioactive characteristics. Soybean conducted LPCP for three treatments (5, 10, and 15 minutes) and at two power levels (10 and 20 watts). The pre-treatment significantly increased the amount of oil extracted, indicating that LPCP promotes extraction efficiency by modifying soybean structure. The antioxidant activity fluctuated with plasma parameters: it elevated to 10 W but decreased to 20 W, and progressively decreased with extended treatment durations, probably due to oxidative damage resulting from plasma exposure. The indicators of oxidative stability, including peroxide value (PV) and thiobarbituric acid reactive substances (TBARS), demonstrated heightened vulnerability to oxidation. The plasma treatment increased bioactive chemicals in the oil, such as total phenolic content (TPC) and antioxidant activity (DPPH), indicating structural modifications or the generation of novel phenolic derivatives. The protein content diminished at 10 W but increased at 20 W, suggesting that higher power levels may enhance protein release or stability. Furthermore, color analysis indicated that plasma treatment enhanced lightness (L*) and reduced chromaticity (a* and b*), likely attributable to alterations in pigment composition. The findings underscore LPCP's capacity to improve soybean oil production and specifically increase specific bioactive qualities, while also stressing the necessity for meticulous regulation of plasma parameters to preserve antioxidant integrity and oxidative stability. This work enhances the comprehension of LPCP as a novel pre-treatment in oil processing, indicating the potential for enhancing extraction methods while maintaining quality attributes.

Keywords: cold plasma, soybean, oil, physicochemical

AG-16-62

Management of Golden Banana Plantations in Sang Khom District Udon Thani Province, Northeastern Thailand

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Abstract
Golden bananas are rich in nutrients according to nutritional principles, such as vitamins and fiber, which assist in digestion. The flesh is deep yellow, fragrant, and sweet. They have significant market potential due to their desirable characteristics: good weight, beautiful clusters, and the skin turns golden yellow when ripe. They have a pleasant taste and aroma, making them appealing to consumers. In Sang Khom district, Udon Thani province, northeastern Thailand, the bananas grown are of the Gros Michel variety. This variety of banana is characterized by its firm flesh, sweet taste, fragrant aroma, thick peel, and flexibility. It is resistant to bruising during transport to other countries. Production Standards for Golden Bananas According to Good Agricultural Practices (GAP), the strategies for agricultural practices aim to achieve high-quality and safe produce according to specified standards. The production process must ensure safety for both farmers and consumers, be free from chemical contamination, and not cause environmental pollution. Resources should be utilized efficiently to maximize benefits, achieve high yields (980 kg/ha), and ensure a worthwhile investment. These practices promote sustainability in agriculture, the environment, the economy, and society. Prepare the land by planting in double rows with 1 m. between each double row, 2 m. between each plant, and 3 m. between rows. The plantlets used for cultivation are from tissue culture of the Gros Michel variety. These plantlets are strong, disease-free, and pest-free. Use plastic mulch to control weeds and help manage diseases and pests. This abstract provides insights into the comprehensive strategies employed to sustain high-yield, high-quality banana production in this geographic area.

Keywords: golden bananas, Gros Michel variety, GAP

AG-16-63

Genome Characterization and Growth-Promoting Effects of *Priestia* sp. RMT 2 NF4 on Sweet Corn Seedling Vigor

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Abstract
Bacterial strain RMT 2 NF4, a Gram-positive bacterium, was isolated from the rice rhizosphere in northern Thailand. Whole genome sequencing of RMT 2 NF4 revealed a genome size of 5,318,699 bp, with a G+C content of 37.89%, an N50 value of 811,292 bp, and an L50 of 3. Phylogenetic analysis based on 16S rRNA gene sequencing identified the strain as belonging to the genus *Priestia* sp., a genus known for plant growth-promoting bacteria. This study investigated the growth-promoting potential of strain RMT 2 NF4 on sweet corn seedling vigor under controlled laboratory conditions. Seed germination and growth parameters were evaluated with and without RMT 2 NF4 inoculation over 7 days. Results demonstrated that RMT 2 NF4 significantly enhanced germination percentage (86.76%, p = 0.001) and germination index (7.32 plants/day, p= 0.002). Furthermore, RMT 2 NF4-treated seedlings exhibited a higher growth rate (34.33 mg/plant) compared to the control, indicating a marked improvement in early growth performance. These findings suggest that RMT 2 NF4 may promote seedling vigor through enhanced nutrient uptake or stress resistance mechanisms, presenting a promising approach to support sustainable crop production. Incorporating beneficial rhizobacteria like RMT 2 NF4 in agricultural practices could potentially reduce dependence on chemical inputs, enhancing both productivity and environmental sustainability.

Keywords: plant growth-promoting, rhizobacterium, whole-genome sequence

AG-16-64

Monitoring Salt Stress Development in Rice Plants using Pocket Thermal Camera

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Abstract

Infrared thermography, a non-destructive method, has been used to assess plant health under a variety of stress conditions. However, it requires a high-throughput camera for detecting infrared radiation emitted from plants. Here, we present using a simple pocket thermal camera, FLIR C2 camera, to examine salt stress development in rice plants by detecting their temperature changes. To capture the image, artificial wet and dry references were set near rice plants in control and stress-treated groups. Brown acrylic sheets were used as a background to increase the temperature difference between the plant and the background. Plant temperatures were employed by FLIR Tools software, and then were used to calculate crop water stress index (CWSI) and index of stomatal conductance (Ig). We observed stress progress in hydroponically grown seedlings of the 'IR29' rice cultivar, which were subjected to gradually increased concentrations of NaCl (40, 80, and 120 mM) for 13 days. The results showed that the NaCl condition influences the elevation in leaf temperature. Seedlings exposed to NaCl exhibited greater changes in temperatures and higher CWSI. The FLIR C2 camera was also used to study the impacts of silicon on salt stress amelioration in 'KDML' rice seedlings. The results clearly showed the discrimination of temperature and CWSI among treatments. To summarize, a simple thermal imaging procedure can effectively detect salt stress responses in rice plants.

Keywords: infrared thermal camera, plant stress, rice, salinity, thermography

AG-16-66

A Comparative analysis of Anther Dehiscence and Pollen Viability of Rice Varieties under Two Heat Stress Conditions

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Abstract
In the face of rising global temperatures, the resilience of rice, a staple for much of the world's population is increasingly under threat. This study delves into the effects of high-temperature stress on reproductive traits in seven rice varieties, spanning both japonica and indica genotypes, to uncover the potential for enhanced heat tolerance. By subjecting plants to controlled heat stress at 37.5°C and 40°C, we observed notable differences in anther dehiscence and pollen viability, with specific varieties standing out. Hanachizen consistently exhibited robust anther dehiscence and stable pollen viability, marking it as a promising candidate for extreme heat resilience. Kohishikari, while demonstrating high pollen production at 37.5°C, showed decreased viability at 40°C. Crucially, our regression analysis revealed a strong correlation between basal dehiscence length and pollen germination rates, positioning basal dehiscence as a key indicator of heat tolerance. These findings suggest that traits such as basal dehiscence length offer invaluable markers for breeding programs targeting heat resilience. By identifying and harnessing these adaptive traits, we contribute essential insights into sustaining rice productivity under mounting climate stress, paving the way for the development of rice cultivars capable of thriving in a warming world.

Keywords: heat stress, anther dehiscence, pollen viability, rice varieties

AG-16-68

Virtual Land and Water Flows Through International Trade of Maize: a Global Level Analysis

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Abstract

The world's population is estimated to increase to 9 billion in 2050 from the current level of 7.2 billion, and the primary objective of all countries today is to ensure good security in the country and improve and sustain agricultural practices. Since land and water are limited, we need to ensure that we increase productivity and use less water. Among the crops, wheat, maize, and rice are the world's leading staple cereals, each cultivated on some 200 million ha and accounting for an estimated 42% of the world's food calories. Maize has become the leading global staple cereal in annual production, exceeding 1 billion metric tons. Given the importance of maize, this research aims to understand the global trade dynamics of maize, along with the virtual flows of land and water. For this purpose, FAO's data was used to determine the area, production, and yield. Food balance sheets, a detailed trade matrix, and population data for 2011-20 were used. The trade dynamics have been depicted using network plots. Some countries heavily depend on a few countries, raising concerns over food security. There are situations where the country is unable to sustain agriculture. For instance, India ranks third regarding the area harvested for maize production after the USA and Brazil but had the lowest yield among the top 10 exporting countries between 2011 and 2015; the USA's yield was 3.76 times that of India. Also, India requires the most water among all the countries for maize production, which equals 2554 m3/ton, and 44.29 billion cubic meters (BCM) of water were exported between 2011 and 2015. High water requirements, low yield, and reduced maize crop export quantities are significant concerns for India and the world, as the crop is in high demand worldwide and is a crucial crop for food security.

Keywords: virtual flows, international maize trade, food security, productivity

AG-16-70

Effects of Crop Diversification on Weed Diversity and Beneficial Organisms in Organic Arable Systems

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Abstract

Organic agriculture is a farming approach that avoids synthetic inputs, relying instead on natural processes, biodiversity, and ecological principles to enhance soil health, crop productivity, and ecosystem balance. A major challenge in organic agriculture systems is effective weed and pest control, as synthetic agrochemicals are not permitted. Weeds compete with crops for vital resources such as nutrients, water, and sunlight, often reducing yields and crop quality, while pests may directly damage crops by feeding on leaves, stems, or roots, leading to further productivity losses. Without agrochemicals, organic farmers need to depend on alternative crop management strategies, including crop rotation, cover cropping, intercropping, mulching, etc. to address these challenges. This study examines the effects of different crop diversification strategies on weed seed banks and beneficial organisms in two organically managed cropping systems. The field experiment, conducted in southern Sweden, consisted of two 6-year crop rotations: a Reference rotation (a less diversified rotation) and a Diversified rotation (incorporating cover crops and intercrops in the reference system). Results showed a significant reduction in weed biomass in the Diversified rotation compared to the Reference. Intercropping positively influenced weed suppression while also increasing weed species richness and diversity. However, overall weed abundance, evenness, and seed bank dynamics were not significantly impacted. The intercrops in diversified systems showed higher populations of carabids, earthworms, and lacewings, compared to the sole crops indicating that crop diversification practices can enhance beneficial biodiversity and support weed control in organic systems. However, implementing practices like intercropping and cover cropping often requires additional knowledge, and careful planning, and can increase labor and management costs, underscoring the need for tailored approaches to optimize crop management in organic agriculture.

Keywords: cover crops, crop diversification, crop rotation, intercropping, organic agriculture, weed control

AG-16-73

Effect of Heat Treatments on Cannabidiol (CBD) and Nutritional Value in Hemp Seed Tea Products

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Abstract

In Thailand, the Highland Research and Development Institute (Public Organization) has reported that hemp seed (Cannabis sativa L.) strain RPF 1 shows higher protein content as well as antioxidant and cannabidiol (CBD), but very low in Tetrahydrocannabinol (THC). Recently, hemp seed has been developed into various food products such as beverages, oils, snacks, milk, high-protein food supplements, etc. This study was also focused on how to develop a product of hemp seed, according to the previous customer survey (18 to 45 years old) the result showed that 61.2 % of them interested in tea beverages. So, in the process of tea production heating process may affect the losses of nutritional value and important active compounds. Then, this research aimed to study the effect of heat treatments on CBD, THC, and nutritional value in hemp seed tea products. Heating treatment of hemp seeds using a hot air oven at 70°C for 4 h was compared with roasting at 160°C for 15 min. Both heating treatments were employed for a hole seed and a ground seed. It was found that both heating treatments influenced the change in the color (values of L*, a*, and b*), and affected the nutritional value as well as the CBD and antioxidant contents. While the roasting of ground seed retains higher nutritional value and antioxidant content compared to others. So, it was concluded that heating treatment has effects on the CBD and nutritional value of hemp seed tea. The results obtained from this study can be used as a suggestion for further development of hemp seed products.

Keywords: hemp seed, heating, cannabidiol (CBD), nutritional value

AG-16-74

Selection of High-Potential Genotypes from Capsicum annuum and C. chinense Based on Nutritional and Flavor Characteristics

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Abstract

The cultivation of the genus *Capsicum* originated in South America approximately 10,000 years ago. In Peru, chili pepper landraces are cultivated across various regions, reflecting the country's rich diversity in *Capsicum* varieties. However, despite this genetic wealth, only a limited number of varieties such as 'paprika' and 'yellow chili', dominate the commercial market. This is a consequence of genetic erosion, which has encouraged farmers to shift toward more lucrative crops, thereby threatening the preservation of plant genetic resources. This study aims to conduct a comprehensive nutritional and pungency characterization of nine Capsicum accessions, including those from *C. annuum* and *C. chinense* from Peru, Myanmar, and Japan, as well as a commercial sample of 'Bhut Jolokia', recognized as the spiciest chili pepper in the world. The assessment focuses on identifying promising accessions for the development of a hybrid F1 population (*C. annuum x C. chinense*). Total capsaicinoid content ranged from 106.83 to 4403.84 mg/100 g dry weight, representing a spectrum from sweet to highly pungent fruits. Significant variation was observed in nutritional components. Carotenoids levels exhibited a positive correlation with vitamin C content, while both characteristics showed a negative correlation with total polyphenols. Genotypes with fruity aromas, low pungency, and high nutritional profiles were identified as promising candidates. These selected accessions are expected to contribute to the production of flavorful *Capsicum* fruits while aiding in the conservation of *Capsicum* biodiversity.

Keywords: vitamin C, polyphenols, carotenoids, pungency, aroma

AG-16-75

Development of a Rice Transplanter-Mounted Map-Based Manual Variable Rate Boom Sprayer

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Abstract

The application of fertilizers and pesticides are crucial to every crop production. One of the precision agriculture techniques aligned to site-specific crop management for efficient use of liquid fertilizer is the variable rate application (VRA) technology. The goal of this technology is to apply farm inputs (ex. fertilizer, seed, pesticides, etc.) at different rates across a field. Currently, there are no existing VRA systems implemented in the Philippines. Existing VRA control systems abroad are expensive and not yet suitable for local use in our existing spraying equipment. This study developed a mechanical rice transplanter-mounted boom sprayer capable of implementing varying application rates of liquid solutions. The system comprised a roller pump, pressure controller, varying sizes of spray nozzles, and a prescription map imported to mobile devices (ex. android tablet) to provide the operator with the level of application rates based on the real-time location of the boom sprayer in the field. Preliminary tests revealed that the discharge rate of spray nozzles can be varied from 27.1 L/hr to 118.6 L/hr by manually controlling the application pressure which can range from 40 to 100 psi. Such results showed that the system can apply the desired application rate across the field on-the-go (real-time) during spraying operations.

Keywords: variable rate technology, boom sprayer, rice transplanter, prescription map, real-time

AG-16-76

Evaluation of Rice Production Changes from 2003 to 2023 in a Village in Khon Kaen, Northeast Thailand: II. Assessment of Present Rice Production Based on UAV and Smartphone Application

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Abstract

The previous study reported rice production has changed in the past 21 years in Don Daeng village in a suburban area of Khon Kaen, Northeast Thailand. This study conducted a field investigation to record the present situation of rice production by utilizing UAV and smartphone applications in 2023. UAV monitoring and field investigation indicated that KDML 105 and RD 6 were still major rice cultivars. However, earlier maturity rice cultivars such as RD 15 and RD 22 were partly introduced for dry season rice cultivation. Vegetable production has been becoming common in some areas. Big shopping centers seemed to be trying to develop new producers. The "Rice-scouter" function of the smartphone application "Hojo" was validated for RD 6 in another study site in Ban Phai district in Khon Kaen. The validation suggested that Rice-scouter can estimate yields with an error of 30% as expected by the developer, although yields are not guaranteed in areas with a lot of weeds or lodging. Field investigation using the Rice-scouter in Don Daeng village showed that rice yields ranged from 1.3 to 5.2 t ha^{-1} with an average of 3.0 t ha^{-1}. The yield level was quite consistent with that conducted in the study area in the 2000s. This study proposes that UAV and smartphone applications are quite useful tools to support field investigation, especially in the present situation where farmers are not often in their fields or villages. Accumulating such digital data is considered important for assessing changes in agriculture.

Keywords: rice yield, rice cultivar, land use, dry season rice, vegetable production

AG-16-77

Evaluation of Rice Production Changes from 2003 to 2023 in a Village in Khon Kaen, Northeast Thailand: I. 21 Years Trend Based on Satellite Data

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Abstract

Don Daeng Village is one of the research targets where investigations recorded agricultural production activities and residence livelihood in Northeast Thailand. The village is located in a representative rural area but has been included in the suburban area of Khon Kaen due to its expansion. In this study, we analyzed satellite data of MODIS to assess rice production change over the past 21 years. The study area was divided into 9 clusters depending on the LAI product of MODIS. These clusters tended to be arranged according to distance from Chi River, reflecting flood is the main variable in rice production. LAI in the clusters located near the river was severely damaged in the flooded years but showed higher than those in other clusters in drought years. These characteristics were previously reported in other studies but quantitatively supported by the satellite data. Since irrigation channels were partly constructed in the area, the peak of LAI in the dry season was observed but not large. Although quantitative analysis of LAI peaks in rainy and dry seasons is required, no obvious changes were observed for 21 years. However, the lives of village residents were affected by socio-economic changes, which also affected rice production: the importance of rice production relatively declined; and contract work with tractors and combines became common. Detailed analysis associated with such socio-economic change is recommended.

Keywords: rice, drought, flood, irrigation, dry season rice, socio-economic change

AG-16-78

Using Soil Amendment in Improving Saline-Affected Soil Characteristics and Rice Yield in The Mekong Delta, Vietnam

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Abstract

The Mekong River Delta (MRD) is located in the south of Vietnam and is one of the most favorable areas for agricultural activities. In recent years, the impact of increased saline water intrusion and freshwater scarcity due to climate change has been evident in the MRD, leading to yield losses in many rice-growing regions. The purpose of this study was to investigate the effectiveness of soil amendment in improving soil characteristics of saline-affected soils and thus, maintaining the sustainability of rice growing systems in the MRD of Vietnam. The long-term field experiments located in the coastal areas were arranged in a completely randomized block consisting of four treatments with four replications: Triple rice crops per year (RRR), double rice crops per year (RR), double rice crops per year applied with compost at a rate of 3 tons ha^{-1} (RR+CP) and double rice crops per year applied with biochar at a rate of 10 tons ha^{-1} (RR+BC). Soil characteristics including bulk density, porosity, electrical conductivity (EC), amount of dissolved and exchangeable Na^+, K^+, Ca^{2+} cations, and soil exchangeable sodium percentage (ESP) were analyzed. At harvests, rice yields and straw biomass yields as well as total uptake of N, P, and K in rice grains were recorded and analyzed. In parallel, a column experiment was established to investigate the effect of soil amendments on enhancing salinity leaching. The results from this study demonstrated that compost and biochar amendments could enhance soil salinity leaching by decreasing soil bulk density and increasing soil porosity in the topsoil layer (at a depth of 0-15 cm). In addition, the application of compost significantly increased exchangeable Ca2+ concentration in soil and the total uptake of N in rice grains. The application of biochar significantly increased exchangeable K^+ concentration in soil and the total uptake of N and K in rice grains. Both amending compost or biochar significantly increased rice yields grown on saline-affected soils.

Keywords: Mekong river delta, rice yield, saline-affected soil, soil amendment, soil characteristics

AG-16-80

Development of No Sugar Added-Osmotic Dehydrated Chinese Bitter Gourd

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Abstract

This research aimed to evaluate the quality of fresh Chinese bitter gourd (*Momordica charantia L.*), study the debittering of fresh Chinese bitter gourd, study the drying process on the quality of no sugar added-osmotic dehydrated Chinese bitter gourd, and evaluate the quality of no sugar added-osmotic dehydrated Chinese bitter gourd. The results showed that the brightness (L*), redness (a*), and yellowness (b*) of Chinese bitter gourd were 36.32 -5.72 and 18.72, respectively. It had a large fruit size of about 4 centimeters in diameter and about 20 centimeters in length. The total phenolic content and antioxidant activity were 44.12 mg/g and 10.94 ug/g, respectively. The effectiveness of blanching the Chinese bitter gourd in a 10% potassium hydroxide solution for 1 minute was good and 26 panelists failed to detect the bitter taste ($p<0.05$). Osmotic dehydration of Chinese bitter gourd over 5 days in a solution of stevioside (0.83%) and erythritol (98.87%) demonstrated suitable conditions. The quality of the osmotic dehydrated Chinese bitter gourd was significantly impacted by the freeze-drying technique ($p<0.05$). The brightness (L*), redness (a*), and yellowness (b*) of osmotic dehydrated Chinese bitter gourd were 55.11 -2.40 and 6.70, respectively. It has a total phenolic content of 38.92 mg/g. It has an antioxidant activity of 3.30 ug/g and a water activity value of 0.69. The sensory scores of appearances, color, aroma, flavor, and overall liking were 8.20, 7.93, 5.33, 6.40, and 7.87, respectively.

Keywords: Chinese bitter gourd, *Momordica Charania L.*, no sugar added-osmotic dehydration, freeze drying, sweetener

AG-16-82

Eco and Bee CPS: Integration of CPS into Traditional Beekeeping

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Abstract

Our innovative beekeeping project, conducted on the rooftop of the Tokyo University of Agriculture extends beyond traditional agriculture. Beekeeping plays a vital role in pollination processes and is now recognized for its efficiency in assessing the diversity of the surrounding environment. Through detailed analysis of pollen and honey DNA, we practiced conventional beekeeping with advanced technology. Using the M5Stack microcomputer, we built a smart beehive, for exploring new dimensions in apiculture. Between March 2023 and September 2024, we undertook a beekeeping project that provided us with valuable insights. During that period, we collected honey and DNA samples, which helped us to analyze the biodiversity of the surrounding environment. During this project, we utilize the M5Stack device, which has ESP32 capabilities, as a crucial tool to achieve our smart beekeeping goals. This device enables us to integrate with environmental sensors and motors seamlessly and gather real-time data. As a result, we will optimize our beekeeping practices. The urban landscape of Setagaya Ward, Tokyo, is often seen as unsuitable for beekeeping, an unexpected abundance of honey was found from March to August, revealing a rich ecosystem through DNA analysis. We verified DNA amplification using PCR techniques, which allowed us to gain knowledge of the vegetation environment. Additionally, we used the M5Stack microprocessor to create a Cyber-Physical System (CPS) prototype with IoT integration that included CO_2, humidity, and temperature sensors. By enabling real-time data and monitoring, we achieved the productivity and health of bee colonies. In evaluating environmental diversity, we explored Honey DNA as a new approach to ecological analysis. Our smart beekeeping prototype leads to sustainable, tech-enhanced apiculture. Developing the prototype to assess effectiveness in optimizing beekeeping and ensuring bee colony health is our future perspective. These initiatives balance technological progress and ecological preservation, promoting harmony between humans and nature.

Keywords: CPS, beekeeping, bio-robotics, environment, agricultural engineering, DNA

AG-16-83

Phosphate Solubilization and Plant Growth-Promoting Properties of Photosynthetic Bacteria from Wetland and Hot Spring Areas

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Abstract

Photosynthetic bacteria, which utilize light energy for nutrient synthesis, play crucial roles in ecosystems through oxygen production and nutrient cycling in soil and water systems. Given their ecological significance and potential agricultural applications, this study aimed to isolate and characterize photosynthetic bacteria with plant growth-promoting properties from diverse environmental sources. Five distinct bacterial isolates were obtained from wetland and hot spring environments in Thailand: Hot spring4 (H4), Maehia1 (M1), Maehia2 (M2), Maehia3 (M3), and Maehia4 (M4). These isolates were evaluated for multiple plant growth-promoting traits, including phosphate solubilization, potassium solubilization, and indole-3-acetic acid (IAA) production. Quantitative analysis revealed varying phosphate solubilization capabilities among isolates (2.17, 3.10, 0.82, 4.03, and 6.48 ppm for H4, M1, M2, M3, and M4, respectively). Among these, isolate M4 demonstrated significantly superior phosphate solubilization efficiency (P = 0.0001), while M3 exhibited the highest IAA production and potassium solubilization capabilities. Further investigation using mustard seeds as a model system showed that isolates M3 and M4 significantly enhanced seed germination rates (97.5% and 98%, respectively) and promoted maximum root elongation (1.74 and 1.53 cm, respectively; P = 0.0001) compared to untreated controls. These comprehensive findings demonstrate the multifaceted plant growth-promoting characteristics of the isolated photosynthetic bacteria. The identified strains show promising potential for development as biofertilizers, offering sustainable alternatives to chemical fertilizers in agricultural applications while promoting environmental sustainability.

Keywords: purple non-sulfur bacteria, Indole-3-acetic acid, potassium solubilization

AG-16-84

Development of a Lidar-Based Crop Growth Evaluation Method

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Abstract

Greenhouse farming is one of the countermeasures for crops affected by recent climate change. In a greenhouse, artificial control of the environment parameters, such as temperature, humidity, and CO_2 concentration, facilitates stable yield and quality, and stabilization of supply is considered important as a means of protecting the food supply. On the other hand, appropriate growth evaluation is necessary for environmental control in the facility. Leaf Area Index (LAI), one of the growth evaluation indices, is used as an indicator of photosynthetic rate. However, conventional LAI measurement is generally based on destructive measurement using the harvesting method, making continuous measurement during the growing period difficult. This research aims to develop a non-destructive LAI evaluation method using LiDAR technology to achieve stable crop production in a greenhouse. In this study, we used an iPhone LiDAR sensor and PIX4D software to model komatsuna (Scientific name) leaves in 3D and derived an equation to estimate leaf area from leaf length and leaf width. The accuracy of the estimation equation was verified through comparison with actual measurements, and by applying a correction factor. The method developed resulted in satisfactory accuracy for the estimation of LAI. This method enables precise environmental control and management within greenhouse facilities based on growth conditions. Additionally, by enabling growth evaluation through measurement, it is expected to facilitate efficient resource management and stable production in conjunction with environmental control systems.

Keywords: LAI, 3D model, LiDAR, Accuracy verification, horticulture

AG-16-85

Environmental and Sociocultural Importance of Spondias Purpurea to Climate Resilient and Sustainable Agroecosystem in San Miguel Batangas Philippines

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Abstract

Spondias purpurea is undervalued for its contribution to agrobiodiversity and livelihood enhancement, hence very little support is given to its production and conservation. The study aims to determine the environmental and socio-cultural importance of *Spondias purpurea* and its implication for the sustainability and climate resilience of the agroecosystem and the farming community. A field assessment was conducted to measure the contribution of Spondias purpurea to agrobiodiversity and carbon storage. Interview with key informants was also conducted to determine the sociocultural value and contribution to livelihood enhancement. The agroecosystem where *Spondias purpurea* was integrated exhibited a relatively high diversity index (2.2), species richness (16) from a total number of 150 tree species, and population size of 9.3. Associated plant and tree species consist of legumes, other fruit trees, and ornamentals. Results also revealed that *Spondias purpurea* alone in mixed cropping can trap 14.92 Mg C up to 32.24 Mg of Carbon. Geo-tagged trees have DBH measurements ranging from 11 cm to 33 cm of varying ages ranging from 7 to over 15 yrs. As a carbon sink, this study revealed that a hectare of *Spondias purpurea* will be able to remove a low of 54.7 Mg CO2 to a high of 118.23 Mg CO2 from the atmosphere. In terms of contribution to agricultural livelihood, a farmer with 48 to 50 trees of *Spondias purpurea*, may earn additional income of up to 500 USD every year, despite the "plant and forget" practice given. Income was even higher years before insect infestation that remains uncontrolled. Integration of underutilized fruit trees like *Spondias purpurea* results in a diverse agroecosystem that promotes ecological stability and improves agricultural productivity benefitting both the environment and the farmers. Continuous neglect of underutilized tree species like *Spondias purpurea* will adversely affect the resilience and sustainability of existing agroecosystems.

Keywords: *Spondias purpurea*, agrobiodiversity, resilient, sustainable, agroecosystem

AG-16-86

Integrated Crop-Livestock Systems as a Development Opportunity for Farmers: Case Study in Region IV-A, Philippines

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Abstract

The integration of livestock, fish and crops has proved to be a sustainable system as it increases diversity and environmental sustainability. This paper aims to document the innovative approaches and key practices of selected farms adopting integrated crop-livestock systems in Region IV-A. Six case study farms were chosen based on the type of crop-livestock system namely, a) livestock and annual cropping systems, and b) livestock and perennial cropping systems. Key informant interviews with the municipal, city agriculture office and DA Regional Field Office IV-A were done. To fully grasp the situation in the ground, FGD was also conducted among farmers' association members. The cases highlighted the optimization of using available resources for improving resource efficiency through various key and innovative practices like crop rotation, vermicomposting, manure composting, organic fertilizer and concoctions production, and value adding of products such as tableya production from cacao. Innovative technology such as greenhouse with automatic mixer, UV light and pH meter was highlighted by a farmer to have higher expected yield. Identified challenges were market stability, labor and manpower, and slow production of using manure compost. The SWOT analysis revealed that integration of crops and livestock expands economic opportunities as it reduces cost of fertilizer inputs. Further, active involvement of farmer members offers wider opportunities for network and information and knowledge exchange and market potentials. Pest and diseases such as ASF, bird flu, and typhoons were identified as threat in their operation. An integrated crop-livestock system can be considered as sustainable and climate-resilient agricultural systems. However, its implementation remains challenging in the farmers' level. Policy support, including accessible price incentives and credit, is necessary to motivate farmers to embrace ICLS practices.

Keywords: integrated crop-livestock systems (ICLS), innovative, approaches, sustainable

AG-16-87

Evaluating the Impact of Biochar Application on Rice Growth in Paddy Soils with Different Soil Properties

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Abstract

Climate change is increasingly damaging rice and other crops, with extreme events like heatwaves, typhoons, and heavy rainfall becoming more frequent and severe. The effects of climate change are expected to increase at an accelerating rate in the future, and there is a need to reduce greenhouse gases, which are the main cause of climate change. Biochar has gained attention in recent years for its role in improving soil health and mitigating greenhouse gas emissions. Few studies have investigated the effects of biochar application on rice paddies compared to field soils, and there is a need for further research. In this study, we investigated the effects of rice husk biochar application on water use efficiency, rice growth, and yield in three different types of soils. A total of 18, 1/2000a sized Wagner pots were used, and three replications were made for each treatment. In biochar treatment, biochar was applied at the rate of 20 t/ha. The results showed that yields tended to be higher in the biochar area in the sandy loam soil, but the difference was not significant. The yield of silty loam soil tended to be lower in the biochar treatment, but again, no significant difference was observed. These results suggest that the effect of biochar application depends on soil characteristics and that there is a difference in the effect on yield between sandy loam and silty loam soils. Future research is needed to determine the optimal conditions for biochar application according to soil characteristics and the long-term effects of biochar application.

Keywords: rice husk biochar, rice paddy, grain yields

AG-16-88

A Convolutional Neural Network Model for Precision Agriculture: Custom Dataset-Based Classification for Soybean-Weed Detection

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Abstract

This study introduces a Convolutional Neural Network (CNN)-based classification model designed to detect the CL-Soy1 soybean variety and common weeds for precision agriculture, utilizing a custom dataset captured with a low-cost camera. In soybean crops, traditional weeding methods, particularly herbicide application, can be harmful to the environment, lead to herbicide resistance, and damage non-target plants, including the soybean itself. This presents a need for more sustainable and targeted weed management solutions. The model aims to automate weed detection and soybean variety classification, optimizing agricultural practices by reducing herbicide use and minimizing crop damage. The model achieved an accuracy of 88.65% when trained, validated, and tested on a set of 1,392 images taken from an uncontrolled environment using a low-cost camera, effectively identifying between soybean and weed images. The performance of the model is assessed using key metrics, including precision, recall, and F1-score. The precision of 88.54% indicates a low rate of misclassification, while the recall of 88.65% reflects strong detection capabilities, proving that the majority of images are correctly identified. The F1-score of 0.88 demonstrates a well-balanced performance, ensuring reliability in detecting both true positives and minimizing false positives. Furthermore, the mean average precision (mAP) of 79.12% suggests the model is effective at ranking predictions across different classes, though further fine-tuning could improve precision at various thresholds. While the results are promising, further improvements are needed to refine the model's overall precision and strength. Future work will focus on enhancing the model's performance by adjusting parameters, exploring different architectures, and expanding the dataset. Lastly, this model will be integrated into a weeding machine, providing a sustainable solution for weed control that minimizes herbicide use and improves crop yield, contributing to more efficient and environmentally friendly farming practices.

Keywords: precision agriculture, machine learning, weed management, neural networks

AG-16-89

Optimizing Rice Production: A Study on the Effectiveness of System of Rice Intensification

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Abstract

This study aimed to assess the agronomic and economic benefits of the System of Rice Intensification (SRI) compared to conventional irrigated rice cultivation. Three popular inbred rice varieties (NSIC-Rc 216, NSIC-Rc 222, and NSIC-Rc 358) were evaluated under both methods during the wet season of 2023 in Barangay Cabano, San Lorenzo, Guimaras. A split-plot design was employed, with the crop establishment method (SRI vs. conventional) as the main plot factor and rice variety as the subplot factor. Results revealed that the SRI method significantly enhanced plant growth parameters and yield components, irrespective of the rice variety. Notably, SRI achieved comparable tiller numbers to the conventional method while using fewer seedlings per hill. Gross yield increased to 20% under SRI, accompanied by reduced chemical fertilizer and agrochemical inputs. Among the varieties, NSIC-Rc 222 demonstrated superior performance in both methods, yielding the highest output and economic returns per hectare under the SRI system. The findings of this study emphasize the potential of SRI as a sustainable and economically viable alternative to conventional rice cultivation, offering significant benefits for small-scale farmers. Future research should explore the long-term impacts of SRI on soil health, biodiversity, and climate resilience.

Keywords: organic agriculture, system of rice intensification, sustainable agriculture, rice yield, inbred rice varieties

AG-16-90

Effect of Different Soil Management Practices on the Growth, Yield of rice and Soil Properties in The Mekong Delta of Vietnam

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Abstract

The Mekong Delta in Vietnam, producing around 17 million tons of rice annually, accounts for 52% of national rice production with yields of 4.3 tons per hectare. However, climate change has intensified drought and seawater intrusion, which causes soil salinity, impacting plant growth and soil health, and hindering agriculture. This research aims to evaluate the effect of different soil management practices on growth, yield of rice, and soil properties in the salt effected area of the Vietnamese Mekong Delta. A field experiment in Tran De district, Soc Trang province Vietnam was conducted in a completely randomized block design with five treatments and three replicates for each treatment. The treatments used biochar, organic fertilizer, and the NPIKSi bacterial product, and these treatments applied 50% of the recommended NPK formula. Through two experimental crops, agronomic parameters and rice yield results showed no statistically significant differences among treatments. The soil nutrient results indicated that using the NPIKSi microbial product, organic fertilizer, and biochar increased available P, exchangeable K, available S, and soluble Zn in the soil. Additionally, these treatments also helped increase the number of bacteria, including phosphorus-, potassium-, and silicon-solubilizing bacteria in the soil. Moreover, there was a significant increase in the levels of total K in stems and leaves, as well as P and K in rice grains. These results demonstrate the efficacy of some biological soil amendment methods in improving rice growth, yield, and soil health and specifically reduced chemical fertilizers by 50% under current conditions of climate change and salinity.

Keywords: biochar, climate change, microbial product, organic fertilizers, salt-tolerant bacterial consortia, soil salinity

AG-16-91

Efficacy of Finished Organic Fertilizer from Biowaste Sources on the Growth, Yield of Lettuce (*Lactuca sativa*), and Soil Properties Under Field Conditions

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Abstract

This study aimed to evaluate the effectiveness of a microbial product containing six strains of lactic acid bacteria in decomposing organic vegetables and fruit wastes to produce microbial organic fertilizer. Additionally, the study also evaluates the impact of the finished organic fertilizer on lettuce growth, yield, and soil properties under field conditions. The experiment evaluating the decomposition of organic waste was conducted using microbial product, which had a density of 10^6 CFU/g of lactic acid bacteria. The field experiment was in a completely randomized block design with five treatments and four replications. The results showed that the addition of acid lactic bacteria fastened the composting process, meaning reducing the decomposition by 2.4 times as compared to the control treatment without bacterial inoculation. In the field, the treatment with 50% NPK+10 tons/ha of organic fertilizer increased lettuce yield by 18% as compared to the control treatment fertilized with 100% NPK, while also reducing nitrate content in the stems by 80%. Furthermore, applying 10 tons/ha of organic fertilizer improved soil pH, bacterial numbers, and beneficial bacteria in the soil. Based on these findings, it is recommended to reduce chemical fertilizer use by 50% and apply 10 tons/ha of PHC organic fertilizer (made from vegetables and cow manure) once at the first crop for three consecutive lettuce crops. This approach minimizes chemical fertilizer use while promoting safe vegetable production, environmentally friendly cultivation, and sustainable agriculture.

Keywords: lactic acid bacteria, lettuce, microbial product, plant growth, organic fertilizers, organic wastes

AG-16-92

Application of Plant Growth-Promoting Bacteria in the Management of Fungal Diseases and Activity of Enzymes Related to Resistance Stimulation in Cucumber

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Abstract

Anthracnose caused by the fungus *Colletotrichum lagenarium* steadily affected the yielding and qualitative cucumber. Chemical management of pests was generally used in agricultural cultivation, whereas the dangers of uncontrolled chemical methods had many serious risks such as environmental pollution, soil degradation, and biodiversity. Plant growth-promoting bacteria can protect plants against harmful fungi by competition for environmental survival and nutrients, siderophore-mediated. Furthermore, the mechanism of disease resistance stimulation also helps plants increase many enzymes to transmit signals for reactions against pathogens. This research illustrates the detailed results of the disease-reducing influences, peroxidase (POX), and polyphenol oxidase (PPO) activities related to the mechanism of disease resistance stimulation by two strains of bacteria mixture. The experiment under pattern net house used seed treatment with Bacillus VL4.6 and Bacillus CL8, which were investigated in volume proportions: 1:0, 1:1, 1:2, 2:1, and 0:1 respectively, with only microbial density of 10 8 cells/mL per ratio, and the percentage result of the infected leaf area was recorded every 24 hours for seven days after inoculation with Colletotrichum lagenarium. In terms of disease reduction results, the figures of proportion bacteria 1:1 were the most effective in disease reduction with the percentage of diseased leaf area approximately 7.5% (bacteria-with inoculation), closely followed by the figures positive control with 6.8% ($CaCl_2$ -with inoculation) seven days after inoculation. In contrast, a negative control was observed at 30.7% (water-with inoculation) seven days after inoculation. Regarding the enzyme activities result, it gave information about the peroxidase (POX) and polyphenol oxidase (PPO) extracted from leaf tissue, which were significantly increased by those Bacillus mixtures in the treatment of disease strain. The results demonstrate that the Bacillus VL4.6 and Bacillus CL8 mixture at a proportion 1:1 was the highest treatment for disease reduction. In that way, plant growth-promoting bacteria contributes to inhibiting pathogen attacks, activating functional genes that produce enzymes, and activating signal transduction pathways.

Keywords: Anthracnose, *Bacillus, Colletotrichum lagenarium*, resistance, peroxidase, polyphenol oxidase

AG-16-99

Profitability and Economic Viability of Upscaled Mussel Hatchery Operations

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Abstract

Mussels are bivalve species with established ecological and economic importance. They are known to provide essential supporting services like nutrient recycling and storage, structural habitat, substrate, and food web modification, and use as environmental monitors; regulating services such as water purification (biofiltration); and provisioning and cultural services including use as a food source, as tools and jewelry, and for spiritual enhancement. Mussel hatcheries are crucial in ensuring a stable supply of mussel seed, supporting the growing global demand, and contributing to sustainable aquaculture practices. This study attempts to evaluate the profitability and economic viability of the upscaled mussel hatchery in Miagao, Iloilo, Philippines. Primary and secondary data were used in the study to analyze profitability and financial viability. Six business revenue models were considered in the study: invest in housing and produce 1-mm spats, invest in housing and produce 1-cm spats, invest in housing and grow 1mm-spats until 1-cm, no investment on housing-produce until 1-mm, no investment on housing- produce until 1cm, and finally, no housing—produce 1cm-spats from the until 1mm. The indicators used include total revenues, net profit, gross profit margin, net profit margin, return on investment, net present value, internal rate of return, breakeven volume and price, and payback period. Results showed that the upgraded mussel hatchery will require an initial investment of approximately PhP 3 million pesos. In addition, the most profitable business model involves producing mussel spats up to 1 cm. Both results are consistent with or without investment in housing. Investment in mussel hatchery is capital intensive. In the short run, existing/unused hatcheries owned by SUCs and government institutions can be rehabilitated. Meanwhile, to increase profitability, existing R&D can be extended to improve survival rates, particularly at the pediveliger to early spats and 1-mm- to 1-cm stages.

Keywords: mussel hatchery, economic viability, profitability analysis, upscaling, sustainable aquaculture

AG-16-102

Evaluating the Agronomic Performance of Pechay (*Brassica rapa subsp. chinensis*) in Biodegradable Pots Made from Agricultural Waste

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Abstract

This study investigated the potential of biodegradable pots made from agricultural waste materials (coco coir and bamboo leaves) to enhance pechay (*Brassica rapa subsp. chinensis*) cultivation. The experiment compared the growth and yield performance of pechay plants grown in various bio-pot substrate combinations to conventional plastic pots. Key parameters such as plant height, leaf number, leaf size, and overall yield were assessed. Results indicated that bio-pots, particularly those with a 75:25 ratio of bamboo leaves to coco coir, demonstrated comparable performance to conventional plastic pots. This finding highlights the feasibility of using biodegradable pot technology as a sustainable alternative to plastic, reducing environmental impact and promoting resource efficiency. Further research is recommended to optimize bio-pot formulations, evaluate their long-term effects on soil health and plant productivity, and explore their applicability to other vegetable crops. By adopting such eco-friendly practices, we can contribute to a more sustainable and resilient agricultural system.

Keywords: sustainable agriculture, biodegradable pots, coco coir, bamboo leaves, urban agriculture

AG-16-105

Social Networks at Work: The Mango Contractors of Pangasinan, Philippines

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Abstract

Social dynamics play a crucial role in information transfer within the agribusiness sector, particularly since it is highly community-based and traditional. In the mango contracting industry, the transfer of market information is a critical process that needs further examination to identify areas for improvement. This study aims to explore the social interactions among mango contractors, focusing on how these interactions influence information flow. A semi-structured survey was conducted from August to October 2022, involving 100 mango contractors. The study employed K-means cluster analysis using R to categorize the contractors, helping to identify patterns in their communication behaviors. Additionally, Social Network Analysis (SNA) was used to assess the interactions within and between contractor groups, as well as to determine the central figures in each cluster based on their relationships. The research also showed a visual representation of these contractors` social networks to identify key actors in communication within each cluster. Network density was calculated to measure the proportion of connected participants by dividing the number of ties between participants by the total number of possible ties. This analysis also highlighted differences in social dynamics within and across the different contractor clusters. The results indicate that “Backward Integrators”, “Forward Integrators”, and “Employees” consistently rely on community-based sources of market information. However, Backward Integrators tend to use a more diversified set of information sources compared to Forward Integrators and Employees. This may be due to their higher educational levels, which likely make them more proactive in seeking information from a variety of channels. In contrast, the Employee group relies more on relational ties within their immediate networks for market information.

Keywords: social networks, mango contractors, information transfer

AG-16-106

Multi-Attribute Evaluation of Modified Chrysanthemum Genotypes: Nutritional, Biological, and Consumer Preferences

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Abstract

Currently, with the growing interest in and emphasis on a healthy lifestyle, the acceptance of edible flowers has increased significantly. Edible flowers serve various purposes, including as decorative elements in food, therapeutic agents, and nutrient-rich food sources. Chrysanthemum, one of the top ten cut flowers globally, is valued not only for its ornamental qualities but also for its medicinal and culinary applications. This study evaluated 20 modified chrysanthemum genotypes at the Mahallat Research Institute to identify the best-performing genotypes. The research, conducted from November 2022 to October 2023, comprised two phases: experimental and survey based. Data were collected on the nutritional value, biological properties, antioxidant capacity, and consumer preferences of the 20 genotypes. Using the multi-attribute decision-making (MADM) method, weights were assigned to these four indicators via the CRITIC method. The genotypes were then ranked using three MADM techniques: TOPSIS, ARAS, and WASPAS. The rankings derived from these methods were combined and analyzed using the average rank method. In the experimental phase, Code 110 emerged as the top genotype for nutritional and biological values, while Code 751 exhibited the highest antioxidant capacity. During the survey phase, factors such as flower appearance, usage, consumer preferences, and the importance of a healthy lifestyle influenced the evaluation. Codes 674, 562, and 354 received the highest scores for consumer preference. By integrating the findings of the four indicators through the MADM method, Codes 110 and 603 were ranked first and second, respectively, while Codes 684, 138, and 801 received the lowest ranks. Furthermore, the combined results of the experimental and survey phases highlighted chrysanthemum as a suitable and valuable food source, widely appreciated by consumers for its diverse and appealing characteristics.

Keywords: multi-attribute decision-making, Chrysanthemum, TOPSIS, ARAS, and WASPAS

EM-16-01

Global Analysis of Urban PM2.5 Levels and their Correlation with Aerosol Optical Depth Across 73 Major Cities

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Abstract

Air pollution remains a significant environmental health risk, impacting 99% of the global population. This study examines the global urban footprint of fine particulate matter (PM2.5) using data from 76 AirNow monitoring stations worldwide, collected between January 2019 and March 2024. The analysis also explores the relationship between PM2.5 concentrations and satellite-derived Aerosol Optical Depth (AOD). Notably, all 76 stations consistently exceeded the World Health Organization's (WHO) annual average air quality guideline of 5 μg/m³, and 29 stations surpassed the WHO's interim target 1 of 35 μg/m³. A global map of mean PM2.5 concentrations highlighted South Asia as a significant hotspot with persistently high levels. When disaggregated by World Bank income groups, the data revealed income-based disparities, with lower-middle-income countries showing a median PM2.5 concentration of 42.09 μg/m³ compared to 22.48 μg/m³ in upper-middle-income countries. Correlations between PM2.5 levels and AOD, derived from AirNow and MODIS data, varied significantly across stations, with correlation coefficients (R) ranging from -0.60 to 0.79. A case study in Vientiane, Laos, demonstrated that GEMS satellite data, due to its intra-day acquisition capability, provided more frequent observations than MODIS. The GEMS AOD-PM2.5 data pairs exhibited a clear diurnal pattern, with stronger correlations during mid-morning hours (09:00–11:00 a.m. local time). Overall, the study underscores the effectiveness of integrating AirNow surface monitoring with satellite data for comprehensive global air quality assessment.

Keywords: AOD, air pollution, sensors, AirNow

EM-16-06

Managing Rural Extreme Rainfall and Flood Disasters from the Perspective of Social Resilience: A Case Study of Rural Hebei in 2023

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Abstract

From the end of July to the beginning of August 2023, extreme rainfall occurred in Beijing, Tianjin, Hebei, and other places, and flood disasters occurred in many rural areas of Hebei, causing severe casualties and economic losses. It is necessary to analyze and study the flood disasters in rural Hebei in 2023 from the perspective of social resilience. This study takes the flood disasters in rural Hebei in 2023 as the research object, adopts case study methods and secondary data, and analyzes the advantages and disadvantages of disaster response in Hebei in 2023 from the perspective of social resilience. Based on the social resilience theory and the existing social resilience framework, this study analyzes the performance of social resilience in rural flood disasters from four perspectives: social capital, social culture, social mechanism, and social equity. The study believes that social capital played a vital role in the disaster response and recovery stages of the rural flood disaster in Hebei in 2023, and social equity policies also maintained the smooth operation of society during the disaster. At the same time, the study also proposed that rural areas need to improve their social capacity to resist floods, including low social and cultural attention to disasters, imperfect disaster response mechanisms and disaster information dissemination mechanisms, and limited rural infrastructure and resources in Hebei. The study believes that exploring flood resilience from the perspective of social resilience and making the most of social support networks and social and cultural resources are crucial for rural areas to cope with future disasters.

Keywords: disaster risk reduction, Environmental management, Hebei floods in 2023, rural floods, social resilience

EM-16-07

Impact of Bagacay Mines on Heavy Metals Accumulation and Associated Health Risk of Fishes from Taft River, Philippines

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Abstract

Taft River basin has received the transported sediments and drainage water from the Bagacay Mines in Hinabangan, Samar, Philippines for the last several decades. The impact of this deposition on the fish of the river and its consequences to human health was assessed though quantification of heavy metal contents in the flesh of the fish and the estimated daily intake (EDI) and target hazard quotient (THQ) of its consumption. Exhaustive sampling collected nine fish species namely: Planiliza macrolepis, Siganus vermiculatus, Lutjanus fulviflamma, Megalops cyprinoides, Clarias batrachus, Channa striata, Anguilla japonica, Giuris margaritacea, Scatophagus argus along the three (3) sections of the river. The concentration of As, Cu, Ni, Cr, Pb, and Mn in the flesh varied between different fish species and sampling sites with concentration range of 0 - 29.33 mg kg -1 for As, 5.9 -33.51 mg kg -1 for Ni, 19.67-385.33 mg kg -1 for Cu, 325.00 - 557.67 mg kg -1 for Cr, 0.12 - 2.31 mg kg -1 for Pb, and 492.00 -734.67 mg kg -1 for Mn. The heavy metal concentration are above the critical acceptable limits for seafood products and the estimated daily intakes of As (2.14 µg kg -1 bw day -1), Cr (300 µg kg -1 bw day -1), Ni (12 µg kg -1 bw day -1), exceeded the tolerable daily intake (TDI) but not for Copper (500 µg kg -1 bw day -1), Pb (1.50 µg kg -1 bw day -1), and Mn (300 µg kg -1 bw day -1). Consequently, the estimated THQ non-carcinogenic of As, Cu, and Mn calculated for adults consuming the fish at 2-times a week showed values above the threshold level of 1 while the THQ non-carcinogenic values for Ni, Cr, and Pb were below the threshold level. Overall, the results have shown the level of heavy metal accumulation on different fish species and the associated risk from the consumption of these harvests from the Taft River.

Keywords: heavy metal, health risk, accumulation, Taft River

EM-16-16

Development of erosion risk zones in the Skopje region, Republic of North Macedonia

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Abstract

The project "Erosion Study and Action Plan for the city of Skopje", was initiated by the administration and expert community after a catastrophic disaster that occurred in August 2016 in the Skopje region, when 22 persons died and the total amount of losses and damages was huge. According to the Law on Water article 135: "Based on technical documentation, the state administrative body competent for the environment, the council of the municipalities, of the City of Skopje and the water management enterprises for their respective area shall determine the boundaries of both the erosive area and the area endangered from erosion, and specify the measures and the activities pertaining to the protection of land from erosion and regulation of torrents". Given this legal basis, a methodology was developed for defining actual and potential erosive areas. The starting point was the creation of an erosion map using the Erosion potential method where all of the erosive areas were taken into account. In order to define the erosion risk, the erosion map was overlayed with the critical infrastructure, inhabited areas, and main transport infrastructure. In the Skopje region, there are 5,874 ha of actual erosion risk areas and 36,332 ha of potential erosion risk areas. Within the Action Plan, there are proposed administrative measures and technical works: forbidden activities and obligatory activities separately for the actual and potential erosive areas.

Keywords: soil erosion, erosion risk, erosive area, areas affected by erosion

EM-16-17

(*Un*)Making of Greenbelt Zone as Climate Icon in an Urban Expanse: A Cross-sectional Study

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Abstract

This paper problematizes proposed legislation in Manila to protect remaining coastal greenbelt zones in danger from reclamation projects. It aims to explore the level of awareness, understanding, and interpretation of urban folks on the value of mangrove forests and wetlands as models for climate change mitigation. Las Pinas-Paranaque Wetland Park (LPPWP) and Brgy. 649 (BASECO Compound) in Manila are used as milieus and context in conceptualizing a climate icon. The study employed Pierce's (1903) basic claim on icons and Rawl's (1971) Theory of Social Justice in its distributive concept toward the environment and human-communities. Using purposive sampling, a one-shot survey was administered to guests visiting LPPW Park and to the residents of BASECO, strengthening the regression analysis. Findings revealed consistently, respondents' high level of awareness and understanding of the adaptive capacity against climate change of coastal communities in cities. While the majority of the respondents highly agree that the protection of LPPWP and BASECO as a climate icon promotes social environmental justice in Metro Manila and must be an essential priority program of the government, data on the significance of economic impact and eco-cultural practice in the conservation of mangroves and mudflats showed urgent demand for environmental education among urban folks. Hence, there is a pressing need to broaden advocacy programs in urban communities with the support of the media, and national and local government to legislate, communicate, and socially mobilize the conservation of coastal greenbelt zones.

Keywords: resilience, policy, communities, disaster, environment

EM-16-18

Climate Risks Analysis for Enhancing Climate Resilient Agriculture in Caraga Region, Philippines

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Abstract

Assessment of climate risks, and documenting and analyzing climate-resilient agricultural practices and initiatives are essential inputs in developing strategies for climate change adaptation or mitigation. A climate risk and vulnerability analysis (CRVA) were conducted in the Province of Agusan del Norte in Caraga Region. The information from the climate risk analysis is used for developing coping mechanisms for adaptation to climate change. The findings reveal that flooding is the most significant hazard to agriculture in the Province of Agusan del Norte. The overall exposure shows a higher incidence of flood hazards in the municipalities of Jabonga and Santiago. Jabonga is among the less adaptive municipalities within the province concerning economic, natural, social, human, physical, and institutional aspects, indicating low coping mechanisms of the local government to respond to climate-related hazards. Nonetheless, the survey revealed that farmers have local adaptation practices to climate change, which include crop rotation and adjusting the cropping calendar to evade the adverse impacts of flooding. The adoption level of these adaptation practices is still low. The local government units (LGUs) need to focus more on improving their coping mechanisms by improving their agricultural services and interventions in the villages affected by climate-related pressures. More intensive training and other capability-building activities related to climate change adaptation need to be conducted to educate the farmers and the local agricultural technicians.

Keywords: climate change, climate-resilient agriculture, adaptation practices, flood hazard, adaptive capacity

EM-16-19

Contribution of Local Protected Areas to the Protection of Natural Resources and Livelihood of Community Members in Northern Part of Cambodia

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Abstract

This study explores the economic benefits of locally managed protected areas (LPA), the role of natural resources in local livelihoods, and the future of natural resources existence linked to community-based natural resources management. The study selected 8 Local Protected Areas (LPAs); 3 Community Forestry (CF) and 5 Community Protected Areas (CPA) in Kampong Thom and Siem Reap provinces, Cambodia. There was a total of 17 key informants: 3 Non-Governmental Organizations (NGOs), 2 officials from the Provincial Department of Environment (PDoE), 4 commune leaders, and 8 village leaders. Additionally, 8 group interviews were conducted with the 8 LPA committee members. The quantitative samples include 320 households who are members of the 8 LPAs. The study reveals that agriculture, forest-related activities, and labor are major sources of income, with forest-related income contributing an average of 23%. Multiple regression analyses show that livelihood changes are linked to income sources, perceived importance of LPAs, and participation in natural resources (NR) protection. Despite conservation efforts, challenges like deforestation and limited financial support persist. Women significantly contribute to livelihood activities but are less involved in NR management. A perception gap exists between the poor and non-poor regarding NR benefits. Logistic regression predicts a 96% likelihood of NR persistence, influenced by the benefits derived and protection activities. The study concludes that enhancing community awareness, especially among the poor, along with financial and technical support, is crucial for sustainable NR management, recommending targeted awareness programs, government financial support for LPAs, and external assistance to address challenges and seize opportunities.

Keywords: community-based natural resources management, natural resources conservation and livelihood

EM-16-21

Water Quality Assessment and Evaluation of Human Health Risk in Tributary Rivers of Lanao Del Sur, Philippines

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Abstract

Lake Lanao one of the ancient lakes in the world, is noted as pre-historic and sociocultural significant. The degradation of the lake is very visible now with the decimation of its water quality. Hence, the present study evaluated the current water quality of the major river tributaries of Lake Lanao in Lanao del Sur Philippines, particularly along the Ramain, Taraka, Gata, and Masiu rivers. Water quality assessment involves bacteriological, physical, and chemical attributes. Multiple Tube Fermentation Test was used to quantitate coliform density which was estimated via a most probable number table. Physicochemical parameters measured were electrical conductivity (EC), total dissolved solids (TDS), total organic carbon, chemical oxygen demand (COD), pH, temperature, and turbidity. Biological oxygen demand (BOD), nitrates, and phosphates together with the four trace metals such as: Iron (Fe), Manganese (Mn), Cadmium (Cd), and Lead (Pb) were analyzed. Microbiological analysis revealed that all four river tributaries were severely contaminated with fecal coliform with an MPN of ≥ 1600 cells per 100 ml of water sample. The fecal coliform, Escherichia coli density is highest in Taraka River (mean= 10.11/100 ml of water sample) while the lowest mean (8.11/100 ml of water sample) was recorded in Ramain River. Physicochemical parameters were within the national standard of WHO, DENR, and PNSD-DOH, except for turbidity which was 3x higher in the river water of Taraka, Gata, and Masiu. pH level was also high in the four rivers with values ranging from 9.5-11.45 against the standard range of 6.5-8.5. The computed water quality index (WQI) is 23.66 for the Remain River, 28.10 for the Taraka River, 35.74 for the Gata River, and 35.37 for the Masiu River. The water quality status of Taraka, Gata, and Masiu was translated as “good” while Ramain was “excellent”. Levels of Exping and Expderm from four rivers of Lanao del Sur were observed in the order: Fe>Pb>Mn>Cd respectively. The Hazard Quotient (HQ) through ingestion for children in all four rivers were less than 1 but the Hazard Index (HI) exceeds 1, hence providing evidence for non-carcinogenic risk. The Hazard Index for dermal exposure in both children and adults did not exceed 1, hence, there was no evidence of non-carcinogenic risk. Carcinogenic risk (CR) assessment showed equal CR through ingestion in all four rivers, with cadmium (Cd) having the highest contribution in the CR of a child (1.2×10^{-4}). Further, the CR via the dermal route also showed similar results. However, the child’s CR for Fe (2.58×10^{-2} - 3.33×10^{-2})) and Pb (1.35×10^{-3}) were all very high while the adult’s CR for Fe (1.07×10^{-5} - 1.38×10^{-5}) and Pb (2.23×10^{-6}) are low. Therefore, the children are at high cancer risk with Cd and very high cancer risk with Fe and Pb. Henceforth, water from the four rivers must not be used for drinking and caution should be taken for children's dermal exposure to the water for possible carcinogenic risks.

Keywords: water quality, coliforms, non-carcinogenic, hazard quotient, hazard index

EM-16-22

Tourist Perception and Willingness to Pay for Biodiversity Conservation at Nam Nao National Park, Thailand, as the ASEAN Heritage Park

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Abstract

To achieve sustainable development goals, several schemes have been implemented, including ecotourism and the ASEAN Heritage Park (AHP) program initiated in 1978 to promote biodiversity conservation in Southeast Asian countries. Yet, public participation is a big challenge for effective management. This study examined tourist perceptions toward the AHP status of Nam Nao National Park (NNNP) in northern Thailand. It also estimated tourist willingness to pay (WTP) for biodiversity conservation at NNNP and identified factors influencing their decisions. Data were collected from September to October 2024 using a questionnaire survey, interviews with park officers, and onsite observation. A total of 209 visitors participated in the study of which 5% came from overseas. Moreover, 45% identified themselves as an ecotourist but lacked an understanding of supporting local community livelihoods. Most respondents came to NNNP for the first time, basically for nature-based recreation. They had never heard of the AHP status before visiting the park. However, the respondents expressed positive perspectives toward its status, especially on building conservation awareness, encouraging their participation, and supporting effective management of the park. Regarding the WTP for biodiversity conservation at NNNP, 80% of the respondents said yes with nearly 90% confidence in paying. An average amount of WTP is 40 Baht per year (~US$1.25), which is equivalent to a park entrance fee (for Thai visitors). This finding suggests that visitors are willing to pay double the current entrance fee for biodiversity conservation. The two main activities that they wanted their money to be spent on are fire-break construction and forest restoration. Lastly, generalized linear models identified the type of tourists (i.e., ecotourists), travel frequency (i.e., first-time and frequent visitors), age, and positive perception as key factors influencing amounts of WTP for biodiversity conservation (p-value < 0.05).

Keywords: ecotourism, biodiversity conservation, ASEAN heritage park, tourist perception, willingness to pay

EM-16-23

Electricity Generation and Nutrient Recovery from Food Waste Using a Two-Chamber Microbial Fuel Cell without a Proton-Exchange Membrane

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Abstract

We developed a two-chamber microbial fuel cell (MFC) system without a proton-exchange membrane (PEM) for generating electricity from food waste. However, substrate diffusion from the anode to the cathode chamber was found to deteriorate MFC performance. In this study, we aimed to evaluate the potential of calcium silicate hydrate (CSH) for mitigating this performance deterioration and recovering nutrients from the cathode chamber. Furthermore, we assessed the potential of using CSH as a fertilizer. In laboratory experiments, we placed CSH in the cathode chamber and measured nutrient concentrations, electric current, and oxidation–reduction potential (ORP) of cathode water. Furthermore, CSH was utilized for growing Japanese spinach to assess its effectiveness as a fertilizer. Utilizing CSH increased the current density by 3.2 times and increased the ORP of the cathode water. These observations indicate that CSH efficiently absorbs diffused substrates, mitigating the deterioration in MFC performance. Adding the used CSH to soil increased the nutrient content, wet weight, and projected area of spinach by 2.4, 1.75, and 1.46 times, respectively. These findings indicate the promising potential of CSH as a new fertilizer. Neural network prediction indicated a maximum NH_4^+ adsorption of ~7.5 mg-NH_4^+/kg-CSH. We recommend using CSH in the cathode chamber and replacing it monthly to sustain MFC performance.

Keywords: food waste, electricity, fertilizer, cathode water, CSH, plant growth

EM-16-24

Food Waste Disposal Using a Two-Chamber Microbial Fuel Cell Without Proton Exchange Membrane

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Abstract

Achieving a carbon-neutral society necessitates increased utilization of biomass for energy production. In response, we developed a two-chamber microbial fuel cell (MFC) system that operates without a proton exchange membrane, utilizing food waste as a fuel source. This study evaluated the long-term effectiveness of the established MFC in generating electricity and decomposing food waste over eight months. We also aimed to predict power generation characteristics using a neural network. Laboratory experiments were conducted to investigate electricity generation, with continuous measurement of electric current. System performance, including current, voltage, and power relationships, was measured monthly to assess changes in electricity generation over time. Additionally, a neural network was employed to estimate variations in power density. Experimental results showed that the current density stabilized at an average of 91 mA/m 2, although cathode water replacement was required every 4 days until Day 60 to prevent a decline in current density. Over 220 days of operation, the system achieved a 25% reduction in carbon content and a 32% reduction in loss on ignition at 600°C, demonstrating effective organic matter disposal. Power density predictions indicated that only 25% of organic carbon could be disposed of by the system, and food waste replacement was necessary after 60 days of electricity generation.

Keywords: electricity, food waste, carbon content, loss on ignition, neural network

EM-16-25

Steelmaking Slag Advantages in Methane Fermentation

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Abstract

The use of biomass is highly anticipated as key to achieving a decarbonized society, with methane fermentation playing a major role in this process. However, methane fermentation encounters several challenges such as long hydraulic retention times and digestate management. According to existing literature, steelmaking slag (SS) may be useful for enhancing methane fermentation. This study aims to investigate the effects of SS on methane fermentation, focusing specifically on its influence on fermentation efficiency and digestate quality, using food waste (FW) as the substrate. For experimentation, FW was placed in a cylindrical bottle filled with 1 L of tap water and covered with an SS layer. The bottles were incubated at 35°C, leading to a gas production of 3 L in 15 d with SS and 24 d without SS. By Day 10, the methane concentration in the gas was approximately 22% without SS, whereas it reached 50% with SS. These results indicate that SS effectively reduces the fermentation period and improves methane production efficiency during anaerobic digestion. In the digestate, the phosphate concentration decreased from 43 mg/L without SS to <0.03 mg/L with SS. Chemical oxygen demand also decreased from 360 to 70 mg/L, thereby suggesting that SS addition could help lower digestate disposal costs. Furthermore, SS continued to provide benefits with increasing FW thickness, demonstrating its sustained effectiveness. Therefore, SS addition is recommended to enhance methane fermentation.

Keywords: food waste, methane, steelmaking slag, phosphate removal, ferric ion

EM-16-26

Revitalizing Soils Through Carbon Restoration: Impact of Organic Amendments to Enhance Soil Productivity and Water Retention

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Abstract

Soil is a living miracle natural resource. Just a handful of soil contains more organisms than there are people on the planet. We rely on healthy soil for 95% of what we eat. However, centuries of plowing, deforestation, and erosion have severely degraded our soils, and this loss is accelerating. When soil is damaged, it releases carbon dioxide (CO_2) into the atmosphere, which has worsened climate change. High atmospheric CO_2 levels are causing global temperatures to rise and also acidifying our oceans, posing risks to marine ecosystems. Simultaneously, the soil itself is losing carbon, many agricultural soils have lost over half of their original carbon content. Fortunately, there is hope, that we have effective methods to restore soil carbon. Plants absorb CO_2 through their leaves and transfer carbon down to their roots, nourishing soil microbes. Practices such as maintaining plant cover, increasing crop diversity, and composting can effectively restore soil carbon. Carbon-rich soils have improved water absorption during floods and can supply water to plants in dry periods, adding carbon to soil makes the land much more productive. This research evaluates the impact of organic amendments on restoring soil carbon, productivity, and water retention by applying five treatments with three replications (T0: control, T1: sawdust, T2: compost, T3: chicken manure, and T4: mixed) at application rates of 2.5%, 5%, and 7.5%. The goal is to restore soil carbon and enhance productivity, which are essential for sustainable farming in water-limited regions like Afghanistan.

Keywords: soil carbon restoration, organic amendments, water retention, climate change mitigation

EM-16-28

Valuing the Role of Trees in Reducing Stormwater Runoff to Promote Urban Greening Towards a Sustainable City

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Abstract

Urban trees are increasingly recognized as an integral component of a suite of green infrastructure systems due to their hydrologic functions in stormwater management and the array of ecosystem services they provide. Tree canopies provide an important pathway for stormwater management by routing the rainfall into various components of the hydrologic cycle. This study modeled and evaluated the stormwater runoff reduction potential of birch (Betula pendula) and pine (Pinus nigra) trees in three scenarios (i.e., birch, pine, mixed-species planting) on a storm event basis using the updated SWMM tree canopy module. The interception routine implemented in the updated SWMM model effectively captured the temporal evolution of throughfall + stem flow under both trees in different phenoseasons. A strong correlation was found between the simulated and observed throughfall (r = 0.97-0.99) and interception values (r = 0.72) across all storm events. Results revealed that the reduction in runoff volume and peak flow across all scenarios and phenoseasons in an event-based is between 20-25% and 16-25%, respectively. The mixed-species tree planting scenario performed better in reducing both runoff volume and peak flow than the single-species scenarios. However, the stormwater reduction efficiency of both trees becomes limited during intense, high-volume storm events, though they continue to provide tangible benefits. Water balance analysis further emphasizes the contribution of canopy interception in the stormwater runoff reduction benefits of urban trees, particularly during the leafed season, small to moderate storm events, and when trees are in directly connected impervious areas. Infiltration and storage under the trees play the dominant role in managing net rainfall before it contributes to runoff, accounting for over 20% of the water balance. These findings underscore the broader value of integrating diverse tree species into urban greening as this strategy not only fosters biodiversity and ecological services but also provides more stormwater management benefits.

Keywords: birch, pine, heavy rainfall, rainfall interception, runoff, stormwater, SWMM, tree canopy, urban greening, urban trees

EM-16-29

Examining the Intersections of Marginalization Through Natural and Anthropogenic Hazards in Kerala, India

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Abstract

This paper investigates the impact of climate change on marginalized communities residing in four disaster-prone regions of Kerala, India's southernmost state. The elected locations–*Anjuthengu*, *Chinnapparakudy, Gandhinagar, and Kvalappara*–were identified based on the state's climate change policy document, which outlines significant climate-related challenges and the affected communities. While Kerala generally boasts better infrastructure, such as roads, drinking water, and public services, these are outliers, facing substantial infrastructure deficits that disrupt resident's everyday lives and livelihoods. *Anjuthengu* has been heavily affected by coastal erosion, worsened by heavy rains and the construction of a harbor along with multiple breakwaters. Although additional breakwaters are planned to attract tourists, residents allege that funds meant for local improvement projects are misappropriated due to corruption. In *Chinnapparakudy*, a tribal village, continuous rainfall has caused severe soil erosion, drastically reducing agricultural productivity and food availability. The forest department further restricts community access to forest lands, limiting traditional practices like shifting cultivation and forest gathering. With fewer crop options due to soil erosion, the community increasingly relies on fertilizers and pesticides, which have led to serious health risks. In the urban slum of Gandhinagar, residents face high flood vulnerability, where even mild rains lead to wastewater flooding their homes. Drainage channels clogged with waste, including plastic, exacerbate this issue by causing sewage contamination in local water supplies. The hilly area of *Kavalappara* frequently experiences landslides, leading to the loss of land and lives. These climate-related hazards have deeply affected local agriculture, further threatening the community's livelihood. The paper argues that the complex interplay of natural and anthropogenic hazards in these areas creates overlapping forms of marginalization that exacerbate these communities' existing privations. This underscores an urgent need for government intervention that recognizes the lived experiences of these communities, their experiences of climate change impacts, and the adaptive strategies they employ to manage these challenges.

Keywords: climate change, anthropogenic hazards, livelihoods, vulnerability, multiple marginalization

EM-16-30

Investigation of Copper Speciation in Swine Manure During Vermicomposting by Synchrotron Approach

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Abstract
Swine farming has increased rapidly around the world to meet the increasing demand for food and protein supply. However, swine farm produces a lot of manure which has a high concentration of Copper (Cu) because Cu is added to feed additives to promote pig growth. Therefore, Cu in swine manure is becoming an environmental concern problem. Vermiremediation technology has been rise to study about detoxification of Cu in swine manure. However, the evaluation of the change speciation of Cu as affected by the earthworm activity is needed. This study was conducted to evaluate the speciation of copper in swine manure when mixed with rice husk ash, cassava peel, and Korat soil series under the vermicomposting process by using synchrotron induced X-ray absorption near-edge structure spectroscopy (XANES). The result showed that Cu speciation was different between the treatment with and without earthworm and vermicomposting. This step decreased the availability of copper and reduced the mobile fraction while increasing the stable form of copper. Vermicomposting process could reduce toxicity of copper in swine manure. Therefore, vermicomposting process from swine manure, cassava peel, rice husk ash and Korat soil series could reduce the distribution of copper into the environment and food chain.

Keywords: swine manure, vermicomposting, earthworms, copper, bioremediation

EM-16-31

Assessing Soil Carbon Sequestration in Salt-Affected Areas Managed with Vermicompost and Organic Waste Materials: A Geographic Information System Approach

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Abstract

Global warming is a significant challenge that many countries around the world are currently facing. It adversely affects the environment, climate, society, agriculture, and human life. The primary cause of global warming is the accumulation of greenhouse gases, which leads to issues such as droughts, decreased agricultural productivity, and climate change. Notably, soil and plants are capable of storing carbon more than the atmosphere. In many regions of the world, salt-affected soils are a prevalent issue. Therefore, monitoring and surveying soil carbon storage is essential. This research aimed to utilize geographic information systems (GIS) to assess organic carbon levels in salt-affected soils in an area where vermicomposting was applied with organic waste management. The study's results showed that during the rainy season, the managed areas with vermicompost had a relatively low soil organic carbon (SOC) content of 0.338%, which decreased to very low levels of 0.192% in the dry season. Additionally, the saline soils treated with vermicompost with organic waste had a higher SOC of 0.560% compared to the unmanaged areas, which had an SOC of 0.350%. Moreover, the soil electrical conductivity in the managed areas with vermicompost was lower (10.16 dSm^{-1}) compared to the unmanaged areas (13.69 dSm^{-1}), and the soil salinity levels during the rainy season were also reduced. The electrical conductivity (ECa) values at a depth of 0-0.75 m were higher than those at a depth of 0-1.5 m, indicating that soil with high organic carbon content had lower electrical conductivity, while soils with low organic carbon content exhibited higher conductivity. In conclusion, the experiment demonstrated that managing saline soil areas with vermicompost with organic waste materials effectively increased soil carbon sequestration and reduced soil electrical conductivity, with more benefits observed during the rainy season compared to the dry season.

Keywords: soil carbon sequestration, vermicompost, salt-affected soil, geographic information system

EM-16-33

Faunal Biodiversity Assessment in Loboc Watershed Under the Philippine Red Cross Greening and Disaster Risk Reduction Project in Bohol

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Abstract

The faunal biodiversity assessment in the Loboc Watershed, part of the Philippine Red Cross Greening and Disaster Risk Reduction Project in Bohol, provides essential insights into the region's ecological health and resilience. Utilizing standard survey techniques, we comprehensively sampled vertebrate species–including. anurans, avifauna, and bats–through visual encounters, mist netting, bio-acoustic sampling, and species accumulation curves. Our survey recorded 253 amphibians, with *Platymantis corrugatus* being the most abundant, indicating that species distribution is closely linked to habitat conditions and moisture levels. We captured 108 birds from 13 species, with *Todiramphus chloris, Aplonis panayensis,* and *Hypsipetes philippinus* dominating the population, while rare species like *Batrachostomus septimus* highlight potential habitat limitations. Additionally, we recorded 970 bats representing seven species, with *Cynopterus brachyotis* and *Rousettus amplexicaudatus* prevailing, while low counts of *Haplonycteris fischeri, Miniopterus schreibersii, Macroglossus minimus* suggest habitat pressures. Our findings raise significant conservation concerns for the Near Threatened *Limnonectes visayanus*, *Rhacophorus bimaculatus*, and Near Threatened Rhinolophus rufus. The assessment reveals multifaceted threats to Bohol's fauna, including habitat degradation from illegal logging and charcoal production, poaching, and unsustainable resource extraction. These findings emphasize the urgent need for targeted conservation strategies to address the threats facing the biodiversity of the Loboc Watershed, thereby supporting sustainable practices that will enhance the ecological resilience and long-term sustainability of this vital region for future generations.

keywords: wildlife, conservation, species diversity, ecosystem

EM-16-34

Characterization of Microplastics in Landfill Soil and Their Effects on Growth and Reproduction of Earthworms (*Eisenia foetida* and *Eudrilus eugeniae*)

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Abstract

Microplastics, which are defined as plastic particles smaller than 5 mm, are widely present in the environment. While significant research has focused on their impact on marine and freshwater ecosystems, studies regarding their presence and effects in soil environments are still limited. This study aims to monitor the presence of microplastics in soil from a 57-year-old landfill and to examine the effects of microplastic contamination in landfill soil on earthworms (*Eisenia foetida* and *Eudrilus eugeniae*) over 45 days. The results showed that microplastics in the landfill soil existed in three forms: fibers, films, and fragments. The majority were fragments (896,000 particles per kg), followed by films (137,000 particles per kg) and fibers (23,000 particles per kg). We tested Microplastic concentrations of 0% and 0.1% were tested for toxicity using a bedding mixture for raising earthworms that consisted of soil, cow manure, rice husk ash, and Azolla in a ratio of 4:3:2:1. The study found that microplastics significantly affected earthworm growth, juvenile production, and cocoon production ($p<0.01$). These findings highlight the potential risks that microplastics pose to soil organisms and ecosystems, emphasizing the need for further research on their ecological impacts in terrestrial environments.

Keywords: plastic pollution, soil contamination, landfill, earthworms

EM-16-38

Assessment of Agricultural Land-use/Land-cover Change in the Diamphwe River Basin Using Sentinel-2 Imageries

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Abstract

Land-use and land-cover (LU/LC) classification is an important aspect of study across various sectors of society. With technological advancement, LU/LC classification is a catalyst to achieve set goals, including the Malawi 2063 agenda. Several developments to support mankind take place on the land surface. However, land area does not change while LU/LC are constantly changing due to human activities. Advancements in remote sensing technologies have made the classification of LU/LC and the actual changes that take place possible. Like other parts of the country, the Diamphwe River basin, with over 90 percent of the inhabitants as rain-fed-reliant small-scale farmers, has been experiencing changes in LU/LC. To track the changes (change detection), this research used Sentinel-2 imagery that has good spatial and temporal spectral resolutions by first identifying the right method of classification. Class area percentages and the accuracy assessment parameters, e.g. kappa and overall accuracy coefficients, were used to identify the right method. Geoprocessing tool-CR was identified as the best among the three methods and was used to classify LU/LC in the Diamphwe River basin. The basin is in a vastly flat land and is among the important agricultural watersheds in central Malawi, with a lot of potential in both commercial and subsistence agriculture production. LU/LC assessment is vital in land use planning such as irrigation, climate change adaptation remedies, and other crucial sectors. The results show that, except for agricultural land, whose class area decreased by 26.8 percent, all the other classes had their class areas increase in the six-year project period (2017-2022). It was detected that 9.3 percent of agricultural land was converted to forest land due to the reclamation of forest land under the Dzalanyama forest reserve area from encroachment. Also, 5.3 percent of agricultural land was converted to settlement land, indicating urbanization growth in the basin.

Keywords: sentinel-2, LU/LC, change detection, classification method, agricultural land

EM-16-39

Soil Degradation Patterns in Deforested and Forested Areas in the Municipality of Cobija, Pando Department, Bolivian Amazonia

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Abstract

Cobija, the capital of the Pando Department in Bolivia, has undergone substantial deforestation in the past three decades, primarily driven by regional development initiatives and illegal logging operations. This anthropogenic transformation has resulted in the conversion of once-verdant forests into pastureland and urban areas, adversely impacting local soil conditions and increasing susceptibility to erosion. Vegetation cover plays a pivotal role in maintaining soil integrity by mitigating surface runoff, enhancing water infiltration, and stabilizing soil structure. To evaluate the consequences of deforestation on soil health, soil samples were collected from three forested sites (A, B, C), and three deforested sites (D, E, F), with twenty samples obtained from each group. In situ, measurements of pH, electrical conductivity (EC), and permeability were conducted, while organic matter content was analysed at the laboratory of Tokyo University of Agriculture. A rigorous statistical analysis using ANOVA revealed significant differences in pH, EC, permeability, and organic matter content between deforested and forested areas. Specifically, deforestation was associated with a decrease in soil pH, attributed to reduced organic matter inputs and increased leaching of basic cations, leading to heightened soil acidity. Furthermore, substantial variations in EC, permeability, and organic matter content were observed, indicating altered soil due to the loss of vegetation. These findings underscore the profound impact of deforestation on soil degradation, highlighting the critical importance of maintaining vegetation cover to mitigate erosion risk in Cobija. Implementing strategies to preserve and restore vegetation are essential for sustaining soil health and ensuring ecological balance within the Amazonian region.

Keywords: deforestation, soil degradation, soil properties, Amazonia, vegetation cover

EM-16-40

The Current State of Vegetation at the Base of Street Trees Where Weeding is Taking Place, Fukuoka City

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Abstract

In recent years, studies on urban biodiversity have focused increasingly on the contribution of plants that have invaded/colonized street tree bases. Previous studies have shown that street tree bases are invaded/colonized by a variety of native plants in a manner that is comparable to urban greenspaces. These studies have shown that street tree bases enhance urban biodiversity by acting as habitats for a variety of native plants. However, usually, plants that invade/colonize street tree bases are treated as weeds and removed. Therefore, this study reports the results of a year-round survey of plants growing at the base of weeded street trees. The results showed that even in environments where general weeding in Japan is taking place, the study showed that street tree bases form a diverse native plant community throughout the year, and the majority of the plants invading/colonizing street tree bases were reproduced and preserved the species.

Keywords: street tree maintenance, invading/colonizing plant, biodiversity, nature-positive

EM-16-41

Citizen Segments and Attitudes Towards Empowering Farmers for Sustainable Rural Management: Evidence from Five European Countries

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Abstract

Farmers play an important role in sustainable rural management and should be empowered through means such as financial support and capacity building. To achieve this, it is essential to understand citizens' views on farmer empowerment taking into account citizen heterogeneity, which, however, remains underexplored in current literature. Using an online survey of citizens (N = 3,190) in the Czech Republic (n = 649), Spain (n = 623), Sweden (n = 645), Switzerland (n = 641), and the UK (n = 632), we segmented participants based on their perceptions of ecosystem service (ES) benefits and threats in rural areas and examined how these segment memberships, along with other factors, influenced support for different approaches to empowering farmers in sustainable rural management. A two-step cluster analysis identified four segments: 'rural ES benefits-conscious citizens', 'balanced appraisers of rural ecosystems', 'rural ES benefits- and threats-conscious citizens', and 'ecocentric citizens'. The results showed that participants in the 'rural ES benefits- and threats-conscious citizens' segment were the most supportive of farmer empowerment, and those in the 'balanced appraisers of rural ecosystems' segment were the least supportive. Logistic regressions indicated potential synergistic effects of perceived ES benefits and perceived threats on participants' support. Of the selected approaches to empowering farmers, Swiss participants exhibited greater support for helping farmers adopt traditional practices, while participants in other countries prioritized financial assistance to farmers. Trust in national government was a stable positive predictor of support across countries except for Switzerland, in which trust in local administration and farmers and landowners tended to be positive predictors. Building on the results, recommendations for enhancing public participation in and support for farmer empowerment in sustainable rural management have been proposed.

Keywords: farmer empowerment, sustainable rural management, citizen segments, ecosystem services, social trust, perceived threat

EM-16-42

Seasonal Land Cover Classification in Japanese Agricultural and Wetland Landscapes via Machine Learning and Multi-Source Sentinel Data

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Abstract

This study evaluates the performance of Random Forest (RF) and Support Vector Machine (SVM) algorithms for land cover classification in two distinct Japanese landscapes: Taki with its agricultural fields and Oze protected wetland, using multi-temporal Sentinel-1 and Sentinel-2 satellite data from 2023-2024. Sentinel-1 SAR features (VV, VH, and VV/VH ratio) were combined with Sentinel-2 optical bands and vegetation indices (NDVI, NDBI, BSI, and MNDWI) to create seasonal median composite maps to reduce cloud interference and enhance classification accuracy. Although both machine learning models were tested, RF consistently outperformed SVM in classification accuracy and class identification capability. In Taki, RF achieved overall accuracies above 85% across both growing and non-growing seasons, with the optimized model reaching an accuracy of Kappa coefficient over 79% for both seasons in identifying forest, cropland, bareland, water, and built-up areas. In the Oze wetland, RF maintained high accuracy levels (91–93%) across five temporal periods, effectively identifying open water, wooden walkways, deciduous forest, grass, and herbaceous plants (kappa value over 80%) whereas SVM showed limitations in identifying certain classes. The superior performance of RF is likely due to its capability to handle complex spectral signatures and temporal variations, though some spectral confusion remained between wooden trails and herbaceous vegetation in the wetland area. This study highlights RF's advantages over SVM for seasonal land cover classification, providing a reliable framework for monitoring land cover changes in both agricultural and protected wetland ecosystems. The comparative analysis highlights RF as the preferred algorithm for similar landscape classification applications.

Keywords: cross-seasonal, dual-sentinel, machine learning, agricultural-wetland, ecosystem classification

EM-16-43

Humic Acid Characterization as a Potential Green Fertilizer

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Abstract

A wine red to dark brown-colored water flows freely from the artesian-well of Santa Barbara in Iloilo, Philippines. The neat water sample was found to be slightly alkaline with an average pH of 8.60(±0.05) at 28.24(±0.11)^{0}C. It has a capacity to conduct electricity at 2.34(±0.13) mS/cm and a salinity of 1.10(±0.06) ppt. These results are correlated with the high amount of total dissolved solids determined which was 1410.03(±59.54) ppm. The coloration of Santa Barbara artesian well-water is due to humic acid (SBHA). SBHA is a complex organic compound formed in soils, sediments, and natural waters by biochemical reactions during the decay and transformation of plant and microbial remains. It was extracted through acid precipitation, centrifugation, and freeze-drying method, consecutively and was found to be present at 76.50(±4.38) mg/L. Scanning electron micrographs show SBHA as an amorphous organic compound with irregular, fragmented granules that tend to clump together, containing crystalline salts. Additionally, the isolated SBHA has an ash content of 4.52(±0.12) %. Heavy metals such as Cu, Cr, and Zn are present at acceptable levels for Class A water except for Cr. Chromium is four times higher, 0.4545(±0.016) ppm, than the 0.1 ppm maximum value. Moreover, the CHN elemental composition and spectra of functional groups were considerably comparable to standard except for carbon content which is slightly higher, and a unique peak at around 1510 cm^{-1} which can be due to C=C-C (1510–1450 cm^{-1}) an aromatic ring stretch. In summary, SBHA has a potential as a metal adsorbent for water pollution and as agricultural green fertilizer to improve soil quality, enhance crop productivity, and thus promote food security.

Keywords: humic acid, physico-chemical, scanning electron microscope, spectroscopic, metal absorbent, fertilizer

EM-16-45

Water Yield Quantification in Logged Upper Muda River Catchment, Ulu Muda Forest Reserve

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Abstract

Logging activities in forested regions can have significant impacts on water yield, affecting both quantity and seasonal flow patterns. The Upper Muda Catchment in the Ulu Muda Forest Reserve, a critical water source for downstream communities, has experienced selective logging that may alter its hydrological dynamics. This study aims to quantify water yield and analyze its variability over one year from May 2018 to April 2019. Flow measurements were conducted to assess the hydrological response of the catchment to selective logging activities. Methodologies included field-based hydrological monitoring and data analysis to correlate flow rates with seasonal rainfall distribution. Results indicated distinct seasonal variations in water yield, influenced by precipitation patterns and forest management practices. The findings underscore the complex interaction between selective logging and hydrological outputs, providing insights into sustainable forest management as a strategy for water security. This research highlights the importance of integrated river basin management that incorporates sustainable forest practices to maintain water yield and quality. Such an approach ensures long-term water security and resilience for downstream ecosystems and communities, balancing environmental, social, and economic needs.

Keywords: water yield; selective logging; forest hydrology; Upper Muda Catchment; seasonal flow analysis

EM-16-46

Assessment of the Biodiversity Status of a Highly Urbanized City: The Case of Manila City, Metro Manila, Philippines

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Abstract

Urban green spaces are becoming a platform for enhancing the quality of life in urban areas improving health conditions, refreshing bodies and minds, providing an interesting and enjoyable leisure time for the inhabitants in the community, and offering a buffer for roads and residential areas, among others. These recognized gains from urban green spaces that are considered as a public good, caused demand to rise in modernized urban cities. The growth of the urban population of the Philippines by 65.6% of the total population in 2050 naturally pushes the urban limits from the core to the periphery putting further at risk nearby biodiversity-rich areas and leading to the fragmentation of the ecosystems compromising the benefits derived from biological resources. The research aims to assess the total biodiversity status of Manila City, a highly urbanized city in Metro Manila through urban biodiversity indicators. These indicators, collectively measured as the Manila Urban Biodiversity Index (MUBI), served as a tool to guide goal setting towards the promotion of urban biodiversity in urban settlements in terms of four components: biophysical attributes, ecological terrain, institutional arrangement, and financial mechanisms. Results revealed that Manila City recorded a MUBI score of 37% which falls under the low biodiversity category. This implies that overall biodiversity status is below the acceptable level in terms of biophysical, ecological, institutional, and financial arrangement. From the standpoint of sustainability and not simply on biophysical and ecological attributes, it is evident that the management of urban biodiversity stations has to be given immediate attention, including the setting up of appropriate management mechanisms, policy instruments, and appropriate financial arrangements to effect the sustainable operation of such important community service. This necessitates a biodiversity conservation development initiative within the context of resilient and sustainable human settlements, which encompasses an integrated service delivery that includes maintenance of ecological balance and resilient urban planning.

Keywords: urban green spaces, sustainable human settlements, resilient urban planning, biodiversity-rich, ecological balance, ecosystems

EM-16-47

Eutrophic Condition of Urban Lakes in Vientiane Metropolis, Laos

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Abstract

Rapid population and economic growth in Vientiane, Laos, have led to a rapid change in land use from agricultural to urbanized, built-up areas. In addition, the deterioration of the water environment in the region has become increasingly severe; according to a JICA feasibility report, several water treatment facilities are planned to be constructed, but the relocation of residents and land expropriation settlements have been very difficult in this heavily populated area. This study focused on the water purification effects of natural or artificially developed urban lakes and marshes. Urban lakes have been constructed in Vientiane since the 1970s for agricultural use, but their number is now decreasing, and the decrease in the number of urban lakes accelerates the deterioration of Vientiane's water environment. Therefore, in order to sustainably conserve these lakes in an appropriate state, a quantitative assessment of the eutrophication level of the lakes is extremely important from the perspective of water environment conservation in the region. In this study, 9 lakes in urban and rural areas were selected and monitored for COD, NO_3-N, NH_4-N, PO_4-P, and DO at approximately 6-month intervals from 2021 to 2024 to evaluate seasonal changes. Using the observed water quality data, cluster analysis was applied to characterize the eutrophic status of each lake, which was classified into four groups that seem to relate to land use, population density, water storage capacity, etc. The complexity of the problems facing Vientiane's urban lakes requires a comprehensive management plan that is not only effective in maintaining the stability of the lake ecosystems, but also in improving urban life - the social, cultural, and economic conditions of the people around the lakes. The basic requirement is that urban lakes should be managed according to the characteristics, conditions, and functional context of their surroundings.

Keywords: water environment, land use, lake conservation, nutrient balance, cluster analysis

EM-16-48

The Sustainable Use of Freshwater Lens in the Yumi-Hama Peninsula, Japan: Effects of Precipitation on Groundwater Level Fluctuations

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Abstract

The formation of a freshwater lens, a distinctive lens-shaped body of freshwater underground, is a marvel in areas surrounded by saltwater, such as islands and peninsulas. Despite saltwater infiltration beneath freshwater underground, the density difference ensures that freshwater remains separate and floats on saltwater. This freshwater lens, replenished by rainwater infiltration, is a precious freshwater resource of immense global significance. The study area, the Yumi-Hama Peninsula in Tottori, Japan, uses it for agricultural irrigation. However, the limited number of studies on freshwater resources and their fluctuations in this area is a cause of concern for sustainability in the future. Moreover, the problem is that droughts have happened frequently. Therefore, the unstable surface water indicates the importance of sustainable groundwater use. This paper investigated the effects of precipitation on groundwater level fluctuations with a cross-correlation analysis of effective rainfall and groundwater level. Effective rainfall is the amount of rainfall involved in the groundwater fluctuations, which is calculated using an exponential function to describe the underground infiltration and storage processes. As a result, there were positive correlations between effective rainfall and groundwater levels at most sites. However, the correlation coefficients were relatively low at sites close to canals and large-scale farmlands. Possible factors contributing to the low correlation coefficients were the effects of infiltration from canals and pumping for agricultural purposes. In addition, time lags taken for rainwater to reach the groundwater table from the land surface were within 1 day at most sites. They can be explained by the high hydraulic conductivity of sandy soil in the study area.

Keywords: groundwater recharge, effective rainfall, cross-correlation analysis

EM-16-50

The Long-term Accumulation of Heavy Metal in Agricultural Soils and Bioaccumulation Risks for Medicinal Plant Cultivation

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Abstract
Chemical fertilizers gradually accumulated heavy metals in agricultural soils, increasing concerns about long-term ecosystem health and the bioaccumulation of toxic metals in medicinal plants. This research aims to evaluate heavy metal accumulation in fertilized agricultural soils in North-Eastern Thailand and assesses the bioaccumulation risk by medicinal plant uptake, Centella asiatica. Soil samples were collected from fertilized agricultural fields and control sites with no fertilizer application. Samples were analyzed using the USEPA Acid Digestion method and ICP-IOS to quantify the contamination of heavy metals. The result shows manganese (44.60 mg/kg), zinc (43.13 mg/kg), copper (39.87 mg/kg), lead (14.40 mg/kg), nickel (8.53 mg/kg), and arsenic (2.40 mg/kg) in agricultural soils. Bio accumulator factor (BAF) for Mn shows higher values (BAF>1), but the hazard quotient is below 1 (HQ<1), indicating low contamination risks. Although current results indicate safe conditions, the continuous use of fertilizers poses a long-term risk of contaminating agricultural land, potentially compromising the safety of medicinal plants and the herbal product industry.

Keywords: heavy metal contamination, bioaccumulation, long-term accumulation, medicinal plants

EM-16-51

Water Quality Characteristics of the River Using by Grazing Livestock

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Abstract

Forest grazing, which uses grassland and woodland for grazing, is generally expected to be an environmentally friendly method of livestock management. However, its implementation is rare, and the full extent of its environmental impact remains to be fully understood. In this study, we examined the current state of river water quality and the effect of forest grazing by targeting a river that flows through K Farm, located in eastern Hokkaido, and carries out forest grazing. In the river basin, there is a forest and pasture in the upper reaches, and a flood control dam exists downstream of the pasture. The river flows through a residential area downstream and flows into the Pacific Ocean. River water was collected at nine points on the main river and at five tributaries that join the main river near the pastureland (upstream of the dam). Firstly, the average T-N concentration in the river water at the 14 sampling points ranged from 0.25 to 1.26 mg/L, with a tendency for higher concentrations in the tributaries than in the main river. In particular, the T-N concentration in the main river varied little from upstream to downstream. Next, the total concentration of the 12 main ions ranged from 14.6 to 28.4 mg/L. The concentration of the main ions also tended to be higher in the tributaries than in the main river. The composition ratios of each ion component were similar at the 14 sampling points, and there were no significant differences between the sampling points around the pastureland and the other points, but the concentration of NO 3 - was higher around the pastureland than at the other points. This suggests that forest grazing may have a localized impact on specific ion concentrations in the water.

Keywords: forest grazing, T-N concentrations, NO_{3-}, livestock management

EM-16-53

Transforming Septic Tank Sludge into Agricultural Resources: A Pathway for Sustainable Development and Rural-Urban Synergy

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Abstract

This study explores a practical and innovative composting method for reducing microbial contamination in septic tank sludge, or "septage" offering valuable insights for sustainable agriculture, rural development, and public health. By co-composting dewatered septage with readily available carbon-rich materials like rice straw, sawdust, and woodchips, the research demonstrates a simple yet effective way to transform waste into a beneficial agricultural resource, particularly in rural areas. The composting process reached thermophilic temperatures that helped significantly lower pathogen levels, achieving a 95% reduction in fecal *E. coli* and meeting the United States Environmental Protection Agency (USEPA) safety standards for *Salmonella* and helminth eggs, thereby producing a stable compost safe for application to land. The results highlight the promise of septage composting as an affordable waste management strategy that not only enhances soil health but also reduces the need for chemical fertilizers. Among the tested combinations, the woodchip-septage mix performed best, completing composting in 61 days, achieving a 25% reduction in total volatile solids (TVS), and yielding a product with improved pH stability. These benefits are particularly important for rural areas, where they support local agriculture, reduce environmental impacts, and cut input costs. Additionally, the improved soil structure and water retention from this compost can help rural communities better adapt to climate challenges such as droughts and floods. Overall, this study demonstrates how septage composting could play a meaningful role in sustainable rural development. It offers a viable, community-focused solution that addresses waste management needs while enhancing agricultural productivity and strengthening resilience against climate-related risks.

Keywords: septage composting, sustainable agriculture, waste repurposing, climate resilience, waste management

EM-16-54

Influence of Pedological Characteristics and Land-Use Types on Soil Erodibility in Pared Sub-watershed, Alcala, Cagayan, Philippines

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Abstract

The study determined the influence of pedological characteristics and land use types on soil erodibility in Pared sub-watershed in Alcala, Cagayan. It specifically characterized the pedological features and major land-use types in the area and established variability of soil erodibility relative to the land-use types which included corn field (CF), rice field (RF), forest land (FL), and grassland (GL). Water (aggregate stability) and wind (erodible fraction, dust emission potential, and soil erodibility) erosion indicators were assessed through the dry sieving method. The relationships of soil properties and soil erosion indicators were identified. The on-site cost of soil erosion was estimated using the replacement cost approach. The pedological features (morphological and physicochemical properties) of each of the land-use types indicated that these sites were prone to soil erosion. Based on soil erosion indicators, FL was the most resistant to erosion. Soil structure, soil texture, and organic matter (OM) were also noted to directly influence soil erosion indicators such as aggregate stability index (ASI), and soil erodibility (K). The highest erosion rate (51.04 t/ha/year), however, was noted in RF. In general, the erosion rate regardless of land-use types reached 33.11 to 51.04 t/ha/year which was way above the tolerable soil loss of 3 to 10 t/ha/year. The cost of replacing nutrient losses in PhP/ha/year due to erosion amounted to 50,347.93 for CF, 15,260.85 for RF, 50,88.68 for FL, and 13,399.08 for GL. The results of the study can be used by farmers, local government units, and other stakeholders to set priority locations for erosion control measures to prevent vast flooding similar to what happened in Alcala, Cagayan, Philippines in 2019.

Keywords: aggregate stability, dry-sieving, replacement cost approach, soil erosion

EM-16-55

Climate Change Impact on Surface Water Availability in Tinau River Watershed, Nepal

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Abstract

The changes in climate variables can cause an increase in surface runoff and evaporation, decline in groundwater recharge, and lead to water-induced hazards. For efficient management of the available water resources and for sustainability of water use, it is necessary to analyze the impact of climate change on water sources. In this study, Tinau River Watershed in Nepal is selected which feeds many traditional irrigation systems and out of which some are outdated due to maintenance issues. Due to climate change, people living along the bank of Tinau river are experiencing the decline of water levels, change in production and productivity of crops, frequencies of diseases, change of crop calendar. The Tinau watershed is in Palpa and Rupandehi districts of Nepal and has an area of about 554.15 sq.km, with majority of land covered by forests (70%) followed by cropland (28%). This study is conducted by using SWAT model and using the Digital Elevation Models with 30 m spatial resolution, soil data from FAO, Land use/Land cover map and weather data from Department of Hydrology and Meteorology (DHM) for the model setup. The model is calibrated by using river flow data collected from DHM for the hydrologic station located at Butwal. Simulated result showed good agreement with observed river discharge. Nash-Sutcliffe Efficiency (NSE) were 0.80 in calibration and 0.69 in validation showing satisfactory accuracy. By using the model, future water availability was estimated by inputting MIROC5 GCM data of emission scenario RCP 8.5 for the period of near future 2026- 2050, mid future 2051-2075 and far-future 2076-2100 periods. The results show that Stream flow, Rainfall and Temperature will increase but Evapotranspiration (ET) will decrease in annual basis. However, on the monthly change, rainfall increase in May, June might be a cause of flood, and ET reduction in July-Oct leads crop yield reduction.

Keywords: climate change, water availability, Tinau River, river flow

EM-16-56

Experimental and Modeling Investigation of Bio-oil Hydrodeoxygenation to Produce Aviation Fuels

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Abstract

The worldwide issues of decreasing fossil fuels, expensive gas prices, and environmental concerns significantly motivate the search for an alternative fuel reserve. Bio-oil derived from biomass is a promising source but cannot be directly used as a 'drop-in' transportation fuel and therefore a need to upgrade. Catalytic hydrotreatment is one method to refine bio-oil and the pre-sulfided Ni-Mo_xS_y/y-Al_2O_3 catalyst has been widely used for hydrodeoxygenation (HDO). Various experimental works have been done on the HDO of bio-oil considering light compounds and other catalysts, but still, the reaction pathways could hardly be understood especially for the highly active bio-oil compounds which are reported to cause catalyst deactivation. In this work, the Density Functional Theory method (DFT) is employed to investigate the adsorption behavior and hydrodeoxygenation reaction pathway of the highly reactive bio-oil compounds over an unsupported MoS 2 catalyst. The experimental work utilized a batch-type Parr reactor to hydrogenate the heavy bio-oil fraction co-processed with waste cooking oil. The resulting hydrocarbons were analyzed accordingly, and results showed that most of the feedstocks were converted to hydrocarbons conforming to ASTM standards specifically for aviation fuel. The identified carbon species of the resulting hydrocarbons consist of n-paraffin, iso-paraffin, cycloparaffin, and aromatics. On one hand, modeling results showed that hydrogenation and hydrolysis were the main reactions occurring during the HDO of the highly reactive bio-oil compounds. The result of this study will contribute to the understanding of bio-oil refining. The modeling work can also pave ways to further investigate other bio-oil compounds such as the heavy oligomers which are reported to cause coke formation during hydrotreatment, and other reaction mechanisms such as polymerization.

Keywords: biofuels, upgrading, hydrodeoxygenation, renewable energy, sustainability

EM-16-57

Enhancing Community Perception of Agarwood from Lapnisan (*Aquilaria Species*) in The Philippines

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Abstract
Agarwood is a resinous part produced from *Aquilaria* species which is a valuable product for medicine and fragrance. However, insufficient information on community perception and biophysical characterization of Lapnisan (*Aquilaria* species) in Mount Hamiguitan Range Wildlife Sanctuary in Davao Oriental, Philippines. Hence, this study was conducted to gather community perception and biophysical characterization of *Aquilaria* species in the area, as well as collect climatic and edaphic data. Social perception was determined through Key Informant Interview. Biophysical characterization uses a Line Plot Method. A transect line was established in barangay La Union and Maputi, measuring 150 meters in length and 20 meters in width. Within each plot, *Aquilaria* species were identified. Moreover, average soil depth, soil series, wind speed, temperature, relative humidity, and heat index were gathered and recorded. The study analyzed the demographics, knowledge, perceptions, and attitudes of the respondents. Biophysical characterizations were described highlighting their distinguishing features and adaptations to the environment. Transect data from two locations were analyzed using PAST software. Barangay La Union exhibits shallow soil depth and a rocky surface, with *A. malaccensis* and *A. cumingiana* present. While, Barangay Maputi has deeper soil depth and fewer rocks, with *A. cumingiana* growing in the area. Climatic factors show slight variations between the two barangays. Thus, the findings enhanced the understanding of the people on the use of the species for ex-situ conservation as a strategy for livelihood opportunity and potential species for forest plantation in mitigating climate risks.

Keywords: agarwood, heat index, morphology, social perception, soil index

EM-16-58

Comparison of Evapotranspiration Rates at Open Field Conditions and Agriculture Field Protected by Tree Shelter Belts in Ovche Pole

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Abstract

The primary goal of establishing tree shelterbelts in the Ovche Pole region of Macedonia was to enhance agricultural productivity by mitigating the adverse effects of the prevailing northwest winds. Despite their long presence and known ecosystem services, there are no scientific studies known to the authors that quantify their specific influence on evapotranspiration. To address this gap, the aim of this is to compare the evapotranspiration (ET) rates between open field conditions and agricultural fields protected by tree shelterbelts in the region. The study was conducted on an agricultural field near the village of Erdzelija. Meteorological sensors were placed on the southeast side of the shelterbelts at three points: 20 meters (Point 1), 70 meters (Point 2), and 160 meters (Point 3) from the tree line. Points 1 and 2 represent areas influenced by the shelterbelt's protection, while Point 3 serves as a control, representing open field conditions unaffected by the shelterbelt. Sensors at Points 1 and 2 measured temperature (T), humidity (RH), and wind speed at 2 meters above ground (u2). At Point 3, additional sensors measured wind direction and solar radiation (Rn). The reference evapotranspiration (ETo) was calculated using the FAO-56 Penman-Monteith formula. Results showed that the average wind speeds were 0.83 m/s, 1.78 m/s, and 2.55 m/s at Points 1, 2, and 3, respectively. This indicates a significant windspeed reduction of 68% and 30% at Points 1 and 2 compared to Point 3. Evapotranspiration rates were 6.09 mm/day at Point 1, 7.09 mm/day at Point 2, and 7.65 mm/day at Point 3. Statistical analysis (ANOVA, Tukey test) revealed a significant difference in ETo between the three points (at the 0.05 level). The findings confirm that tree shelterbelts reduce evapotranspiration in the protected areas, supporting their role in water conservation and enhancing agricultural sustainability in the research area.

Keywords: tree windbreaks, water conservation, reference evapotranspiration

EM-16-59

Sustainable Community-Based Tourism: Case Study of the Tonle Bati Tourism Community in Cambodia

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Abstract

Economic growth coupled with a nation's image is often related to the success and value of the tourism sector. Tourism sectors across the globe are developing and growing to meet tourists' demands. Sustainable Community-Based Tourism (SCBT) which guides tourism policy, infrastructure, and program development, is critically important to create valuable and sustainable tourism sectors. SCBT development efforts include the preservation of the environment and local culture, raising local community awareness and empowerment, sharing economic benefits, and developing integrated marketing and communication strategies with local partners and stakeholders. SCBT assures tourists are offered safe, secure, and unique offerings generating broad-based income and economic growth. To study SCBT, we selected the Tonle Bati tourism community, Bati District, Takeo Province, Cambodia. The study was conducted in phases with the initial data collection from March to April 2024, with additional data obtained from October to December 2024. The non-probability purposive sampling technique and simple random sampling were used and measurement included both qualitative and quantitative data. The sample size was 111 representing multiple tourism and community stakeholders. Benchmark data from three other tourism communities was used for comparison. SPSS.26 software was used for our analysis. The estimation results demonstrate that the dimensions of economic benefit, marketing activities, cultural and historic temple conservation, cooperation and partners, and education of the local community, have a significant and positive influence on SCBT of 29.7%; 22%; 21.4%; 17.6% and 15.8%, respectively, with $p \leq 0.05$. The economic benefit factor has the greatest impact on SCBT ($R^2 = 0.297$ or 29.7%), with a t-value of 5.533 ($t > 1.96$) and p-value = 0.000 ($p < 0.05$). This relationship has the highest important 0.435 (or 43.5%). Recommendations and implications for policy makers are discussed and guidelines for future research are provided so that SCBT guides infrastructure and strategic plans while meeting tourists' expectations.

Keywords: community-based tourism, sustainable, Tonle Bati tourism community, Bati district, Takeo province, Cambodia

EM-16-60

Baobab Seed (Adansonia digitata) Biochar as a Soil Amendment to Improve Soil Quality in Dodoma Region, Tanzania: A Review

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Abstract

Soil degradation in the Dodoma region of Tanzania poses a significant threat to agricultural productivity, primarily due to poor soil fertility, low organic matter, and inadequate water retention. Biochar, a carbon-rich material produced from organic biomass, has emerged as a promising soil amendment. This review explores the potential of baobab seed (Adansonia digitata) biochar to improve soil quality in Dodoma. The baobab tree, iconic in African landscapes, particularly in semi-arid regions like East Africa, holds a unique ecological and cultural significance. Known as the "Tree of Life," baobabs can live for thousands of years, providing not only food and shelter but also medicinal and economic resources to local communities. These combined benefits suggest that baobab seed biochar could offer a sustainable, locally sourced solution to combat soil degradation in Dodoma, improving soil quality and boosting agricultural yields offering smallholder farmers a path to greater food security and income stability. As rural communities in Dodoma rely heavily on agriculture for their livelihoods, increased crop productivity through baobab seed biochar use could directly benefit household income levels. Additionally, the processing and sale of it could open up new market opportunities, providing local communities with value-added income streams and reducing dependence on costly, external soil amendments. Baobab seed biochar aligns with sustainable development goals by lowering carbon footprints, enhancing soil quality, and supporting sustainable agricultural practices. Its use could offer a practical, low-cost approach to soil restoration that also strengthens the economic resilience of farming communities facing climate-related challenges. As demand for sustainable agricultural products grows, baobab biochar could help empower rural communities in Tanzania and similar semi-arid regions, improving their economic stability and contributing to a sustainable future. Thus, baobab seed biochar presents not only an innovative soil amendment but also a pathway to enhance livelihoods and foster sustainable rural development.

Keywords: Adansonia digitata, baobab seed biochar, soil amendment, soil fertility, biochar

EM-16-61

Effects of Coffee Pulp Biochar Application Rate and Particle Size on Soil Carbon Sequestration and Emissions

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Abstract
Biochar, characterized by its highly aromatic carbon compounds, resistance to microbial degradation, and high porosity, has gained widespread attention for soil carbon sequestration and as a soil amendment to improve soil quality and crop yield. This study investigated the effects of coffee pulp biochar application rates and particle sizes on soil carbon sequestration and missions. The experiment employed a factorial design with four biochar application rates (0, 1, 2, and 3% w/w) and two particle sizes (0.5 and 2.0 mm). Measurements were taken on days 1, 3, 5, 7, 14, 21, and 35 after incubation, analyzing dissolved organic carbon (DOC), microbial biomass carbon (MBC), CO2 emissions, and soil organic matter content (OM). Results showed that neither biochar application rate, particle size, nor their interaction significantly affected organic matter content and DOC values (p<0.05). The highest OM value (0.84) was observed with 3% biochar (0.5 mm), while the control treatment (0% biochar) showed the lowest value (0.63). DOC values ranged from 1,383 to 1,650 mg kg^{-1}. MBC was significantly affected by biochar application rate but not particle size, with the highest MBC content (950 mg kg^{-1}) observed at 1% biochar (0.5 mm). Carbon emissions were influenced by both biochar rate and particle size, and their interaction, but only during initial incubation (Day 1). In subsequent measurements, only the biochar application rate significantly affected carbon emissions. The highest carbon emissions were observed in treatments with 3% biochar (2.0 mm), followed by 3% biochar (0.5 mm), and 2% biochar (2.0 mm), with emissions decreasing over the incubation period. In conclusion, biochar application rate predominantly influenced soil biological activity, while particle size had minimal effects on the measured parameters. These findings contribute to our understanding of optimal biochar application strategies for soil carbon management.

Keywords: coffee pulp biochar, carbon sequestration, carbon emission

EM-16-62

Development and Evaluation of Nutrient Loss in Novel Hybrid Granular Fertilizers for Sustainable Agriculture in Sri Lanka

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Abstract

In Sri Lanka, the overuse of chemical fertilizers has raised significant environmental concerns, emphasizing the need for more sustainable alternatives. This study explored the development of hybrid granular fertilizers that combine urea with organic materials, tested at urea-to-organic dry mass ratios of 70:30, 50:50, and 30:70. The organic fraction consisted of a 1:1 mixture of cow dung and compost, aimed at enhancing natural nutrient cycles and improving soil fertility. Molasses was incorporated at concentrations of 0.5%, 1%, 2%, and 3% to assess its role in controlling nutrient release and stabilizing the fertilizer mixture. Furthermore, granular sizes were tested in three categories: 2.00 - 4.75 mm, 4.76 – 8.00 mm, and greater than 8.00 mm. A water resistance experiment was conducted to simulate shearing forces caused by surface runoff and to assess nutrient loss across the three granular size ranges. The performance of the hybrid fertilizer was compared with that of traditional chemical fertilizers and organic amendments. The results showed that the hybrid fertilizer significantly reduced nitrogen and phosphorus losses, as well as suspended solids, under simulated runoff conditions. These findings suggested hybrid fertilizers offer enhanced slow-release nutrient efficiency and greater resilience against nutrient runoff. This research contributes to the development of cost-effective, nutrient-efficient hybrid fertilizers that can support sustainable agricultural practices in Sri Lanka.

Keywords: hybrid fertilizer, nutrient loss, shearing force, surface runoff, Sri Lanka

EM-16-64

1.5-degree Lifestyles in Japan: A Key to Achieve Carbon Reduction Target

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Abstract

To achieve the goal of reducing global temperature to 1.5 degrees Celsius, countries have set targets and launched various adaptation and mitigation strategies. The Japanese government has established the goal of achieving net zero greenhouse gas emissions by the year 2050. It is recognized that a 46% reduction in greenhouse gas emissions by 2030 is critical in achieving this goal. Japan is making progress in introducing new measures and supporting policies to achieve the 1.5-degree target, in line with the 1.5-degree roadmap. In addition to the efforts of the government and enterprises, citizens can also make individual contributions by living in 1.5-degree lifestyle, which is essential for carbon reduction and achieving the 1.5-degree goal. This paper introduced the concept of 1.5-degree lifestyles and its significance. Specifically, first, current patterns of household carbon footprints in Japan are addressed. Second, enablers and barriers to 1.5-degree lifestyles are also discussed. Third, the paper proposed recommendations for progress toward the 1.5-degree lifestyle in Japan.

Keywords: lifestyles, carbon reduction target, lifestyle carbon footprint

EM-16-65

Hydrochemical and Isotopic Characteristics of Irrigation Channel Water in Oil Palm Plantation of Kuala Selangor, Malaysia

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Abstract

The rapid expansion of oil palm plantations in Southeast Asia brings economic benefits but also leads to substantial environmental challenges due to deforestation and excessive fertilizer use. Irrigation runoff from these plantations can flow into rivers, impacting river ecosystems and human water resources. However, there are limited studies on the water quality characteristics of irrigation in areas adjacent to oil palm plantations. To address this gap, this study aims to clarify the hydrochemical and isotopic characteristics of irrigation channels within plantation areas. We conducted an intensive field survey and collected water samples at irrigation channels in an oil palm plantation located in Kuala Selangor, Malaysia. We analyzed major dissolved ion concentrations and water isotope ratios. The pH, electrical conductivity (EC), and dissolved oxygen (DO) ranged from 2.67 to 6.59, 7.27 to 138 mS/m, and 0.46 to 4.83 mg/L, respectively. The analysis revealed that there was spatial variation in water quality among similar irrigation channels. On the northern side of the Selangor River, the water was brownish and acidic, with pH values below 3 and low conductivity. These characteristics are likely due to humic acids typically found in peatlands. The water was characterized by high concentrations of Mg^{2+}, SO_4^{2-}, and Cl^-. A strong correlation between EC and SO_4^{2-} would indicate the influence of seawater intrusion or the contribution of sulfate from fertilizers. The isotopic analysis indicated that the source of the irrigation channel was meteoric water, with some isotopic enrichment occurring due to evaporation. Overall, these findings imply that after precipitation enters the plantation area, subsequent evaporation and human activities modify the water quality. These results underscore the need for sustainable oil palm management practices to safeguard water resources and mitigate environmental impacts on surrounding ecosystems.

Keywords: oil palm plantation, water quality, isotope, Kuala Selangor, irrigation channel

EM-16-66

Impact of Grassland Contract Policy on Pastoral Social-Ecological Systems: An Empirical Analysis Based on the SES Framework

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Abstract

The Inner Mongolian Grassland, a critical component of the Eurasian Steppe, accounts for 22% of China's total grassland area and covers 74% of the land area of the Inner Mongolian Autonomous Region. However, since the late 20th century, these grasslands have experienced increasing degradation, a trend that continues to the present. The grassland contract policy is widely considered a key institutional factor contributing to this degradation. This study applies the Social-Ecological System Framework, using data from nine counties in XilinGol League to examine the impacts of the grassland contract policy on the ecosystem, herder incomes, and pastoral communities. The findings indicate that the policy incentivizes herders to settle, disrupting the traditional relationship between livestock and grass turnover, which has negatively affected vegetation cover. Under the grassland contract policy, climate factors continue to significantly influence herder incomes, though this effect is now mediated by changes in production costs. Furthermore, the decline in social capital within pastoral communities has weakened herders' resilience to disasters. The study recommends enhancing livestock mobility through modern technologies, establishing a comprehensive livestock insurance system, rebuilding pastoral communities, and further developing a diversified grassland management system that integrates self-governance with contractual arrangements.

Keywords: inner Mongolian grassland, grassland management, social-ecological systems, pastoral communities

EM-16-67

Impact of Land Use Change on Land Desertification in the Farming-pastoral Ecotone in Northern China

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Abstract

The Northern China farming-pastoral ecotone plays a crucial role in various functions, such as agricultural and pastoral production, wind and sand control, and the conservation of water and soil resources. However, the region faces significant challenges due to the combined pressures of human activities and climate change, leading to an increasingly severe land desertification problem. Frequent changes in land use patterns have further exacerbated this process. Despite its importance, there remains a lack of empirical studies addressing the impact of land use changes on desertification. This study utilizes land use and desertification data from 2000 to 2020, employing structural equation modeling and geographically weighted regression models to assess the influence of land use changes on desertification. The findings indicate that the primary form of land use change involves the conversion of grassland into cropland and forestland. Initially, the degree of desertification rises but subsequently declines. The most severe desertification occurs in low-cover grassland and unused land while converting low-cover grassland into cropland tends to mitigate desertification. Human activities are identified as the principal driver of desertification in this region, directly influencing the environment and indirectly affecting climate, thus impacting the dynamic changes in land desertification—an influence that is intensifying over time. This study elucidates the evolution of desertification and the driving mechanisms behind it in the Northern China farming-pastoral ecotone, offering valuable insights for global desertification research and contributing significantly to the advancement of desertification prevention and control efforts.

Keywords: land desertification, land use change, farming-pastoral ecotone, driving mechanism

EM-16-68

From Bountiful Seawaters to Condition of Excessive Depletion of Marine Resources

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Abstract

From bountiful seawaters to conditions of excessive depletion of marine resources. This qualitative study was made to obtain information and stories from fisher respondents in 6 islands of Bohol about their thoughts on the condition of marine resources. The fisher respondents of this study have presently resided in the islands with at least a residency from 50 - 60 years. They were chosen because of their knowledge and experiences of marine resources. Three important information to gather from them: (1) Pertaining to the condition of coral reefs and reef fishes, (2) About the fish catches of fishers, and (3) Current issues and problems met by the islanders in relation to marine resources conservation and management. It has been said by 12 (100.00%) fisher respondents that the current condition of coral reefs in the 6 islands was severely damaged with few reef fishes observed, fish catches of fishers were reduced to 2 - 3 kilograms per fishing effort as subsequently mentioned by 10 (83.33%) fisher respondents, meanwhile, illegal fishing and destructive activities were identified, together with pollution and improper waste disposal from households, and due to tourism activities. For the issues and problems met by the islanders, it is recommended that the local government units in 4 municipalities where the 6 islands of Bohol are located should strengthen their law enforcement units with a reasonable budget for law enforcement activities and projects, and encourage the involvement of local communities where all sectors in the island communities should involve, participate, and play its role to support the local and national government for the marine resources conservation and management.

Keywords: bountiful, depletion, corals, marine resources, fishers, law enforcement units

EM-16-69

Study on Land Use Alterations Following Collaborative Land Use Planning for Sustainable Resource Management

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Abstract

Land use planning in Laos is government-directed, with policies established for zones nationwide based on regional characteristics and a national master plan. The Land Use Planning and Land Allocation (LUP/LA) program began in the 1990s, later evolving into Participatory Land Use Planning (PLUP) in 2010 to increase village involvement. This technique has long been considered as having negligible impact on rural livelihoods. The objectives of this study are: i) to compare the Land Use and Land Cover changes after the PLUP at three dates (2015, 2017, and 2019), ii) to assess smallholder farmers' level of understanding of PLUP, iii) to determine the factors affecting the implementation of activities by the PLUP and iv) to compare economic/income contribution. The research was done in four villages in Luang Prabang province (Huayvat and Nongkham villages in Pakseng district and Phoutong and HuayKhay in Viengkham district). It is based on data from a socio-economic baseline survey carried out on three dates (2015, 2017, and 2019). Regarding land use and land cover change, data reveal that Phoutong, Huayvat, HuayKhay, and Nongkham have completed by 80%, 48%, 37%, and 28% in line with the original PLUP. Farmers' degree of grasp of PLUP fluctuates according to village: in Phouthong, the level of understanding was medium, while in the three other villages, the level was relatively low. Regarding the factors affecting the implementation of activities by the PLUP, results show that Village Land Management Committee (VLMC) contributes strongly (by 63% or 2B) to the village development plan and in fine to the village land use, while in Huayvat and NongKham, changes in land use and land cover mainly resulted from external support (2C) by 40-43%, and in HuayKhay was 48% of Geographical conditions and identification of suitable production areas (2D). However, agriculture remains the predominant activity of smallholder farmers. In 2017, agricultural incomes varied from 8.7 million kips to 17.5 million kips in the four villages, and in 2019, the average income per family was 11.3 million kips. The results showed that land use land cover change has been linked to the land reserve-land use by villagers in the past, and villagers' understanding is still low in the village. These have no strengthening activities after the planning process; the strength of VLMC with extremal support is significant to Sustainable Land Resource Management.

Keywords: participatory land use planning, land cover changes, local involvement, agricultural economy

EM-16-70

Assessment of Soil Health Under Different Land Uses (Forest, Ruzi Grass, and Cropland) in Xiengkhouang Province, Lao PDR

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Abstract

Angle of farmers increasingly engaging in improved pasture establishment for livestock development but with little knowledge/evidence about land use change effect on soil health. e.g. Over the past two decades. The objective of this study was to assess the impact of different land uses on soil health in Xiengkhouang Province, focusing on three main land uses: pastureland compared to the main current cropland use (maize or upland rice), and non-cultivated land use (forest land) as control. To evaluate soil health, Biofunctotool®, a low-tech and cost-effective field tool was used, to analyze 96 soil samples collected in July 2024. This tool allowed us to assess key soil health indicators related to three primary soil functions: soil structure maintenance, biological activity, carbon dynamics, and soil nutrient cycling. The visual Estimation of Soil Structure (VESS) indicated that Ruzi grass pastures exhibited the highest soil compaction, while forests showed the lowest. Fallow land and maize had similar compaction levels, although maize displayed greater variability. In terms of soil biological activity, in situ respiration was higher in forests and fallow lands, with lower levels observed in Ruzi grass pastures and maize areas. Earthworm populations were abundant in forests and maize, with high numbers but low density, whereas Ruzi grass pastures had lower overall numbers but higher density. The analysis revealed that the labile carbon (POXC) levels were greater in the forest and fallow lands compared to Ruzi and maize fields. In conclusion, the best soil health ranked from highest to lowest is found in the forest, fallow, Ruzi grass, and maize land uses, according to the four main parameters analyzed.

Keywords: soil quality, land use change, improved pasture, POXC

EM-16-71

Estimation of Sediment Load of Iponan River, Philippines Using Empirical Equation and Swat+ Modeling

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Abstract
Sedimentation is a process whereby rivers transport and deposit eroded material from various sources. Understanding the sediment transport dynamic is essential to address these challenges. This study aims to estimate the sediment load of the Iponan River using empirical equations and the SWAT+ Model. Sensitivity analysis of the SWAT+ model identified nine critical parameters, including the Pothole Evaporation Coefficient and the Soil Conservation Service (SCS) curve number. Model performance was evaluated using Nash-Sutcliffe Efficiency (NSE) and Percent Bias (PBIAS). Predicted river flow, based on data from the Department of Public Works and Highways used in the warm-up period, was validated against observed river flow, resulting in an NSE of 0.968 and a PBIAS of -4.241, indicating an excellent match with slight underestimation. Estimated sediment load, derived from predicted river flow and total sediment load equations, was also validated against observed sediments, achieving an NSE of 0.932 and a PBIAS of -4.546, again showing high accuracy with slight underestimation. These high NSE values and acceptable PBIAS demonstrate that the SWAT+ model is an effective tool for simulating river discharge and sediment load in the Iponan River catchment. Consequently, these findings provide a solid foundation for developing water resource management and sediment control strategies in the Iponan River watershed.

Keywords: sedimentation, iponan river, empirical equation, swat+ model, sediment load

EM-16-72

The Potential for Producing *Aquilaria Cumingiana* (Decne.) Ridl. Seedlings by Vegetative Propagation Methods

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Abstract

The Philippines is home to nine agarwood-producing tree species, including *Aquilaria cumingiana* (Decne.) Ridl. Agarwood is a resinous wood substance that is highly regarded for its numerous applications; consequently, it is extensively exploited. *Aquilaria cumingiana* is classified as Vulnerable (VU) by Department Administrative Order No. 2017-11 (DENR-DAO, 2017). Therefore, it is imperative to preserve and manage sustainably this species. In response to the rapidly declining Aquilaria population and to meet market demand, significant efforts have been dedicated to agarwood production in plantations. The establishment of plantations is preferable than wild collecting and trade prohibitions. Nonetheless, ensuring the source of planting materials poses a challenge. This study seeks to determine the most effective and cost-efficient macro-propagation techniques influenced by indole-3-butyric acid (IBA) to maximize species survival rates and root development. The study demonstrated that cuttings treated with 500 ppm exhibited a notable survival rate of 42% and an average root length of 20.86 mm after three months post-planting. In the interim, marcots subjected to 2500 ppm exhibited the highest rooting success rate of 24.67% after two months of layering, along with a higher survival rate of 88% post-potting. Moreover, air layering yielded larger and taller seedlings compared to top cuttings, leading to enhanced stomatal conductance and assimilation rates, as well as considerably ($p \geq 0.05$) increased biomass production. Moreover, cuttings are typically more costly than marcotted seedlings because to the requirement for advanced irrigation systems and plant propagation greenhouses. Moreover, the costs of the rooting hormone considerably raise the cost of seedlings per treatment in both propagation methods.

Keywords: top-cutting, Aquilaria cumingiana, marcots, seedling propagation, root development

EM-16-73

Integrating Resource Occupation and Sustainability in Agriculture through the Resource Time Footprint Indicator

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Abstract

Over the past decade, agricultural land use has expanded rapidly and is projected to double to support global social stability. While technical efforts have improved food crop supply potential, achieving this without compromising environmental resource integrity and social fairness remains a significant challenge. Agriculture products often travel extensively through distribution networks to reach demand sites, which are typically far from agricultural hubs. This study focuses on a scientific evaluation of human intervention in the supply and flow of food crops from an intergenerational sustainability perspective, using the lifespan of beneficiaries as the unit of analysis. The temporal occupation of four essential resources—materials, land, labor, and pollutants, is assessed by comparing their usage to capacity through the Resource Time Footprint indicator. Applying this indicator to four agricultural crops (conventional potatoes, organic potatoes, rice, and sugarcane) reveals the trade-offs and identifies the farming aspects that must evolve to sustain and increase the net societal benefits of intensive agricultural production. In comparative case studies conducted in Bhutan, resource occupation rates were observed in the following order: rice (10 years) > conventional potatoes (0.8 years) > sugarcane (0.7 years) > organic potatoes (0.4 years). For each crop, the aspects with the highest temporal occupation rates (e.g., water and land use in rice) were highlighted as targets for management intervention. By addressing ecological integrity, social fairness, and long-term sustainability, this research aims to promote broader integration of intergenerational sustainability into agricultural life cycle assessments.

Keywords: agricultural sustainability, resource time footprint, life cycle assessment

EM-16-74

Effects of Corncob Biochar and Urea Fertilizer on Ammonium and Nitrate Leaching in Sandy Soil

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Abstract
Sandy soil, high water permeability leads to significant nutrient loss through leaching. This study investigated the combined effects of urea fertilizer and corncob biochar on reducing ammonium and nitrate leaching in sandy soil. The experiment was conducted at the Department of Highland Agriculture and Natural Resources, Faculty of Agriculture, Chiang Mai University, Thailand. Corncob biochar was prepared through pyrolysis at 300-550°C for 4 hours, followed by pulverization and sieving to 2 mm particle size. The study comprised six treatments: (1) Control: No amendments, (2) UF1: 1% urea fertilizer, (3) UF1CC1: 1% urea fertilizer + 1% corncob biochar, (4) UF1CC2: 1% urea fertilizer + 2% corncob biochar, (5) UF1CC3: 1% urea fertilizer + 3% corncob biochar and (6) UF1CC4: 1% urea fertilizer + 4% corncob biochar. The soil samples were initially incubated with 290 mL of distilled water for 14 days. Leachate samples were collected after applying distilled water on days 0, 7, 14, 21, and 28, and analyzed for ammonium and nitrate concentrations. Results showed that the UF1CC4 treatment was most effective in minimizing nutrient leaching, with ammonium and nitrate concentrations in leachate measuring 50.71 and 663.30 ppm, respectively. This treatment also maintained the highest soil nutrient retention, with ammonium and nitrate concentrations of 111.54 and 69.73 ppm, respectively. The study concluded that combining 1% urea fertilizer with 4% corncob biochar effectively reduces ammonium and nitrate leaching in sandy soil.

Keywords: ammonium, nitrate, leaching, urea fertilizer, corncob biochar, sandy soil.

EM-16-75

Estimating Irrigation System Design Capacity Using Historical Evapotranspiration and Its Variability

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Abstract

Irrigation systems need adequate capacity to replace the water used by the crop to avoid crop water stress, yet not so much that the irrigation system costs are excessive, and the irrigator must make constant on-off decisions to avoid over-watering. A method for calculating the irrigation system design capacity was developed here that considers the daily and interannual evapotranspiration (ET) of a crop and its variability by using weather historical data and soil information. To demonstrate the process historical evapotranspiration data were gathered from three climatically different locations in Washington State: near Prosser, Puyallup, and Omak to represent arid, humid, and mountain valley areas, respectively. The mean and standard deviation of the ET for each day of the year were used in the calculation of the minimum design capacity with a selectable probability of adequacy. Using the developed method, the net irrigation design capacity was adjusted to its minimum value such that during high water use times of the season, the soil water could be depleted, but without resulting in water stress. Including the effects of the ET variability and a probability of adequacy increases the computed irrigation design capacity. This resulted in greater confidence in the chosen design capacities compared with the traditional methods of selecting design capacity, which simply uses the peak ET or maximum of the mean month ET. Calculating the irrigation design capacity without considering daily and interannual variability can cause more years of inadequate system design.

Keywords: irrigation design capacity, daily evapotranspiration, daily and interannual variability

EM-16-77

Vulnerability Assessment of Communities to Climate Variabilities and Extremes in Cangaranan Watershed, Antique, Philippines

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Abstract

This study assessed the vulnerability of households in the Cangaranan Watershed to climate variability and extremes and examined their adaptive strategies. Utilizing a mixed-methods approach, data were collected through face-to-face interviews and focus group discussions across two municipalities in the province of Antique: Bugasong and Valderrama. The research involved 192 randomly selected respondents, complemented by socio-demographic data and development plans from municipal and provincial sources. A community-based vulnerability index was developed, identifying key factors contributing to vulnerability. Findings reveal that the average respondent age is over 55, with a balanced gender distribution (54% female). Most respondents are married, have diverse educational backgrounds, and have an average monthly household income of PhP 12,434.00. Agriculture, particularly rice farming, is the primary livelihood in the area. The watershed has faced severe climate-related challenges over the past two decades, including numerous typhoons (e.g., Frank, Ondoy, Yolanda, Paeng, Odette) and prolonged droughts, notably during the 2009, 2015, and recent El Niño events (2023-2024). These events have resulted in food shortages, water scarcity, and disrupted domestic water supplies. Farmers employ various coping mechanisms, such as reducing consumption, taking out loans, and seeking assistance from social networks, NGOs, and government agencies. The study underscores the urgent need for effective and inclusive climate resilience strategies, emphasizing the importance of development planning that prioritizes the most vulnerable populations. Future research should focus on evaluating the long-term impact of adaptation measures and addressing socio-economic barriers in marginalized communities.

Keywords: climate variability, climate extremes, vulnerability assessment, climate change, adaptation practices

EM-16-79

The Applications of the Miyawaki Method to Enhancing Community Resilience in Thailand

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Abstract

The Miyawaki method is a unique technique to recreate native forests with native species, planting mixed species, dense, random, multi-layer. Prof. Akira Miyawaki, a Japanese ecologist, developed such an innovative method. In Thailand, the Miyawaki method has been applied since 1991, and at present (2024) there are over 60 restoration sites. The principles of the Miyawaki method contribute to and improve natural resources and environmental conditions leading to community resilience as follows: 1) Planting with native species of trees, shrubs, and herbs. 2) Restoration of degraded land by using organic wastes and local manure. 3) Mulching with rice straw to keep moisture and decompose for nutrients. 4) Mixed species culture rather than monoculture to reduce the risk of pests and diseases. 5) Preventing windbreak and disaster protection (flood, storm, erosion). 6) Increasing biodiversity for instance birds, insects, butterflies, and bees for pollination. 7) No pesticides and chemicals applied. 8) Promoting organic farming, food safety, and integrated pest management (IPM). 9) No burning on farmland can reduce CO2 emissions. The good practices based on the Miyawaki method can be categorized into various types of land use as follows: a) Create natural forest to restore degraded land into a forest ecosystem. b) Protection strip along the fence, buffer zone between forest area and agricultural land. c) Agro-forestry by planting economic tree species and cash crops to earn income. d) Fruit orchard for instance mango, durian, mangosteen, rambutan, jackfruit, etc. e) Planting supplementary crops/understory plants in rubber plantation. g) Vegetable garden by rotation planting a variety of vegetables. h) Ridge tillage garden to improve water drainage before planting and keep water for plants. i) Backyard garden for food security and additional income. The practices mentioned above have been somewhat successful and enhancing community entrepreneurs. However, they still require continuous strategic development.

Keywords: Miyawaki method, community resilience, Thailand

EM-16-82

People's Evaluation of Paddy Landscape and Its Element

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Abstract

In order to prevent farmland abandonment and continue sustainable agricultural production activities, land consolidation projects are being carried out. While this improves productivity, it also significantly transforms the rural landscape. In this study, people living in various regions of Japan are asked to evaluate various rice paddy landscape photos and analyze why they liked the rice paddy landscape by adopting the semantic differential method. The survey was conducted online in February 2024. 500 men and 500 women were respondents. 60% of the respondents lived in urban areas, and 40% lived in rural areas. Only 1.5% of the respondents were in the agriculture, forestry, and fisheries industries, with the majority being in the service and manufacturing industries. There were 16 rice paddy landscape photos used in the survey, with the following breakdown: 13 flat land photos and 3 sloping land photos. In terms of conditions, there were 10 before consolidation and 6 after consolidation. The highest score was given to consolidated paddy fields on sloping land with a total of 57%, followed by rice paddies before development on sloping land with 26%. 13 photos on flat land received the highest score only 17%. Each respondent was asked to rate the selected rice paddy landscape photos using 22 pairs of adjectives. The adjectives used to evaluate the most popular and the second most popular rice paddies were simple, remote, boring, beautiful, impressive, and bright. The adjectives for before and after development were slightly different. Adjectives for before land consolidation are varied, untidy, and unsettling, while evaluations of rice paddies after consolidation were monotonous, orderly, and reassuring. On both flat land and sloping land, the scores were higher for the rice paddies after consolidation, so it can be said that development has improved both productivity and landscape. However, there were also negative evaluations of rice paddies after consolidation, so it is necessary to consider what kind of development method is best.

Keywords: paddy field, landscape, evaluation, Semantic Differential method

EM-16-85

Insect Diversity and their Role in Agarwood Production in Leyte, Philippines

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Abstract

The Aquilaria is mainly cultivated for its highly prized resin, known as "agarwood," used in upscale scented products. The production of high-quality agarwood is contingent on the plant's immune response to fungal infections and insect injuries. While many records of insects associated with Aquilaria spp. have been reported in other countries, there are no reports from the Philippine Aquilaria wild populations and plantations. This study aimed to survey and assessed the insects associated with Aquilaria spp. in the mountains and different plantations of Leyte, Philippines, and determine their potential role in sustainable agarwood production. Insect species were collected using visual observation, handpicking, and sweep netting and were preserved in 70% alcohol and identified in the laboratory. Results show that 10 insect Orders represented by 26 families, were found in the natural habitat, while 6 orders, represented by represented by 20 insect families, were recorded in plantations. The most common insects collected and identified belonged to the families from Orders of Hymenoptera, Coleoptera, Hemiptera, Orthoptera, Blattodea, Lepidoptera, Diptera, Phasmatodea, Odonata, and Mantodea. Insect pests such as the trunk borers/feeders, including beetles (Coleoptera) can induce an immune response resulting in agarwood formation. Additionally, ants (Hymenoptera: Formicidae) were the most prevalent groups observed in almost all the inspected trees. These insects have the habit of tending fungi gardens in their nest. Fungal spores could be widely dispersed by the ants in Aquilaria trees and reportedly play a role in agarwood formation. Some insects were notably rare, suggesting their migratory and transient functions. It is necessary to conduct follow-up research to determine the potential functions of the many insect groups connected to Aquilaria species for sustainable agarwood production.

Keywords: Aquilaria, insects, sustainable agarwood production

EM-16-88

Investigating the Status of Lake Bito: Water Quality, Fish Communities, and Land Cover Analysis in MacArthur, Leyte, Philippines

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Abstract
Lake Bito is one of the major lakes in the country located in MacArthur, Leyte, Philippines. Its main economic uses are aquaculture production and eco-tourism. In recent years, Lake Bito has faced environmental challenges, including a major fish kill incident in 2012 and subsequent fish kill events. Water quality, fish abundance, participatory rural appraisal, and land cover analysis were performed to address existing knowledge gaps regarding its condition. Analysis showed that the physico-chemical parameters measured were within the limits of Class B of the Philippine water quality guidelines and general effluent standards of 2016, except phosphates. Results showed pH (.0001), BOD (.0159), and DO (.0001) exhibit seasonal variation ($p < 0.05$). A total of 354 individuals of freshwater fish from eight families and nine species were recorded. A very low diversity index (0.37) was observed, dominated by omnivorous type of forage, with no significant correlation found between the fish distribution and physico-chemical parameters ($p < 0.05$). Community-based land use maps showed significant changes in Lake Bito's watershed from 2002 to 2021, with an apparent increase in fish cages, fish pens, and fishing boats, but with decreasing fish catch in the lake. Lake Bito's watershed covers a total of 1,525.35 ha in which agricultural area dominates (58%) followed by forest areas (28.9%), water (9.39%) and built-up areas (3.63%). The study recommends the completion of diversion canals, water quality monitoring, a policy recommendation of 10% of the total land area reserved for aquacultural activities and eco-tourism development of the lake as an alternative livelihood.

Keywords: diversity, omnivores, physico-chemical and watershed

EM-16-90

Evaluation of Low-cost ORP Sensors Based on Arduino for Monitoring Treated and Disinfected Water

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Abstract

Oxidation-reduction potential (ORP) sensors are valuable tools for monitoring water's capacity to inactivate contaminants, which is essential for evaluating water treatment effectiveness. In industrial settings, ORP sensors have been used to reduce residual chlorine by optimizing disinfection methods, thereby improving water safety. However, in agricultural applications using treated wastewater, water quality monitoring tools are often limited to microcontrollers that measure a few basic chemical and physical parameters. Although ORP sensors have been employed in hydroponic systems with tap water, there is limited research on the performance of low-cost ORP sensors in monitoring treated and disinfected wastewater. This study evaluates the application of low-cost ORP sensors in treated and disinfected wastewater for agricultural reuse. Mixing treated and disinfected wastewater at varying ratios showed a positive correlation with the oxidation potential typical of disinfected water, although a longer response time was required for precise measurement. Due to the chlorine application in disinfected water, higher ORP values were expected in this treatment; however, it was the treated wastewater that showed higher ORP levels. These findings align with the concept that for water to be considered free of coliform bacteria, the ORP value must exceed 500 mV, a threshold indicating low microbial load. This was further confirmed by the presence of coliform colonies measured by the MPN method. These results suggest that ORP sensors could serve as viable, cost-effective tools for small-scale disinfection systems in agriculture.

Keywords: ORP, water quality monitoring, coliforms, low-cost sensors, microcontrollers

EM-16-91

Ecological Modelling on Forest Carbon Stocks in Mt. Apo Natural Park, southern Philippines: A Baseline Study

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Abstract

This work explored the application of remote sensing for the baseline assessment of forest carbon storage in Mt. Apo Natural Park, an ASEAN Heritage Park in the Philippines. Communities living in proximity to the forested areas face the daily survival challenge that may lead to forest cover loss. This study offers an accurate and non-destructive method for characterizing remaining forest cover in a remote location. It aimed to examine the vegetation profile and estimate species-specific biomass of Mt. Apo Natural Park, and to generate landscape-level biomass estimates using interferometric synthetic aperture radar (IFSAR). Field data on 3 management zones was gathered from 1382 trees, covering 52 local species during fieldwork in July and August 2013 before the forest fire incident in March 2016. Local insurgencies hindered our full fieldwork coverage. Referenced biomass were estimated from 3 tropical allometric equations by relating tree height, diameter-at-breast height, and wood specificity volume. A vegetation profile across the park was generated using a canopy height map across the park. Results showed that resampled IFSAR products can be used to characterize biomass and carbon storage at the landscape level and in a cloud-dense tropical location. This research has demonstrated the adoption of IPCC's Tier 2, a combination of field and remote sensing data in estimating biomass levels in a tropical forest. The maps created can assist in providing information for science-based community forest management. The forest fire incident destroyed major portions of our sampled areas. However, with this baseline study, information on carbon content can be used as a guide for the reforestation of carbon-rich native species, and to encourage potential entry into the carbon credit market to provide incentives and innovative ideas to enhance community resilience. Furthermore, this study can aid in policy implications for sustaining our cultural and national heritage.

Keywords: ASEAN heritage park, forest management, carbon stocks, remote sensing

EM-16-94

Exploring Non-economic Factors that Influence Farmers' Attitudes on Environmental Protection in Okinawa Prefecture, Japan

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Abstract

Maintaining ecosystems is a global challenge, and there is a need to reduce the environmental impact of agriculture, including soil erosion, chemical fertilizers, pesticides, and greenhouse gas emissions. In Okinawa Prefecture, a subtropical region of Japan, red soil runoff from agricultural land and construction sites is a problem that affects the health of the coral reefs surrounding the islands. Various efforts have been made in Okinawa, including enacting the Okinawa Prefecture Red Soil Erosion Prevention Ordinance, establishing a prefectural master plan for prevention of red soil, monitoring the coral reef environment based on the master plan, and supporting runoff prevention measures taken by farmers. However, estimates of soil runoff volume show that most of the soil runoff is from agricultural lands and has not decreased as much as planned, so further prevention measures must be promoted (Okinawa Prefecture, 2019). In this study, we conducted a questionnaire survey of farmers growing sugarcane on Ishigaki Island, Okinawa Prefecture, regarding their perceptions of the impact of agriculture on the environment, their actions regarding environmental conservation, and agricultural conditions that may influence these perceptions and attitudes. In addition, we analyzed the relationship between action and attitudes toward soil runoff prevention measures on agricultural lands to find effective ways to promote these measures.

Keywords: conscious behavior, island, environmental conservation, agriculture, erosion

EM-16-95

Eutrophication Evaluation and the Estimation of Methane Gas Emission from Eutrophic Reservoirs

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Abstract

Eutrophic reservoirs play pivotal roles in carbon cycles by releasing methane gas from water into the air. However, the efforts to estimate this emission have been limited by the high analysis cost and inconsistent methodological approach. Thereby, we did a survey and evaluated the violent eutrophication occurrence in the reservoirs and initiated the estimation of methane gas emission based on the Intergovernmental Panel on Climate Change guideline. The physicochemical characteristics of water, the nutrient ratio, and the trophic state status in two observed reservoirs, Bueng Si Than and Bueng Kaen Nakhon, Thailand, were carried out. The results demonstrated the violent eutrophication phenomenon at a hypertrophic level. The high TKN: TP ratio of 20.24 indicated the TP limitation in Bueng Si Than whereas the low value of TKN: TP ratio of 4.87 pointed that the TKN was a limiting nutrient factor for algal bloom in Bueng Kaen Nakhon. The TSI (TP) and the TSI (Chl *a*) of higher than 70 scores were suited for confirming hypertrophic status in both reservoirs. The average scores ranged from high to low, as follows: TSI (Chl *a*), TSI (TP), and TSI (SD), with a significant difference ($p < 0.001$) among the two reservoirs. The high coefficient of the range was found in TSI (TP), 13.14%, and 4.89% in Bueng Si Than and Bueng Kaen Nakhon. Furthermore, the estimation of methane gas emission was achieved on the average of 303.41±25.12 $kgCH_4d^{-1}$ and 1449.23±186.77 $kgCH_4d^{-1}$ in Bueng Si Than and Bueng Kaen Nakhon, respectively. In addition, the relation between Secchi depth and chlorophyll *a* with the estimated methane gas emission was obtained in this study. However, the maximum Secchi depth is in the range of 0.38-0.43 m. obtained from the simulation was preliminary recommended for the estimation of methane gas emission from eutrophic reservoirs.

Keywords: eutrophication, greenhouse gas, chlorophyll *a*, nutrients, eutrophic reservoir

EM-16-96

Impact of Biochar Application on Soil pH and Electrical Conductivity in Andosol Under *Avena sativa* Cultivation

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Abstract

Biochar, a carbon-rich material derived from the pyrolysis of organic matter, has emerged as a promising soil amendment for enhancing soil properties. It has been shown to increase soil pH, boost microbial activity, improve nutrient retention, and enhance water-holding capacity. When applied to acidic soils, biochar can help neutralize pH and improve nutrient availability, creating a more favorable environment for crop growth. However, the effects of biochar vary significantly depending on soil type, crop species, and biochar application rate. This study explores the impact of biochar application made from branches and twigs on soil pH and Electrical Conductivity (EC) in andosol, under oat (*Avena sativa*) cultivation. Biochar was applied at rates of 0, 2, 4, and 8 tons per hectare, and soil pH and EC were monitored over two and a half months. The results show that biochar initially increased soil pH, with higher application rates (4 and 8 Mg/ha) reaching mildly alkaline levels favorable for leguminous crops. However, soil pH gradually declined over time, suggesting a temporary alkalizing effect. Similarly, EC increased significantly following biochar application, particularly at higher rates, indicating improved nutrient availability in the early growth stages. This effect also diminished over time, stabilizing at lower levels by the end of the study. These findings highlight biochar's potential as a short-term soil amendment for pH and nutrient enhancement in acidic soils, benefiting crops like leguminous oats. The study emphasizes the need for periodic applications or combined soil management strategies to sustain soil quality improvements. This research contributes to sustainable agriculture by offering insights into biochar's role in enhancing soil health and productivity. Further research on biochar's long-term effects and interactions with other soil amendments could help optimize its use for sustainable crop production.

Keywords: biochar, andosol, soil pH, electrical conductivity, oat (*Avena sativa*), soil amendment

EM-16-97

Flood Vulnerability and Risk Assessment of the Physical Assets of an Island Community in Brgy. Binuangan, Obando, Bulacan, Philippines

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Abstract

Barangay Binuangan, an island community in rural Obando, Bulacan, Philippines has formed due to persistent land subsidence and flooding. The community has experienced prolonged rainfall and riverine flooding, leading to its isolation from the mainland. Despite exposure to multiple hazards, residents remain limited in their capacity to mitigate the impacts as they decide to stay on the island because of economic reasons. This study aims to assess flood vulnerability and risk, focusing on the community's physical assets. Unpredictable river level rises and strong winds during typhoons continue to challenge Barangay Binuangan. Initially, residents responded by periodically raising infrastructure, but they have recently adopted a more permanent solution which is abandoning ground-level spaces and extending to higher floors to reduce exposure and potential casualties. Data were gathered through site observations, interviews, self-directed surveys, risk assessment tools, and historical data review. Analysis shows that most cataloged assets are residential, with the majority in fair to poor condition, heightening flood vulnerability. 45% of these are located in high-exposure areas, creating significant risks, especially during severe weather events. Although efforts such as infrastructure elevation and sandbagging are in place, financial constraints and inconsistent application reveal notable gaps in preparedness and resilience. Geographic Information System (GIS)-based flood projections for 5- and 25-year return periods indicate worsening risks, particularly in low-lying areas, with storm surges adding to the threat. These findings emphasize the need for comprehensive flood management strategies incorporating community-based approaches and modern infrastructure solutions, such as floating architecture, particularly applicable to rural areas in the Philippines.

Keywords: island community, riverine flood, flood vulnerability, physical asset risk assessment

EM-16-99

Evaluation of Environmental Factors Influencing Revocation of Bauxite Mine Development in the Solomon Islands

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Abstract

The small island of Wagina is part of the Solomon Islands located in the South Pacific Ocean,1700 km northeast of Australia. Wagina Island has an area of 110 km^2 with 60% of the island (48 km^2) containing an economic quantity of bauxite. A proposed mining tenement would remove 2000 ha of virgin forest and displace 2000 residents. Removal of 150 truckloads of bauxite/day would continue for 20 years and have environmental impacts on water quality, air quality, ecology, and marine environment. It would also have effects on the residents relying on the sea and land for their existence. The mining company Solomon Bauxite Limited (SBL) had been granted a prospecting license over Wagina Island in 2011 and a development consent in 2013. In 2018 residents of Wagina opposed developing the bauxite mine. In 2019 the Landowners Advocacy and Legal Support Unit (LALSU) within the Solomon Islands Public Solicitors Office (PSO) represented the Wagina Island residents in 2018. The Solomon Islands Environment Advisory Committee (EAC) convened for the first time in 2018 since the 1998 introduction of the Environment Act 1998. All grounds presented by LALSU were upheld by the EAC providing a historic defeat of the bauxite mine development. The focus of the paper is to evaluate the environmental factors that influenced the revocation of the bauxite mine development. The EAC decision was based on: '(i) legislative procedures for public consultation and publication of the Environmental Impact Statement (EIS) were not followed; (ii) the EIS did not meet legislative and regulatory requirements; (iii) the decision to issue a development consent is inconsistent with the Convention on Biological Diversity and the Declaration on the Rights of Indigenous Peoples; and (iv) the unacceptable impacts to the environment, to the residents of Wagina and their livelihoods and on nearby islands and marine environment'. The residents were represented by a legal officer from LALSU, an Australian barrister, and four scientific experts who emphasized 'grave deficiencies of the environmental impact statement'. The decision was a win for the Wagina people and the environment of the Solomon Islands by incorporating an independent legal appeals process and the building of environmental law capacity in the Pacific region.

Keywords: Bauxite, impacts, landowners, legislative procedures, environmental law

EM-16-102

Assessing the Impact of Environmental Influences on Water Quality Indicators in the Kemena River (2018–2022): A Multi-Location Graphical Analysis

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Abstract
Water quality monitoring is a vital tool for assessing the health and sustainability of aquatic ecosystems. This study evaluates the water quality of the Kemena River across four locations in Bintulu, Sarawak which is Bandar Bintulu, Pekan Sebauh, Jambatan Kemena, and Pekan Tubau, over the period from 2018 to 2022. Key water quality parameters, including Dissolved Oxygen (DO), pH, Temperature, Electric Conductivity (EC), Salinity (SAL), and Turbidity (TUR), were analyzed to assess spatial and temporal variations that may impact aquatic life and ecosystem health. Results show that DO levels generally remained stable across all locations, with minor fluctuations between 5 and 8 mg/l, supporting a conducive environment for aquatic organisms. pH values ranged from slightly acidic to neutral, mostly staying within 6 to 8, with occasional dips likely due to seasonal or environmental factors. Temperature remained stable between 25°C and 30°C, indicating consistent thermal conditions beneficial for riverine ecosystems. However, significant anomalies were observed in conductivity and salinity, particularly in 2019, with sharp spikes reaching up to 40,000 µS/cm and 25 ppt, respectively, suggesting possible episodic pollution events or saltwater intrusion. Turbidity also exhibited high variability, with peaks exceeding 200 NTU, notably in 2019 and 2020, likely due to increased sedimentation from rainfall or anthropogenic activities. These fluctuations in water quality parameters underscore the potential impact of external influences on river health and highlight the need for ongoing monitoring to manage and mitigate adverse environmental effects. This study provides a baseline understanding of the Kemena River's water quality and can guide future conservation and management efforts to sustain its ecological integrity.

Keywords: Kemena River, water quality analysis, environmental monitoring

EM-16-103

Implementation of Climate-Smart Village Through Soil and Water Conservation to Support Watershed Conservation

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Abstract

The Climate-Smart Village (CSV) approach integrates sustainable land and water conservation practices to enhance watershed resilience and community livelihoods, particularly in areas prone to land degradation and climate variability. This study evaluates the CSV framework implemented in Leksana village, Banjarnegara, Indonesia, located in the upstream area of Merawu watershed. The research highlights traditional and modern conservation techniques, such as agroforestry, terracing, and rainwater harvesting systems (embungs), that mitigate soil erosion, improve water retention, and stabilize agricultural yields. Emphasizing community participation, the CSV model aligns conservation practices with local knowledge and environmental priorities, offering a replicable strategy for similar vulnerable regions. The study employed a mixed-methods approach, combining field observations, community surveys, and focus group discussions to gather qualitative and quantitative data on local conservation practices. Effectiveness metrics, such as sediment retention, water table stability, and crop yield resilience, revealed the interventions' ecological and economic benefits. Results indicated that mechanical techniques like terracing and embungs were particularly effective in managing runoff and preventing soil erosion. At the same time, agroforestry practices, including coffee cultivation, contributed to long-term soil fertility and climate adaptation. However, challenges such as limited adoption of contour planting and organic mulching underscore the need for enhanced community education and technical support. This research underscores the importance of integrating community-driven and climate-resilient strategies within the CSV framework to address environmental challenges and support sustainable livelihoods. By fostering local ownership and prioritizing practices like agroforestry and embungs, the study demonstrates how tailored conservation models can achieve ecological sustainability and social acceptance. The findings provide valuable insights into implementing watershed management strategies in other regions affected by land degradation and climate change.

Keywords: climate-smart village, soil and water conservation, agroforestry, watershed management, community-driven sustainability

EM-16-104

Mapping Land Use Shifts in Nepal's Protected Regions: Insights for Biodiversity and Resource Management

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Abstract

This study investigates the temporal dynamics of Land Use and Land Cover (LULC) changes across 13 protected areas with established buffer zones in Nepal from 1990 to 2021. Utilizing data from the National Land Cover Monitoring System (NLCMS) and advanced remote sensing techniques, the research quantifies significant transitions in land cover categories and evaluates their implications for biodiversity conservation and ecosystem management. Four time periods were considered where 1990, 2000, and 2010 maps were obtained from the NLCMS-Nepal government while the 2021 map was generated in GEE by using the 2010 data as a basis for supervised classification using a random forest algorithm along with Google Earth map The analysis, conducted using Land Change Modeler (LCM) within TerraSet IDRISI software, reveals substantial transformations across various land cover categories. Forest cover exhibited fluctuation, initially decreasing from 8,100.83 km² in 1990 to 7,715.32 km² in 2000, before recovering to 8,334.71 km² by 2021. Notably, shrubland demonstrated the most significant expansion with a net increase of 3,696.14 km², while grassland experienced a dramatic decline with a net decrease of 3,120.31 km². The study identified 54 distinct land cover transitions, with the most substantial conversion occurring from forest to shrubland (470.86 km²). The research documents significant changes in other land cover categories, including an expansion of built-up areas from 4.06 km² to 69.38 km², indicating increased anthropogenic pressure. Snow/glacier areas showed notable fluctuations, with a net expansion of 612.78 km², potentially reflecting climate change impacts. Water bodies experienced a continuous, albeit slight, reduction throughout the study period, while agricultural areas demonstrated a gradual increase until 2010, followed by a modest decline by 2021. Analysis of buffer zone areas revealed distinct patterns, with forest cover showing resilience despite initial declines, increasing from 4,731.89 km² in 1990 to 5,021.95 km² in 2021. Built-up areas within buffer zones expanded significantly from 0.19 km² to 34.08 km², highlighting growing urbanization pressures. These findings underscore the complex interplay between conservation efforts and development pressures in Nepal's protected areas. The study's results provide crucial insights for conservation planning and policy development, emphasizing the need for targeted interventions to address habitat fragmentation and anthropogenic impacts while maintaining ecological connectivity. These findings are particularly relevant for Nepal's unique geographical context, spanning from tropical lowlands to high-altitude Himalayan ecosystems, and can inform sustainable management strategies for protected areas facing similar challenges globally.

Keywords: Land Use Land Cover (LULC), protected areas, conservation, Nepal, remote sensing, buffer zones, ecological monitoring, biodiversity

EM-16-105

Effects of Formation of Plowsole Layer in Peat Farmland on Field Drainage

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Abstract

This study investigates the effects of plowsole layer formation on field drainage in peat farmland. The research was conducted in an upland field in Iwamizawa city, Hokkaido prefecture, where drainage problems occurred in peripheral areas despite the installation of underground drainage systems. The methodology included three main components: measuring penetration resistance and soil moisture content at 130 points, acquiring multispectral images using UAV-mounted cameras, and interviewing farming practices. If the penetration resistance was 1,500 kPa or more, it was determined that a plowsole layer had formed. Soil moisture mapping was performed using the relationship between D-value (derived from Red and NIR spectral images) and volumetric water content. Despite annual plowing, plowsole layers were detected at 77 out of 130 measurement points. This high occurrence was attributed to increased soil compaction from frequent pest control operations due to recent hot and rainy weather conditions. The field's peripheral areas showed a particularly high proportion (65%) of plowsole layer formation, correlating with higher average moisture content. In contrast, the central area had a lower proportion (48%) of plowsole formation, with no significant difference in soil moisture content between points with and without plowsole layers. The findings confirmed that plowsole layer formation significantly affects drainage problems in the field's peripheral areas. The absence of similar trends in the central area was likely due to the breaking up of plowsole layers by pre-wheat seeding plowing, suggesting that proper field management can improve drainage conditions. Future research should consider additional factors such as uneven subsidence of peat soil and variations in topsoil thickness caused by tillage operations.

Keywords: penetration resistances, soil line, plowing

ESD-16-02

The Safe Rice Cultivation Promotion Project is a Particular Concern of Cargill Cares project: A Case Study in Nakhon Ratchasima Province, Thailand

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Abstract

This study aimed to evaluate the safe rice cultivation promotion project that is a particular concern of Cargill for knowledge development and rice production efficiency development. Data were collected from 104 farmers who participated in the training, covering a rice cultivation area of 290.48 hectares in Kratok Subdistrict, Chokchai District, Nakhon Ratchasima Province. The methods used were questionnaires, interviews, and observation. The statistics used for analysis were descriptive, mean, standard deviation, and percentage. The results of the study found that farmers who participated in the project had a higher level of knowledge and understanding of all 7 topics after the training. All farmers were able to harvest an average paddy yield after participating in the project (4400 kg/hectares), resulting in income per area after participating in the project of 404,631.7 USD. In addition, the measurement of the level of knowledge gained found that farmers have used the best and highest quality rice seeds at 94.00 percent, followed by harvesting at the right time at 93.66 percent, using fertilizer at 92.00 percent, etc. From the assessment of farmers' satisfaction with the Cargill Cares project, it was found that farmers were very satisfied at 85.0 percent and moderately satisfied at 15.0 percent. This project succeeded in incentivizing farmers to grow safe and environmentally friendly rice. The transfer of knowledge on the management and efficient use of water for safe rice cultivation is beneficial in developing the knowledge base of farmers as well as being able to apply technology to rice cultivation.

Keywords: safe rice cultivation, knowledge transfer, efficiency development

ESD-16-06

Factors of Influencing Household Water Supply Contracts in Jakarta

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Abstract

In Jakarta, recent increases in flood damage have raised major concerns about the rise of waterborne diseases. Expanding the water and sewage systems is recognized as an essential countermeasure against diseases transmitted through contaminated water. Although pipeline installations are largely complete, water supply system coverage in Jakarta remains at approximately 60%, largely due to incomplete household-level connections, as each household must individually contract water services. Therefore, this research aims to identify the factors of decision-making in households about water supply system contracts. In February 2024, a questionnaire survey was conducted with 523 households across two districts in West Jakarta, gathering responses from 342 households who have contracts for water supply and 136 non-contracted households. Logistic regression analysis of the data identified notable predictors for contracting water services. Households that consider themselves responsible for flood damage were approximately 2.5 times more likely to have a water supply system contract, a finding statistically significant at the 5% level. In contrast, households that prepared medical supplies for flood events were less likely to contract water services compared to those that did not prepare. These results suggest that awareness of self-responsibility for flood risk may influence water supply contracting. On the other hand, households that take independent measures, such as stocking medical supplies, may feel less dependent on the water services, because they have alternative sources of water or a preference for self-sufficiency.

Keywords: flood damage, waterborne disease, water supply system contracts, household decision factors, logistic regression analysis

ESD-16-09

Effects of Vermicompost on Soil properties, Growth, Physiology, and Yield of Chili Production Under Moderately Saline Soil in Greenhouse Condition

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Abstract

The study investigates the effects of vermicompost on the growth physiology and yield of chili plants grown in moderately saline soil under greenhouse conditions. The objective was to observe changes in the chemical properties of saline soil when treated with vermicompost combined with organic growing media. The results showed that applying 1,000 g of vermicompost per pot led to a decrease in soil salinity, the electrical conductivity from 5.49 to 2.75 dS/m. Furthermore, the application of vermicompost significantly increased the levels of nitrogen, phosphorus, potassium, calcium, magnesium, and organic matter in the moderately saline soil. In terms of plant growth, the use of vermicompost per pot resulted in the tallest chili plants. An increase in dry weight was observed in the roots, stems, and leaves, demonstrating a direct correlation with the amount of vermicompost used. Specifically, the dry weight of stems and leaves was higher compared to the control group (without vermicompost), and the dry weight of roots was higher. The application of vermicompost also significantly enhanced both the length and volume of the chili plant roots, consistent with the increase in root dry weight. Regarding chili yield, plants grown in moderately saline soil with 1,000 g of vermicompost per pot successfully flowered and produced fruit. In contrast, when lower amounts of vermicompost (750 g, 500 g, and 250 g per pot) were used, the plants flowered but the flowers fell off without producing fruit. Notably, chili plants grown without vermicompost (control) perished 58 days after transplanting. In conclusion, applying 1,000 grams of vermicompost per pot positively altered the chemical properties of moderately saline soil, creating conditions favorable for the growth and yield of chili plants under salinity stress. This approach represents a viable alternative for rehabilitating and developing saline soil areas to support plant growth using vermicompost along with organic planting materials.

Keywords: vermicompost, soil properties, moderately saline soil, growth, physiology, chili

ESD-16-10

Building Sustainable Futures: PNS Compliance in Organic Agriculture for Climate Resilience

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Abstract

Organic agriculture in the Philippines is increasingly recognized by the government as a vital strategy for broad-based growth and development, particularly in the context of global climate change. The development of the Philippine National Standards (PNS) on Organic Agriculture seeks to address climate-related challenges specific to organic farming, develop targeted adaptation measures, and promote new strategies such as proactive risk management and adaptive behavior. This study aims to assess the role of PNS for organic agriculture in formulating effective climate change mitigation strategies. Utilizing key-informant interviews as a data-gathering method, the main objective is to identify the organic agriculture practices that align with PNS guidelines and evaluate the impact of PNS compliance on environmental improvement and biodiversity enhancement in organic agriculture. The findings revealed that technical training and adherence to these standards have fostered in-depth knowledge and innovation among farmers, enabling them to implement adaptive measures in response to changing temperatures and more frequent extreme weather events. Additionally, this process has inspired many to embrace organic agriculture as a sustainable lifestyle. The experiences and lessons learned by organic producers can be useful in the development of program strategies for policymakers, academics, and farmers, contributing to a more sustainable agricultural community.

Keywords: organic agriculture, climate change, Philippine National Standards, sustainable agriculture, environmental education

ESD-16-11

Integration of Skill Development Programs in Secondary Schools towards Education for Sustainable Development in Cambodia

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Abstract

Awareness and implementation of Education for Sustainable Development (ESD) across secondary schools is remarkably low in Cambodia. Especially, this trend is more obvious in remote areas than in urban areas such as Phnom Penh. More efforts are needed to embed sustainability principles deeply into the curriculum and make it more context-relevant and practical. Income generation skills—with their systemic perspective on farming practices—present one solution for building more climate-resilient farming and household economics. This paper aims to evaluate the ESD activity for integrating context-knowledge on climate-resilient farming systems through the development of income generation skills-based education programs, which were implemented in secondary education by Cambodian higher education institutions, including the University of Heng Samrin Thbongkhmum (UHST). The UHST provided income-generation-skills training, together with a business development plan, to 32 public secondary schools (25 high schools and 7 secondary schools). Four agricultural skills trainings were developed, including 1) animal production, 2) vegetable production, 3) aquaculture production, and 4) poultry production to support a total of 80 target teachers and 1,174 students, respectively. The 32 schools got a series of training on agricultural skills provided by UHST, and the students who joined in the ESD activities were 402 (89%), while the target was 450. After being trained, monitoring and evaluation were made by collecting data through an in-depth questionnaire survey at the implemented schools. Pre-survey and post-survey were also conducted for various comparisons for the assessment. As the outcome of this training, 80 business plans among 82 were set up; 53 already had certain incomes, while the other 24 were growing to raise income to cope with the impact of climate change, and 3 are under progress in March 2024. Students' perception of the agricultural roles in sustainable development with raising resiliency against climate change was deepened with an understanding of the natural environment. The detail results are discussed in the presentation.

Keywords: secondary school, education for sustainable development, skill-based education

ESD-16-12

Cross-Subject Learning with Local Nature and Environment in Thailand

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Abstract

The project "Learning by Local Nature and Environment" was introduced to a group of secondary schools in the Northeastern region of Thailand, in 2016 by the Multidisciplinary Research Center for Environmental Sustainability (MRCES), Mahasarakham University. The project aims to promote a new approach to learning about nature and how to make it locally sustainable. Utilizing natural landscapes as classrooms, called "Nature Classroom", the project has dedicated the most learning processes to the field studies and incorporated the unique local culture, wisdom, and indigenous knowledge into the learning activities. In the beginning, all participating schools incorporated these lessons with only a science subject. However, the project attempted to promote the learning experience with nature and environment to other subjects or fields of study as well. We started the project "Cross-subject learning with local Nature and Environment" in 2022 with 6 schools. By taking a local nature- and environment-based learning approach, the cross-subject integration programs were created by school teachers from various subjects, such as Science, Mathematics, English language, Thai language, Arts, etc. The project has successfully incorporated the new learning program into the local schools and sustainably operated the programs by our local teacher network.

Keywords: local lesson, nature-based learning, environment-based leaning, environmental education, capacity building

ESD-16-13

Assessment of Deforestation and Community Impact: Lessons from an Environmental Awareness Program in Siem Reap Province, Cambodia

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Abstract

In Siem Reap Province, rapid deforestation has occurred, leading to a loss of 75% (153,000 ha) of humid primary forest that existed in 2001. The main driver of forest loss is a rapid expansion of industrial agriculture influenced by trading companies exporting raw materials such as cassava. Recent forest loss may have negatively impacted rural communities in which the residents traditionally relied on forest resources for their livelihoods. Therefore, this study aims to assess deforestation and how the forest loss has impacted their livelihood. The target community is Kna Krao Village in Svay Leu District, and the assessment involved integrating multiple data sources. The sight-specific image analysis was carried out by Global Forest Watch (GFW), and Participatory Rural Appraisal (PRA) as well as a questionnaire survey were conducted under an ESD project facilitated by an International NGO. The PRA tools, such as Timeline and Resource Map were designed to grasp i) the villagers' perception of the land use change over time, and ii) the villagers' demand for specific tree species and location for planting. The questionnaire survey was conducted on 24 key villagers to evaluate iii) the degree of forest resources dependency between now and past, and iv) the locations of forest resources. The results showed that a strong correspondence was observed between the decline in forest area, as shown by GFW, and the Timeline based on the villagers' perception. Also, the degree of villagers' dependency on both Timber-forest Products (TFPs) and Non-timber Forest Products (NTFPs) decreased after 2000, and these trends are strongly correlated with the forest area. However, the overall result indicated that villagers are still utilizing and consuming forest resources in their daily lives. Promoting sustainable forest regeneration and resource-sharing practices is urgent to secure the livelihoods and preserve the traditions of local communities.

Keywords: Cambodia, deforestation, participatory rural appraisal (PRA), timber-forest products (TFPS) and non-timber forest products (NTFPS)

ESD-16-15

Adoption of Agricultural Practices and Technologies in SEARCA Theses and Dissertations

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Abstract

This paper examines the adoption of agricultural practices and technologies in Southeast Asia, focusing on research conducted by SEARCA scholars from 2013 to 2023. The study analyzes 21 theses and dissertations to explore common drivers, challenges, and strategies related to agricultural technology adoption among smallholder farmers. Findings reveal that the scholars' work primarily addresses sustainable and conservation practices, with limited attention to advanced technologies of Agriculture 4.0 and 5.0. Key factors influencing adoption include economic profitability, risk perception, information access, and the compatibility of new practices with local culture and traditions. Government and extension services emerge as crucial facilitators, although informal knowledge sharing, religious beliefs, and traditional wisdom play significant roles in certain contexts. The study highlights the need for participatory approaches, culturally aligned communication, and government-industry collaboration to enhance adoption rates and promote sustainable agriculture across the region.

Keywords: agricultural technology adoption, communication strategies in agriculture, extension services, education for sustainable development

ESD-16-20

Advancing Conservation Strategy Research to Support the Visayas State University's Core Programs in the Philippines

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Abstract

The Philippine government recognizes that reforestation can reverse the loss and degradation of forests. However, many reforestation programs rely on planting fast-growing exotic species, which limits the restoration of natural forests and ecosystem services. To address this issue, the Visayas State University (VSU) has developed the Rainforestation Technology. This strategy is a community-based forest restoration and biodiversity conservation approach that emphasizes the use of indigenous and endangered species. Through scientific research, the University aims to encourage greater assistance and investment in this knowledge-driven approach. These efforts primarily focus on providing substantial support to the University's research, extension, innovation, and instruction programs. The VSU's research on promoting the use of native species has resulted in a widespread network of experts in the Philippines and worldwide. It has been a way to connect more Rainforestation adopters and establish a number of demonstration sites across the country. By advocating the use of indigenous species, the VSU has not only contributed to the preservation of local ecosystems but also helped establish a national standard for sustainable resources, nursery establishment, and management. Lastly, the notable achievements of VSU have contributed to a rise in the number of students interested in programs related to environmental science, tropical ecology, and forest sciences. These programs have been designed to provide students with a comprehensive understanding of these fields and equip them with the necessary skills on the Philippines' biodiversity conservation.

Keywords: Philippines, Visayas State University, rainforestation, Indigenous and endangered species

ESD-16-21

Enhancing Agricultural Extension Through Automation: Evaluating the Functionality and Effectiveness of a Programmable Logic Controller and Arduino-Based Instructional Device

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Abstract
This study aimed to design, develop, and evaluate the functionality and effectiveness of an Automation Controller utilizing both Programmable Logic Controller (PLC) and Arduino as a practical instructional device. Intended for agricultural extension and education, this tool supports trainers in enhancing farmer's, understanding and application of automation for modern agricultural practices, including motor control for irrigation, automated feeding systems, and precision robotic systems. Conducted at Bohol Island State University – Main Campus, Tagbilaran City during the 2021-2022 academic year, the study employed an experimental one-group pre-test and post-test design to assess the impact of hands-on learning with the automation device. Results revealed a notable improvement in participants' skills, with average ratings increasing from 1.64 (pre-test) to 3.36 (post-test). This finding underscores the value of experiential, hands-on training in enhancing technical competence, as participants gained skills essential for sustainable and efficient agricultural production. By integrating Industry 4.0 concepts, this instructional device empowers agricultural extension workers and farmers, fostering capacity building and supporting the transition to sustainable, technology-driven agricultural practices.

Keywords: agricultural extension, instructional device, sustainable agriculture, programmable logic controller, Arduino, Industry 4.0

ESD-16-23

Willingness and Perceptions Towards the Philippine Accounting Standard 41: The Case of Agritourism Farms in the Philippines

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Abstract

The implementation of an accounting standard for agriculture has been received with mixed reactions and varying levels of willingness across sectors and regions. As the agritourism farms in the Philippines were classified as MSMEs, there has been little awareness of managing the farm's biological assets (living animals and plants), particularly how these assets must be recognized, measured, presented, and disclosed in the farm financial records. If biological assets are not accounted for in the financial statements, it may lead to inaccurate reporting and decision-making. This study assessed the accounting practices of agritourism farms in Region IV-A and determined the willingness and perceptions of agritourism farm operators and other stakeholders towards the Philippine Accounting Standard (PAS) 41. A survey was administered to 17 agritourism farm operators, complemented by key informant interviews with technical experts, auditors, and government officials. Mean rating analysis was employed to analyze the willingness of the agritourism farm operators, while thematic analysis was used to analyze the qualitative responses. The results of the study showed that the adoption of the Philippine Accounting Standard (PAS 41) in farm accounting practices is shaped by a complex interplay of economic, operational, and regulatory factors. They showed willingness to use the accounting standard but were hesitant about how it would be implemented. While the fair value approach provides a more accurate reflection of farm assets and offers long-term sustainability benefits, its implementation faces challenges due to complexity, resource constraints, and the current reliance on cost-based measurements. The findings suggest that widespread industry adoption, supported by comprehensive training and regulatory guidance, could enhance compliance. Ultimately, a collaborative effort within the agricultural sector and tailored support mechanisms will be essential for successfully integrating PAS 41 into farm accounting practices.

Keywords: PAS 41, accounting standard, agriculture, thematic analysis, willingness, perceptions

ESD-16-24

The Rama' Fishing Practice Towards Innovative Local Teaching Pedagogy

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Abstract

This study delves into the Ilokano local construct of rama', a unique, locally-based fishing technique employed to catch fish species in the Northern part of the Philippines, specifically along the Magat River of Vista Alegre, Bayombong, Nueva Vizcaya. The rama' culture centers on the collective wisdom and practices of the local fishing community, all aimed at ensuring the sustainability of their fishing endeavors. What makes this local culture particularly captivating is the interplay of cultural knowledge, fostering engagement among locals that captures the nuances and complexities of maintaining a sustainable environment. With the arrival of summertime, the fisherfolk community eagerly prepares for the rama' tradition, which extends beyond a mere account of fishing activities. It serves as a lens through which to explore the dynamic social fabric of the community, shedding light on the reconfiguration of social relationships, the importance of family bonds, sources of entertainment, and the everyday experiences that define their way of life. This local practice of fishing seeks to uncover the subtleties, gaps, and challenges inherent in the rama' practice, especially in the understanding of local fishing practices in the Philippines, which in turn helpful in universities that offer Fisheries courses vis-a-vis its implications to culture's interplay of local knowledge, local ways of knowing and/or methodologies, institutions' roles and engagements with various stakeholders.

Keywords: local knowledge, rama' fishing practice, community engagement

ESD-16-25

Human Well-being and Personal Well-being in Remote, Isolated and Vulnerable Communities in Central Visayas, Philippines: The Case of the Island-Barangays of Bohol

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Abstract

This is a study on human well-being and personal well-being of the residents of the remote, isolated, and vulnerable island-barangays of Bohol in Central Philippines that was part of the overarching task of determining the sustainability of island communities. The variables assessed for human well-being included (1) material needs for a good life, (2) experience of freedom, (3) health, (4) personal security, and (5) good social relations while those for personal well-being were (1) standard of living, (2) health, (3) achievement in life, (4) personal relationships, (5) safety feeling, (6) being part of the community, (7) future security, and (8) religion. Data were gathered through a survey of 384 randomly selected respondents as well as through Key Informant Interviews in 9 sites. Results reveal that in human well-being, the mean values or scores of each of the island barangays were described as "fair." Overall, they had a mean score of 67.0 which described their human well-being as "fair" implying that they were at a better level of socio-economic sustainability or human well-being. For personal well-being, the aggregate mean revealed that 8 island-barangays had mean values or scores that were labeled "satisfied," while only one had a mean value or score that was labelled "neither satisfied nor dissatisfied." Overall they achieved a mean value or score of 68 which is described as "satisfied" indicating that the island residents in the 9 sites generally had better personal well-being. Given the results, despite their remoteness, isolation, and vulnerability, the island-barangays of Bohol manifested a better state of human well-being and personal well-being. It is recommended that the results of this study be disseminated to the National and Local Government Units as well as to development-oriented groups for policy development and intervention.

Keywords: human well-being, personal well-being, vulnerable communities, island- barangays, sustainable development

ESD-16-26

Biochar Application for Soil Health Enhancement and Compaction Reduction in Morogoro Region, Tanzania

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Abstract

Agriculture is a crucial economic sector in Tanzania, contributing approximately 45% to the national GDP and around 30% of export earnings. However, low productivity, particularly in irrigation schemes like the Dakawa Irrigation Scheme (DIS) in the Morogoro Region, hinders growth. Soil degradation, compaction, and nutrient depletion are significant challenges contributing to low yields, especially for rice crops, which dominate production at DIS. This study explores the use of rice husk biochar as a soil amendment to enhance soil health, reduce compaction, and improve overall productivity. Biochar, a carbon-rich material derived from the pyrolysis of organic matter, is increasingly recognized for its potential to boost soil fertility and reduce greenhouse gas emissions. In this research, soil samples from DIS were treated with varying biochar concentrations (2.5%, 5%, 7.5%, and 10%) and examined for bulk density, organic matter, organic carbon, and permeability. The results showed that biochar application significantly enhanced soil physical and chemical properties by increasing soil organic carbon, reducing bulk density, and increasing soil porosity thus enhancing water retention and infiltration—a critical factor for effective irrigation. A 5% biochar application rate (52.15 t/ha) was identified as the most cost-effective and suitable concentration, particularly for smallholder farmers in Tanzania. This application rate not only improved soil health but also aligns with sustainable agriculture practices by contributing to greenhouse gas mitigation. The findings suggest that biochar is a viable solution for improving soil conditions and productivity in Tanzanian irrigation schemes, ultimately supporting economic growth and sustainability in the agricultural sector.

Keywords: biochar, soil health, agricultural sustainability

ESD-16-27

Hospitality and Cybersecurity Amid Conflict: Ethical Concerns for Securing Guest Data

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Abstract
During times of conflict, the hospitality industry faces a distinct set of challenges, among them the critical responsibility of safeguarding guest data and ensuring cybersecurity amidst heightened security threats. The convergence of ethical obligations and the pragmatic necessities of operating in conflict zones necessitates a nuanced examination of the industry's ethical responsibilities. Within this context, the protection of guest information becomes not just a technological concern but a profound ethical imperative. This investigation delves into the complex moral landscape confronting hospitality businesses during conflicts, exploring the tensions between maintaining data security, preserving guest privacy, complying with legal mandates, and operating within resource-constrained environments. The ethical considerations and decisions made in safeguarding cybersecurity during conflict situations have far-reaching implications, influencing trust, reputation, and the fundamental rights of guests amidst adversity.

Keywords: hospitality, cybersecurity, conflict, ethical concerns, securing guest data

IS-16-02

Factors Affecting the Intention to Use Mechanized Harvesters of Sugar Farmers in Tarlac Province

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Abstract

Historically, sugar harvesting in the Philippines has relied on manual labor and traditional methods. However, this practice poses several challenges such as labor shortages, increasing labor costs, and productivity limitations. Several studies found the implementation of mechanized harvesters presents an opportunity to address these challenges. Mechanized equipment offers the promise of increased efficiency, reduced dependency on manual labor, enhanced productivity, and potentially higher yields in sugar cane harvesting. The successful adoption and implementation of mechanized harvesters by sugar farmers in Tarlac Province depends significantly on the acceptance of this technology. The study focuses on small- and medium-to-large-scale sugarcane farms in Tarlac Province, utilizing the Technology Acceptance Model (TAM) and Technology Readiness Index (TRI) frameworks to explore how optimism, innovativeness, anxiety, and insecurity, along with socio-demographic factors such as education and income, impact farmers' perceptions of mechanized harvesters' ease of use and usefulness. Findings from the survey data from 381 sugarcane farmers and a semi-structured interview suggest that optimism and innovativeness positively influence the perceived ease of use and usefulness of mechanized harvesters, while anxiety and insecurity hinder technology adoption. Interestingly, socio-demographic factors, especially education level, play a significant role in shaping farmers' perceptions. In addition, the current model of access variably skews farmers' perceptions by limiting access to mechanized harvesters.

Keywords: mechanization, mechanized harvesters, intention to use, technology acceptance, technology readiness, sugarcane

IS-16-03

Feasibility of Low Water Level Management in Irrigation Ponds: Focusing on Baseflow and Water Storage Recovery Periods in Oro River Basin, Tottori

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Abstract

Japan has about 200,000 irrigation ponds, primarily located in areas with low rainfall and regions lacking nearby rivers. These ponds play a critical role in supplying irrigation water for paddy fields, which is their main purpose, while also serving as sources for domestic water and fire-fighting water throughout the year. In recent years, Japan has experienced an intensification and increase in the frequency of heavy rainfall events from summer to autumn (July to September), leading to an increase in water-related disasters. There has also been a rise in disasters caused by heavy rainfall in these irrigation ponds as well. To address this issue, one of the flood control methods for irrigation ponds is low-water level management. By maintaining lower water levels, it is expected that the risks of dike breaches due to overtopping will be minimized, and peak flow rates into rivers will also be reduced. However, implementing low-water level management may lead to the potential risk of not being able to secure sufficient water supply. This study evaluates the feasibility of implementing low-water level management across 72 irrigation ponds in the Oro River Basin in Tottori Prefecture. We calculated the recovery period for water storage using only baseflow to determine whether it is possible to maintain low water levels without compromising necessary water supplies. The results indicate that low-water level management can be implemented in many ponds without significant concerns over water availability, supporting its potential as an effective flood control measure.

Keywords: low water level management, baseflow, hydrological observation

IS-16-04

Evaluation of Tensile Strength of Tissue Culture-Derived Bamboos of VSU

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Abstract

Bamboos are proven to be of valuable economic, sociological, and environmental importance (mitigating soil erosion, and land degradation). Recently, a project was conducted on the micropropagation of selected bamboo species at Visayas State University (VSU) aimed to help increase the quality planting material of identified bamboo for industrial purposes through the use of tissue culture technology. However, the major problem often encountered with the use of tissue culture techniques is the occurrence of somaclonal variation, which is often inheritable as it represents induced changes in genetics and mechanical properties. Thus, this study presents an investigation on the tensile strength of three-year-old VSU tissue-cultured which include *Dendrocalamus asper, Dendrocalamus membranaceous* var Grandis, *Bambusa tulda*, *Guada augustifolia*, and *Dendrocalamus giganteus*. Fiber tensile strength procedures were conducted based on ASTM-D3379-75. Morphological properties of VSU tissue-cultured bamboo have shown that: D. *giganteus* has the highest internode length (38.49±4.00 cm) and inner diameter (25.65 ± 0.85 mm); D. asper has the largest outer diameter (44.53±9.64 mm), culm wall thickness (12.61±3.31 mm), and highest density (825.01±58.05 kg/mm 3); and G. *augustifolia* the highest moisture content (30.20±3.04%). All species showed similar tensile strength with *Bambusa tulda* (317.31±19.47 MPa) being the highest, whereas in terms of culm height, the top internode (341.16±43.98 MPa) was significantly higher than its counterparts. This is the first report on the tensile strength of tissue culture-derived bamboo. The tensile strength of the VSU tissue-cultured bamboo shows promising results which further supplements the use of tissue culture methods in addressing the need for fast and adequate bamboo seedlings for commercial use.

Keywords: bamboo, tissue culture, tensile strength

IS-16-05

Evaluation of Flood Mitigation Functions in Paddy Fields Using Alternative Dry and Wet Irrigation

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Abstract

With climate change, intense rainfall events are becoming more frequent, particularly in the Asian monsoon region, and this trend is expected to continue. In response, the agricultural sector is enhancing farmland's water retention capabilities to help mitigate flooding through conservation management. Rice paddy fields temporarily store rainwater and release it gradually, which helps prevent rapid water level increases downstream. AWD irrigation is one method of irrigation used in paddy fields. In conventional irrigation methods (continuously flooded irrigation) in Japan, which keep water in the paddy fields throughout the rice-growing season, AWD irrigation involves repeatedly flooding and draining the fields for most of the growing season. In this study, we clarified the effect of temporary storage of rainfall that occurred during the rice cultivation period in paddy fields where AWD irrigation was implemented in Atsugi, Japan. During the cultivation period from 29 May to 4 October 2024, 29 rainfall events were recorded at a demonstration site, totaling 1,030 mm of precipitation over 206 hours, with a peak intensity of 49 mm/h and 271 mm/d. A maximum of 317 mm of rainfall was observed in a series of events. In AWD fields, non-flooded conditions persisted for 1,526 hours—50% of the growing period. During these non-flooded hours, 36 hours of rainfall contributed 114 mm of precipitation. The AWD field delayed the time to reach the automatic drainage valve's set level by up to 5 hours, enabling temporary rainwater storage compared to the control field. These findings suggest that AWD irrigation, a water management strategy for rice paddies, can serve as an effective countermeasure against heavy rainfall in rural areas. By adjusting the timing of water level reduction in coordination with weather forecasts, AWD irrigation could provide additional flood mitigation benefits, particularly during periods when fields are maintained in non-flooded conditions.

Keywords: AWD irrigation, rice paddy, flood management

IS-16-06

Growth Areas of CALABARZON: Exploring the Possible Rise of Major Metropolises in the Philippines and Its Environmental and Social Implications

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Abstract

Industrialization and urbanization of agricultural and rural areas located near the national capital region of the Philippines, which is Metro Manila, started during the 1970s, partly because of certain government policies that sought to decongest the core urban area of the country. Since then, dozens of manufacturing companies either transferred their existing facilities to neighboring provinces or constructed their business establishments in these areas to comply with the government policy to disperse the overconcentration of industries and the rapid population growth of Metropolitan Manila. The establishment of large industries in provinces near Metropolitan Manila also resulted in an increase in the number of shelter projects in those areas, thus resulting in the rapid population increase in these new regional growth areas as well. To understand the process of urbanization and industrialization of areas which are formerly rural areas in the Philippines, this study examined the rise of new metropolitan areas in the Cavite, Laguna, Batangas, Rizal, and Quezon provinces (collectively known as CALABARZON) economic region of the Philippines. This was conducted through key informant interviews, literature review, and secondary data analysis. Furthermore, the study also described the significant physical transformation of selected cities and municipalities which have the potential to rival the national capital region (when grouped together) in terms of population, economic and social relevance, and land area. Using both primary and secondary data available, the study identified that physical transformation has been occurring due to organic and planned development means. The results seem to indicate a development pattern that is enough to compete with or even surpass the National Capital Region (NCR) in terms of number but still with questionable quality or uncertainty due to lack of planning, absence of established planning policy, and competency issues among local government actors. The development patterns are also geared towards a similar negative impact on the natural and social environments in the selected study areas. Policy and program recommendations were laid out as possible responses to those uncertainties.

Keywords: growth areas, regional governance, local governance, physical transformation, agriculture, social activities

RD-16-01

BIDANI Network Program: An Innovative Strategy of State Universities and Colleges of the Philippines Towards Community Development

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Abstract

Malnutrition continues to challenge the country's national development, evolving from a predominantly undernutrition problem to a complex triple burden of malnutrition, which unfortunately leads to children's poor cognitive development, and academic underachievement. The Philippines faces a particularly high prevalence of stunting among children under five, at 26.7%, compared to the global average of 22.3%. Additionally, the country ranks second lowest among ASEAN nations in the 2022 PISA report. Since its inception as the Nutrition Improvement Model (NIM) in 1978, the Barangay Integrated Development Approach for Nutrition Improvement (BIDANI) has evolved to incorporate innovative approaches and a distinctive brand of community engagement. Nutrition is integrated as both an entry point and a deliberate goal, component, and indicator of development. BIDANI focuses primarily on tackling malnutrition and its underlying causes of underdevelopment at the grassroots level. Serving as both an action research and extension program of eight State Universities and Colleges in the Philippines, it has accumulated extensive experience and valuable lessons in social mobilization, community engagement, nutrition intervention, and rural development. The BIDANI program serves as the academe's unique and continuing contribution to nutrition-in-development, owing to the sustainability of the three BIDANI strategies. Through the Barangay Integrated Development Approach (BIDA), local leaders are guided in preparing the Barangay Integrated Development Plan (BIDP), which contains all development efforts in the community. It is a plan formulated by the people themselves, embodying community participation in projects, activities, and services. The Barangay Management Information System (BMIS) is a data banking system that collects social, economic, ecological, sanitation, agricultural, health, and nutrition information from the barangay. It facilitates the identification of barangay needs vital for nutrition and development planning. The Participative Nutrition Enhancement Approach (PNEA) strengthens the skills of local leaders in preparing evidence-based barangay nutrition action plans to reduce the nutrition problems in their community.

Keywords: BIDANI Network Program, nutrition-in-development, barangay, BIDA, BMIS, PNEA

RD-16-03

Empowering Fisher Folk Women Through *Sargassum spp*. Utilization and Management: Needs Assessment

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Abstract

Prior to the harvesting ban of Sargassum in the 1990s, Sargassum or Samo was harvested in coastal intertidal zones of Iligan and Panguil bays as an alternative income for the fisher folks. This study aims to empower and improve the fisherfolk community especially the fishermen's wives' skills and knowledge to utilize the natural resources in the community. The project focuses on the identification of the background, prior knowledge, practices, and needs of the target respondents. This study is qualitative utilizing a phenomenological approach in data gathering through interviews, field notes, and questionnaires for the respondents. The data collected was used as the basis for needs assessment, identification, and development of product technology derived from Sargassum as part of the intervention strategies for empowerment framework and formulation of the training for women to equip them with the knowledge and skills for them to aid additional income for their family. The results of this study may provide a basis for the formulation of intervention strategies needed by fisherfolk women in the target area. The needed data will then be used to formulate and design intervention strategies to empower fisher-folk wives in terms of utilization and management of the Sargassum resource in the area. Results provided a list of fisher-folk wives in the area and their profile necessary for the intervention strategies. Majority of the them were aware of the presence, location, and abundant season of Sargassum in their locality and those who experienced harvesting wild stocks of Sargassum had used the uprooting method. The common response was that they did not have any idea about how to use and utilize Sargassum for commercial purposes. They were not able to use Sargassum as fertilizer or the idea that it could be used as such. They have not tried using Sargassum as animal feed either fresh or dried. In addition, they have no idea that it can utilize as a food ingredient or additive and none of them had used Sargassum for personal reasons. With regards to the management of Sargassum, the majority of the fisher-folks knew that it was against the law (Fisheries Administrative Order) to harvest wild stocks, gather and sell washed ashore Sargassum because they had been told by the authorities and some had heard it through a radio broadcast before; however, they were not aware of the overall content of the FAO and the amendments that had been done. Moreover, they were eager to participate in harvesting Sargassum wild stocks if it would already be allowed by authorities.

Keywords: empowering women, Sargassum, utilization and management, needs assessment

RD-16-04

The Impact of Artisanal and Small-Scale Gold Mining on Food Security of Rural Households in Tigray Region, Ethiopia

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Abstract

The purpose of this study is to investigate the impact of artisanal and small-scale gold mining (ASGM) participation on the food security situation of rural households (HHs) in the Tigray Region of Ethiopia. The study has been guided by a pragmatism worldview and employed mixed research approaches to answer the research questions and objectives. The survey data were collected using structured questionnaires from 378 sample HHs but qualitative data were gathered using KIIs, FGDs, and structured field observation. Purposive sampling was applied to select the study districts, sub-districts, members of KIIs, and FGDs but simple random sampling was employed to draw the survey respondents from the sampling frame of the study. Data were analyzed using multiple methods and techniques. Food security was measured using HFIAS, HFCS, FEI, and PSM. The result from HFISA indicated that 66.3% of the participants were found food secure. In the case of HFCS, 51.9% of the participants were found food secure. Likewise, according to FEI, 58.8% of the participant and non-participant households were found food security respectively. The result from logistic regression indicated that 4 variables (sex of household head, livestock ownership, and credit service) had been positively associated with the food security of households 3 variables (age of the household head, family size of the households, and dependency ratio) were negatively associated to the food security of households. AS per the PSM, the ATT for household total annual income indicates that participating in gold mining increases the income of the household by 23,584.86 ETB. Besides, the ATT on food security using the NNM, RM, and KM have been found 19.65%, 17.89%, and 14.36% respectively. This shows that participating in gold mining increases the food security situation of households by a factor of 19.65, 17.89, and 14.36 percentage points. Therefore, the government should design strategies as to how the local people can make use of gold extraction to ensure the food security of households in the study area.

Key words: artisanal small-scale gold mining, food security, rural households, participation decision, livelihood, non-farm income

RD-16-05

Rice Supply Shocks and University Student Consumption Patterns in Japan

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Abstract

Between June and September 2024, Japan faced a table rice shortage attributed to policy inefficiencies, rising demand, and climate-related challenges. This study investigates how university students, a socio-demographic group of over 2 million predominantly low- to moderate-income, single households, responded to this disruption. Using data from a survey of 106 students selected via convenience sampling, the analysis applies price elasticity of demand, multiple linear regression, paired difference analysis, and ANOVA to address three core objectives: (1) examining the impact of rising rice prices on consumption patterns, (2) assessing the substitution of noodles for rice and shifts in food expenditure, and (3) evaluating the utilization of university meal plans during the shortage. The findings reveal income as a critical determinant of adaptive capacity. While rice consumption demonstrated relative inelasticity across all income groups, higher-income students exhibited greater substitution flexibility and sustained consumption levels through financial adaptability. Conversely, lower-income students were more price-sensitive, showing significant changes in food expenditure and campus dining habits. These shifts highlight limited substitution and consumption options among economically vulnerable students, exposing inequities in food access despite market resilience. This study underscores the importance of targeted economic interventions to support food security for vulnerable populations during supply disruptions, as opposed to relying solely on substitution strategies. Although the sample size constrains generalizability, the results offer valuable insights for policymakers and university administrators. Future research should expand to larger, more diverse populations, with particular attention to the experiences of Japanese versus international students, to guide the development of equitable and effective food security policies during supply shocks.

Keywords: rice shortage, consumption patterns, food security, substitution behavior

RD-16-10

Impact Assessment of the Built Environment and Cultural Practices as Contributors to Disaster Preparedness and Recovery in Bicol Region

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Abstract

Natural disasters pose significant threats to vulnerable regions, and the Bicol Region in the Philippines is frequently impacted by typhoons, volcanic eruptions, and earthquakes. This study examined the effectiveness of existing disaster mitigation strategies, including architectural designs, in enhancing the disaster resilience of small communities in the Bicol Region, particularly in Legazpi City, Albay. The research aimed to understand how architectural interventions, in combination with local cultural practices, contributed to disaster preparedness and recovery. Using a multidisciplinary approach, the study combined on-site analysis with community surveys and interviews involving local residents, architecture professionals, students, and disaster management experts. The research assessed the strengths and limitations of current architectural designs and community spaces in mitigating the impact of natural disasters. Through these qualitative insights, the research examined how well architectural interventions align with local cultural practices and the real-world challenges faced by communities in vulnerable areas. The study concluded that disaster-resilient architectural designs, when integrated with the community's cultural and environmental context, played a crucial role in reducing vulnerability and facilitating faster recovery, and communities that adopted these designs demonstrated better preparedness and stronger engagement in disaster mitigation efforts. The findings provide valuable recommendations for architects, urban planners, and policymakers, emphasizing the need for culturally sensitive architectural solutions in disaster-prone areas like the Bicol Region.

Keywords: natural disasters, disaster mitigation, Bicol Region, disaster resilience, built environment

RD-16-13

Socio-economic Profile and Capabilities of Agricultural Extension Workers in Delivering Agriculture Extension Services in Iloilo, Philippines

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Abstract

This descriptive study aimed to assess the socio-economic profile and capabilities of the agricultural extension workers (AEWs) in the Province of Iloilo, Philippines in delivering agriculture extension services. The workforce profile analysis reveals a highly educated workforce among agricultural extension workers with a significant majority holding college degrees in different Local Government Units (LGUs) of Iloilo. The characteristics of LGUs in Iloilo Province vary across municipality classes, indicating different levels of urbanization, economic development, agricultural activities, fishing industry, livestock sector, and land area. The population size and distribution, as well as the presence of registered farmer organizations and agricultural support services, vary among the different classes of municipalities and Iloilo City. Agricultural Extension Workers play a crucial role in the National Rice Program and in enforcing plant and animal health regulations, production, and propagation. However, there is room for improvement in their information and communications technology (ICT) skills, which are considered essential in today's workplace. LGUs in Iloilo Province provides a range of support services to farmers and fisherfolk, including technology support, market access, credit facilities, input subsidies, and information dissemination. These initiatives aim to enhance the productivity, profitability, and sustainability of the agricultural sector in the region. Common issues AEWs face include inadequate budget support, lack of travel allocation, low salary levels, limited promotion opportunities, and insufficient incentives and benefits. These issues can hinder the effective implementation of agricultural initiatives, affect employee morale and retention, and impact the overall quality of agricultural services.

Keywords: agricultural extension workers, devolution, Iloilo, intrapersonal, local government units

RD-16-16

Establishing A Viable Enterprise Using Free-Range Chicken Production Technology in Nueva Vizcaya, Philippines

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Abstract

The Nueva Vizcaya State University Free-Range Chicken (NVSU-FRC) Project aimed to establish a sustainable poultry enterprise to enhance local farmers' livelihoods and the community's protein supply, while also promoting agricultural innovation, improving self-sufficiency, and strengthening the economic resilience of local communities. A breeding station was established at the NVSU Agricultural Innovation Center at Tuao South, Bagabag, Nueva Vizcaya, Philippines to produce superior F1 stocks from purebred Dominant CZ hens and Rhode Island Red (RIR) cockerels for distribution to partner beneficiaries. The project successfully dispersed 10,265 FRC stocks to 42 farmer-beneficiaries, predominantly women, highlighting women's active role in agriculture. The project provided comprehensive support through skills training, technical assistance, and establishing of model farms to enhance beneficiaries' poultry management skills. Consistent monitoring and evaluation ensured the effective adoption of improved breeding, forage- based feeding, housing, health management practices, and record keeping achieving a 100% adoption rate among beneficiaries. The outcomes were significant with beneficiaries reporting increased flock sizes, improved egg production, and faster growth rates, leading to higher income through regular sales in local markets. Economic analysis highlighted the strong financial potential of the project, with beneficiaries generating substantial net income. Furthermore, the project improved community food security by providing an affordable, high-quality protein source. The impact of the project extended beyond income generation, fostering sustainable agricultural practices and promoting rural economic development. The project demonstrated its potential to scale up similar initiatives contributing to long-term economic resilience and enhanced food security in rural communities.

Keywords: free-range chicken, viable enterprise, capacity building, technology adoption, rural economic development, food security

RD-16-25

Enhancing Education and Child Protection in Rural Conflict Zones: A Case Study of the PEACE-PRO Project in Bangsamoro Autonomous Region in Muslim Mindanao

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Abstract

This ethnographic study examines the impact of the Provision of Expanded Access to Child Education and Protection in Conflict-Affected Areas (PEACE-PRO) project, a private- sector initiative aimed at improving educational quality and child protection in the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM), a rural and conflict-affected area. Conducted from May to August 2024, the study explores how PEACE-PRO addresses educational disruptions resulting from ongoing armed conflict and the COVID-19 pandemic, with a particular focus on rural communities. Using semi-structured interviews, focus group discussions, and surveys, the research engages learners, teachers, parents, and project implementers to assess the project's effects on educational access, safety, and overall quality. Framed by Maslow's hierarchy of needs, the study emphasizes the provision of essential services such as Water, Sanitation, and Hygiene (WASH) facilities, the creation of safe learning environments, and teacher training to foster supportive classrooms. The findings suggest that PEACE-PRO not only enhances educational access but also strengthens community development and child protection in rural areas by addressing foundational needs and providing critical infrastructure. These results contribute to rural development discourse by demonstrating how education and child protection interventions when combined with community involvement and local governance, can help build resilience and sustainable development in rural, conflict-affected regions. The study underscores the importance of integrating basic human needs into rural development strategies and highlights the role of private-sector initiatives in complementing government efforts to address the unique challenges of rural and conflict-prone areas.

Keywords: rural development, Provision of Expanded Access to Child Education and Protection in conflict-affected areas (PEACE-PRO), Bangsamoro Autonomous region in Muslim Mindanao (BARMM), Philippines, Maslow's hierarchy of needs, community development

RD-16-26

Gender-Inclusive Partnerships for Sustainable Rural Development: Leveraging Technology and Community Engagement to Empower Women in Indonesia

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Abstract

This study examines the relationship between gender-inclusive partnerships and rural development in Indonesia, focusing on Cianjur, West Java, and Tabanan, Bali. The study aims to understand how these partnerships influence women's empowerment in agriculture. Utilizing the Women's Empowerment in Agriculture Index (WEAI), this study compared the empowerment levels of women farmers in the two regions. Qualitative interviews explored factors like land ownership, technology access, and community engagement. Data collection included surveys of 70 women farmers in Cianjur and 50 in Tabanan, revealing that women in Cianjur had a slightly higher average WEAI score of 0.55 compared to 0.47 in Tabanan. Qualitative interviews were conducted with 20 informants, highlighting the significant role of partnerships in enhancing women's participation in decision-making, economic independence, and cultural preservation within agricultural practices. Key factors contributing to this empowerment include active participation in value-added activities, such as organic farming and food processing, which have improved household income and reinforced their roles as community leaders. Additionally, access to digital technologies has enabled effective marketing of their products. These results emphasize the need for customized strategies that integrate gender dynamics, community engagement, and technology to foster sustainable rural development, providing actionable insights for policymakers and development practitioners in Indonesia and similar contexts.

Keywords: gender-inclusive partnership, rural development, women's empowerment, community engagement

RD-16-27

A Participatory Rural Appraisal for Watershed Management in Northern Mindanao, Philippines: The Case of Alubijid Watershed

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Abstract

Participatory Rural Appraisal (PRA) is a method for gathering information and understanding rural communities' needs, goals, and views. It is a qualitative research technique that involves community members in the process of data collection and analysis and has been widely employed in rural development, agriculture, and natural resource management programs. The primary objective of this study was to gain insights into various community aspects such as social, economic, cultural, and environmental factors in the three selected barangays of Alubijid Watershed – Tula (Upstream), Lourdes (Midstream), and Poblacion (Downstream). This study utilized the following tools – resource and hazard mapping, problem-tree analysis, timeline/historical events, social networking analysis, and stakeholder analysis. There were 60 participants from the three (3) villages participated in the study. Results showed that the major problems in the watershed were flooding, waste disposal, and farm-to-market roads. Resource mapping revealed that several man-made and natural resources were present in the area with the hazard of being flood and landslide-prone. The common historical events of these barangays were insurgency, natural calamities (i.e., typhoons and flooding, drought), and the COVID-19 pandemic. Stakeholder analysis showed that several stakeholders from the government sector have high power and high interest in managing the watershed. Similarly, in social networking, some of the government sectors have a strong and direct relationship with the community and the management of the watershed. Meanwhile, in terms of knowledge and awareness, most of the participants had limited knowledge about their watershed and its management. Hence, it is recommended to launch an intensive information, education, and communication (IEC) campaign, and establish partnerships with local schools, non-governmental organizations (NGOs), people's organizations (PO), and government agencies to support and sustain the information and education campaign; conduct regular monitoring and assessment of the watershed and to mitigate the pressing needs and concerns of these communities.

Keywords: participatory rural appraisal, Alubijid Watershed, knowledge and awareness, community development

RD-16-29

Evaluation of Soil Characteristics in Pineapple Farmlands in Moung Ruessei, Battambang Province, Cambodia

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Abstract

Soil quality is a critical factor influencing crop productivity and sustainability, particularly in Cambodia, where issues such as nutrient depletion, soil degradation, and excessive use of chemical fertilizers are prevalent. Pineapple cultivation requires specific soil conditions for optimal growth, and understanding these baseline characteristics is essential for identifying soil limitations and improving soil management practices. These challenges, along with imbalances in soil pH, significantly impact crop growth and quality in many regions. This study aims to evaluate the soil characteristics of pineapple farmlands in Muong Ruessei, Battambang Province, Cambodia. The focus is on assessing both chemical and physical soil properties, including nutrient levels (nitrogen, phosphorus, and potassium), pH, electrical conductivity (EC), organic matter, and soil texture. Soil samples were collected from multiple sites across pineapple farmlands. Laboratory analyses were conducted to determine various soil properties, including nutrient levels, pH, EC, organic matter, and soil texture. The results of the study indicate a baseline assessment of soil conditions in pineapple farmlands in the region, identifying key limitations to productivity, and offering practical recommendations for improving soil fertility and management. Research supports sustainable pineapple farming practices in Battambang Province by providing essential guidance for soil conservation decisions.

Keywords: chemical and physical soil properties, soil fertility, soil erosion

RD-16-31

Sustainable Palm Oil Downstream Value Chain in Industrial Zones: Case Study in Riau Province, Indonesia

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Abstract

Indonesia is the world's largest palm oil producer, producing 23.13 million tons in 2023. This production meets domestic and export demand, with an export value of USD 25.61 billion in 2023. The leading province in terms of oil palm production and plantation area in Indonesia is Riau, which produced 8,790,700 tons of 2,869,000 hectares of land in 2023. The Riau government has established three industrial zones related to palm oil: Dumai Industrial Estate, Tanjung Buton Industrial Estate, and Tenayan Industrial Estate. This study analyzes the downstream value chain of the palm oil industry in these industrial zones to identify which has added value to palm oil commodities and to explore the potential for stakeholder integration to improve efficiency in these zones. Among the three industrial zones, only Dumai Industrial Estate engages in downstream activities related to palm oil, thereby producing added value. In Tanjung Buton Industrial Estate, the primary activity is the collection of palm oil waste, particularly oil palm shells, which are exported as renewable fuel for power plants in Japan and South Korea. Tanjung Buton Industrial Estate is still under construction. Dumai Industrial Estate has four distinct value chains: the Wilmar Group, First Resources Group, Permata Hijau Group, and Sumber Jaya Oleo Group. These four chains operate independently and are not horizontally integrated. The governance structure of Dumai Industrial Estate is hierarchical and characterized by a close relationship between producers and consumers within the same company or group. Dumai Industrial Estate produces palm oil derivative products, including oleofood, oleochemicals, and oleofuel (biodiesel). In the future, of the products produced by Dumai Industrial Estate, there is potential for significant horizontal integration among the four groups, which could improve the efficiency of the value chains.

Keywords: downstream, industrial zones, palm oil industry, value chain, Indonesia

RD-16-32

The Role of Community-Led Initiatives in Sustainable Rural Tourism Development: A Case Study of Poncokusumo Village, Indonesia

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Abstract
Rural tourism development brings new economic opportunities for local communities by diversifying rural economic activities from agriculture to more productive sectors. In Indonesia, various stakeholders at the village level are involved in the rural tourism development plan to ensure that the inclusivity and sustainability aspects are maintained. This study examines the role of key stakeholders in promoting sustainable rural tourism development at the village level, focusing on Poncokusumo Village, an emerging tourism village destination in Malang Regency, East Java. Using qualitative methods, semi-structured interviews were conducted with key actors of rural tourism development planning in Poncokusumo Village, and then thematic analysis was applied to explore recurring themes. Results show that the *Pokdarwis* (Village Tourism Awareness Group), initiated by local society, is crucial in promoting rural tourism activities. This group facilitates discussions on tourism development plans with local communities to maintain economic, social, and environmental sustainability. However, the study also highlights that village government support is often inconsistent, primarily influenced by the village chief's political agenda, resulting in fluctuating levels of support. These findings suggest that a bottom-up approach led by local communities can be more effective for sustainable rural tourism development. The study also contributes to the rural tourism development literature by emphasizing the significant role of community-led initiatives.

Keywords: rural tourism, sustainable development, community-led approach, *Pokdarwis*

RD-16-36

Efficiency Assessment of Digital and 'Phygital' Food Retailers through Data Envelopment Analysis

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Abstract
The food retail landscape has undergone significant transformation in recent years, driven by the rapid expansion of online shopping and shifts in consumer behavior. This evolution has catalyzed the growth of pure-play digital food retailers and the adoption of a 'phygital' (physical and digital) approach by traditional retailers. Assessing the efficiency of these models is crucial, as digital-only retailers are expected to benefit from streamlined operations and reduced operating costs, while phygital retailers leverage their physical presence to offer omnichannel experiences, catering to a broader consumer base. Using Data Envelopment Analysis (DEA), this study evaluates the efficiency of 133 food retailers across different regions. This research aims to provide a quantitative assessment of the efficiency of different food retail models, offering guidance for strategic and policy decision-making to strengthen food systems. Further, this demonstrates how efficient retail models can reinforce the resilience of the broader food economy, mitigating vulnerabilities and enhancing stability in the midst of supply chain disruptions.

Keywords: food e-commerce, omnichannel, DEA, click-and-mortar

RD-16-37

Knowledge on Seaweed Utilization in Small Island Communities of Danajon Bank, Central Philippines: A Small-Scale Fisherfolk Perspective Amidst Covid-19 Pandemic

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Abstract

This study investigates seaweed utilization among small-scale fisherfolk (SSF) in small island communities (SICs) of Danajon Bank, Central Philippines, during the COVID-19 pandemic. Through ethnobotanical analysis, the study examines the knowledge, preparation methods, and practices of 103 SSF (49.51% male, 50.48% female). Findings revealed that SSF knowledge on seaweed utilization does not significantly differ by gender ($p = 0.28$) or educational background ($p = 0.58$). However, occupational roles impact knowledge ($p = 0.02$), as seaweed farmers (45.63%) and capture fishers (44.67%) demonstrate greater understanding of therapeutic and edible uses, while gleaners (9.70%) focus more on edible and agricultural applications. Six seaweed species, notably *Kappaphycus striatus*, *Kappaphycus alvarezii*, and *Caulerpa lentillifera*, were commonly used, spanning three phyla and four orders. These species serve diverse roles, from medicinal uses to dietary and agricultural applications. For instance, Kappaphycus species are processed into snacks, jams, noodles, and fertilizers, while *Sargassum ilicifolium* is employed in traditional rituals for good luck in fishing. Ethnobotanical indices highlight *Kappaphycus striatus* as the most important species with the highest Use Value (UV) of 0.72, Relative Importance (RI) of 1.00, and a Relative Frequency Citation (RFC) of 0.40, valued for its versatility in therapeutic diets and cultural significance. *Kappaphycus alvarezii* follows with a UV of 0.53, RI of 0.90, and RFC of 0.38, while *Caulerpa lentillifera* shows moderate importance (UV = 0.41, RI = 0.49). This study underscores the socio-economic role of seaweeds for SSF, showing how these natural resources contribute to food security, income, health, and traditional practices within island communities. Findings offer valuable insights for resource management and sustainable development in coastal and marine ecosystems.

Keywords: Danajon bank, *Kappaphycus striatus*, small-scale fisherfolk, small island communities, seaweed utilization

RD-16-38

Rural Non-Farm Employment Opportunities in India: Past and Present Scenario

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Abstract

Rural India, which encompasses around 65% of the population and 70% of the workforce, remains integral to the nation. Agriculture is the prime sector for livelihood generation and rural development. However, with the changing economic scenario, there is an emerging need for diversification in rural livelihoods beyond agriculture. This transition from farm-based activities to rural non-farm employment (RNFE) is not only reshaping rural economies but also influencing Socioeconomic transformation. Rural non-farm activities are seen as essential to reducing the vulnerability of rural households by diversifying income sources, creating resilience against agricultural risks, and providing employment opportunities for a burgeoning rural workforce. Since independence, the Indian economy has witnessed a series of reforms in the majority of sectors of the economy. This paper critically assesses the existing policies designed to support rural non-farm employment generation. Through a detailed review, the study identifies key policy strengths and gaps in addressing the unique challenges of the rural economy. It explores the role of infrastructure, institutional support, and financial inclusion as enablers of successful non-farm employment initiatives. The study analyses the population and economic census from NSSO data sets to explore the recent trends and growth patterns in rural non-farm employment in India. This paper identifies key policy strengths and gaps in addressing the unique challenges of the rural economy. The study offers policy recommendations to strengthen the integration of technology, foster entrepreneurship, and facilitate the development of rural markets. By addressing these areas, India can harness the potential of RNFE to build a more balanced and inclusive rural economy, ultimately aligning with sustainable development goals.

Keywords: rural non-farm, poverty, diversification, policy, employment opportunity

RD-16-39

Rural Community Development through Non-Farm Employment Opportunity Creation: Scope and Perspective

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Abstract

The rural economy in India has substantial potential to create productive jobs, reduce poverty, ensure food security, and promote social justice. However, many rural workers face decent work deficits, often working informally and living below the poverty line. Rural non-farm employment (RNFE) offers an important alternative to agriculture, strengthening rural economies by diversifying income sources, stabilizing employment, and reducing poverty. This paper explores the role of RNFE in supporting rural community development by addressing economic, social, and environmental vulnerabilities. The study assesses the scope of non-farm employment opportunities for sustainable rural development and identifies key policy interventions to maximize its impact. Utilizing secondary data, including government employment records, census data, and relevant research literature, the paper evaluates trends in rural employment and examines the effectiveness of non-farm sectors. The analysis focuses on sectoral shifts from agriculture to non-farm employment, barriers to enterprise growth, and socio-economic factors influencing rural labor dynamics. Sectors such as rural tourism, handicrafts, and small-scale services are highlighted for their significant growth potential within rural economies. Non-farm employment contributes greatly to economic resilience in rural areas by reducing dependence on agriculture and helping to mitigate migration pressures. Despite these benefits, RNFE faces persistent challenges, including inadequate infrastructure, limited access to credit, and skill shortages. Growth in non-farm sectors can be especially beneficial for marginalized groups, particularly women and youth, by enhancing social inclusion and empowering these populations. While RNFE presents a vital pathway for rural transformation, realizing its potential requires targeted policies, investments in infrastructure, and comprehensive skill development programs. By addressing these critical areas, RNFE can help rural communities build sustainable livelihoods and foster long-term socio-economic stability, positioning non-farm employment as a foundation for resilient and inclusive rural development.

Keywords: rural community, non-farm employment, poverty, diversification, policy

RD-16-40

Towards Sustainable Futures: Women Agrarian Reform Beneficiaries in a Climate-smart Agriculture

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Abstract
Women play a vital role in agriculture, contributing not just as additional labor in production, post-harvest activities, value addition, and marketing, but have become central to every stage of the agricultural process. However, women farmers face many challenges in agriculture, including land ownership, decision-making, access to inputs, information, and financial resources, and the changing climatic conditions affecting productive capacity. This study, utilizing data from key informant interviews, focus group discussions, and literature reviews, explores how women ARB (Agrarian Reform Beneficiaries) farmers, despite these challenges—particularly the changing climatic conditions in their areas—have successfully managed risks and safeguarded resources to improve both economic and livelihood opportunities. Through capacity building and learning sessions, these women have gained knowledge and developed the skills necessary to manage and operate climate-smart facilities. With these facilities, women have demonstrated their farming abilities and experiences in agricultural production despite extreme weather conditions, showcasing their entrepreneurial skills and business acumen towards specific agricultural produce. The continuous learning and application of acquired knowledge, combined with their experiences in production and business, have bridged the gap between theoretical knowledge and practical skills. This has led to a better understanding and appreciation of their capabilities in climate change adaptation and livelihood promotion, ultimately working towards sustainable futures.

Keywords: women, agrarian reform beneficiaries, climate-smart facility, capacity building, theory and practice, sustainable futures

RD-16-41

Prospect, Supply, and Value Chain of the Coco Coir Agro Enterprise of the Castilla Development Cooperative (CADECO)

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Abstract
The current coco coir production, processing, and marketing operations of the Castilla Development Cooperative (CADECO) in Castilla, Sorsogon, Philippines were evaluated. The main objective of the study is to analyze the supply and value chain of the cococoir business of CADECO and to evaluate the operation of the coco coir as an agro-enterprise. Specifically, it analyzes the status of the coco coir agro-enterprise by assessing its raw material supply source, organizational build-up, marketing, financial and technical capabilities, and prepares recommendations for the sustainability, financial productivity, and organizational strengthening of the agro-enterprise. The current capacities of the facilities and equipment of the cooperative can only process about 10 to 15% of the annual total husks available in Castilla, Sorsogon. The current products of the cooperative are baled coco coir sold at P9.50 per kg at 45 to 48 kg per bale, and coir dustsold at P10.00 per bag. The prospect of upgrading the agro enterprise to venture into a new product line was determined and presented in the sensitivity analysis of the financial study. Better income-generating opportunities can be generated through a shift in product line, from baled coco fiber to the production of geonets. The financial analysis indicated that the buying price of coconut husks can be raised from Php 300.00 to Php 1,000.00 per truckload containing about 2,500 pcs; hanks of coco coir from Php 2.50 per piece to Php 3.50 per piece of about 15 meters per hank; and from Php 2,000.00 to Php 2,500.00 per roll of geonet produced by the weavers. This gives a positive prospect for the coco coir as an agro enterprise in Castilla, Sorsogon. This new agro-enterprise prospect however will require additional operating capital for the cooperative but will provide a better livelihood source for the coconut-growing communities in Castilla, Sorsogon, Philippines.

Keywords: coco coir product diversification, new product line development, geotextile nets and logs, financial analysis, business planning modification

RD-16-42

Finding Their Voices: Building Organizational Capacities of Smallholder Coffee Farmers in Southern Philippines

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Abstract

Capacity-building activities for smallholder farmers, along with interventions, are often pre-designed. However, they are already knowledgeable of their local contexts and their immediate environments. They also have rich field experiences, which makes their inputs important. To make matters inclusive, smallholder farmers, who formed themselves into an organization, can now co-design or co-create activities and projects for their group and their communities. Furthermore, this can involve forging partnerships and connecting with other stakeholders. Building on action research, this paper will look at the process of co-design, its mechanisms, and its key insights. It will further provide narratives of the steps, from how the areas were chosen, until how the organizations commenced participation in the project. The two case examples were two coffee organizations in Southern Philippines, formed in 2017 and 2022, with the main goal of receiving and accessing government support. Results showed the observations of how the farmers participated during the initial until the current activities. Some of the activities were focused on group discussions, validation workshops, and training. The workshops during the co-designed organizational strengthening training observed the improvement in farmers' participation. Moreover, the smallholder farmers provided more in-depth discussions as the training progressed. The opportunity to share their experiences recognizes their culture, and diversity as integral to the group's identity. Their membership in their organization facilitates sustainability as it enables access to economic and non-economic benefits. They saw the importance of their input and deliberate efforts to pursue the projects and programs they identified. In addition, they became cognizant of the polycrises brought about by natural and man-made calamities ever present in the area. They need support from external sources, but they have to be clear that it is something that they would need and can sustain even after these external sources leave.

Keywords: inclusion, organizational strengthening, capacities

RD-16-43

Synthesizing Antipolo Rizal Philippines' Cultural Heritage Through Multi-Generational Cognitive Mapping for Resident-Centric Development

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Abstract
This study addresses the gap in local appreciation of Antipolo's cultural heritage, a consequence of rapid urbanization that often overshadows the city's historical identity rooted in its community's folk, foundation, and faith. With the city's heritage at risk of being neglected, this research aims to foster a deeper connection to Antipolo's cultural roots by establishing a comprehensive inventory of tangible-immovable and intangible heritage elements, including local traditions, festivals, and activities. Using a five-zone radial mapping method centered on the Antipolo Cathedral (spanning 0.4 to 2.5 kilometers), the study analyzes heritage density distribution. Data collection involves interviews with local experts, archival research, and site visits to capture a comprehensive cultural picture. This project's findings are expected to reveal how Antipolo's residents (Taal) and tourists (Dayos) perceive the city's cultural heritage, supporting initiatives to preserve and celebrate Antipolo's identity amid its urban growth.

Keywords: cultural heritage, urbanization, heritage elements, heritage density

RD-16-45

From the Sea to Sustainability: Transforming Seaweed into High-Value Products for the Economic Resilience of Farmers Groups in East Nusa Tenggara

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Abstract

Transforming seaweed from a basic commodity into a high-value product has paved a significant path for economic resilience among farmer groups in East Nusa Tenggara, Indonesia. This study aims to (1) examine the potential of seaweed as a primary material in the production of high-value, anti-corrosive coatings, (2) analyze the economic impact of seaweed product diversification on the income and economic resilience of seaweed farming groups in East Nusa Tenggara, and (3) develop a model for coastal community empowerment based on sustainable product innovation. Employing qualitative methods, including observation, in-depth interviews, documentation, and focus group discussions, we investigated the impact of CSR-led training in improving the technical skills, economic opportunities, and environmental awareness of seaweed farming communities. This indicates that product diversification not only increases farmers' incomes but also creates an economic ecosystem that protects them from the volatility of the raw seaweed market. Furthermore, this empowerment encourages sustainable practices that support the preservation of coastal ecosystems. The study highlights the importance of CSR in promoting social innovation, providing insights for policymakers to drive similar initiatives that strengthen economic resilience and Environmental Management in coastal regions.

Keywords: anti-corrosion paint innovation, coastal community empowerment, environmental sustainability, seaweed potential, socio-economic impact

RD-16-46

Local Eco- entrepreneurship in Coffee Farming Communities in Sultan Kudarat, Philippines

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Abstract

Eco-entrepreneurship refers to social initiatives formed to address local and global problems like poverty and climate change. This paper looks into two developing coffee enterprises based in the municipalities of Kalamansig and Lebak, in the province of Sultan Kudarat, and utilizes the focus group discussion and SWOT analysis to understand the strategies adopted by coffee farmer associations. A survey was also conducted to assess the level of readiness to engage in community-based enterprising activities. The two producer associations comprise less than 5% of the total coffee growers in their Barangays. These farmer associations were formed to access and receive assistance from the government and other donors. Additionally, they aim to consolidate their produce to get major buyers' volume and quality specifications. Moreover, the members displayed enthusiasm to build a trading store to consolidate coffee beans from both members and non-members. However, they currently lack working capital as the association is expected to pay cash upon delivery of the Green Coffee Beans (GCB). The association members also face several ecological and erratic climatic conditions such as heavy rains, and landslides that continually affect coffee production. These challenges present some hurdles in their operations, but the spirit of cooperation among its members signals growth and progress. One of the community activities that the association members participated in is to plant trees in forested areas to reduce the incidence of landslides. Despite the entrepreneurial and environmental uncertainties, the association started to explore consolidated trading by engaging with a cooperative for a possible market arrangement. The association plans to unite and build each member's competencies and inspire other farmers to join by implementing worthwhile capacity-building and entrepreneurial activities. Moreover, the association joins the network of coffee farmers to collectively address the environmental and economic challenges they face.

Keywords: eco-entrepreneurship, poverty, climate change, coffee farming

RD-16-47

Banglay at logta Molbog: The Role of Traditional Shifting Cultivation in Cultural Preservation among the Molbog of Balabac, Palawan, Philippines

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Abstract

Shifting cultivation has long been treated as an enemy of rural development since it is often perceived as destructive to the environment. However, integral types of shifting cultivation are embedded with indigenous knowledge, skills, and practices (IKSP) that have resulted in its sustainable practice since time immemorial. This paper aims to showcase this nature of shifting cultivation through the traditional practice of the Molbog community of Barangay Catagupan, Balabac, Palawan called Banglay. By using participatory ethnographic methods such as participant observation, in-depth interviews, and chaine operatoire, this paper (1) describes the material and ritual processes of Banglay, (2) contextualizes Banglay's modern role in the Molbog community's rural development and sustainable agriculture, and (3) analyzes the central role of Banglay in preserving Molbog cultural heritage and their ancestral domain's environment. Banglay serves not just as a subsistence strategy but as a culture-bearing activity, thus, the Molbog community is able to integrate it into state-led development and reforestation programs effectively, such as the National Greening Program (NGP). Further, the integration of these programs into Molbog culture has allowed the community a sense of security of tenure. The swidden areas served as site preparation for the NGP, allowing the community's logta Molbog (traditional territory) to be secured from other parties, such as the military and private developers. The implementation of NGP was instrumental in involving the community in various reforestation activities, i.e., seedling production, plantation establishment, maintenance, and protection. The incentivized continuation of Banglay as a practice has allowed the Matutuwa (elders) to pass on their associated knowledge, in the form of ritual, worldviews, subsistence, and ethnobotany, to the next generation, ensuring cultural preservation. Banglay can thus be used to highlight IKSP's role in sustainable agriculture and rural development.

Keywords: cultural preservation, shifting cultivation, rural development, indigenous people

RD-16-48

Building an Inclusive Innovation Platform: Challenges and Lessons Learned from Selected Coffee Farmers' Associations in Sultan Kudarat, Philippines

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Abstract

An agricultural innovation platform, as defined in the literature, is a space for learning, action, and change where individuals from diverse backgrounds and interests collaborate to discuss challenges, diagnose problems, and identify opportunities to achieve shared goals. This study explores the organization as an inclusive innovation platform, emphasizing how diverse individuals with varying interests work together to strengthen and develop the organization. In this paper, the innovation platform refers to the two coffee producers' organizations in Sultan Kudarat, Philippines–the Coffee Farmers Association of Hinalaan (COFAH) and the Nuling Coffee Growers Association (NCGA). The development of the organizations as inclusive innovation platforms was facilitated by the University of the Philippines Mindanao as part of its project funded by the Australian Centre for International Agricultural Research. Both organizations were formed for the main purpose of accessing government support. The organizations faced challenges, including limited understanding among members and officers of their direction and priority programs, difficulties in identifying common goals and fostering a collective mindset for organizational collaboration. Effective facilitation skills played a vital role in engaging members and fostering their ownership of shared goals, which was crucial for building an inclusive innovation platform. Additionally, developing sustainable exit strategies for the project was essential to ensure the continuity of organizational activities. Targeted capacity-building activities for members of the organizations further contributed to the development of the inclusive innovation platform. The lessons learned from these cases may be applicable to other industries, though the approach would need to be tailored to meet the specific needs of different organizations.

Keywords: coffee, innovation platform, organizational development, sustainability

RD-16-49

How Well Are Smallholders Engaged in Rural Development? Co-Designing Inclusive Coffee Value Chain with Farmers in the Southern Philippines

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Abstract

Despite the increasing use of participatory approaches and methods in the past decades, comments like "too little involvement of farmers..." are commonly heard during or after value chain interventions. Adequate and satisfying involvement of smallholder farmers in the design and implementation of programs and projects remains limited. This affects their collectives, inclusive relations, and sustained involvement; hence impacts of value chain developments in rural development efforts also remain short and non-integrated. This paper explores what extent co-designing an inclusive value chain for coffee contributes to smallholders' ability to identify options and decide on feasible interventions, and how, in the process, this influences their sense of inclusion. As an Action Research, this case study was conducted in Sultan Kudarat, the Philippines' current major coffee-producing province. This study used various engagement methods and tools with smallholders in a reflexive co-design process, such as interviews, focused discussions, formal and informal meetings, and observations. The document analysis showed that the interface between diagnostics, which aimed to understand the context and current involvement of smallholders in the chain, and co-designing interventions was critical in improving their ability to assess production and marketing capacities and their needs with value chain partners. While their participation varied at different levels at different stages of the process, this contributed to building their collective commitments. They valued genuine discussions where their aspirations and voices were reflected in understanding the context and decision-making on interventions. Their limited time, resources, and health affected the level of their participation, as well as their lack of power and relations with other actors in the chain. These imply the need for enabling human and social dimensions of relationship and partnership building with other chain actors, along with the financial and physical aspects of coffee farming. These human and social dimensions should capacitate and provide venues to share their voice, be heard, and be included in other stages of the coffee value chain.

Keywords: rural development, inclusive value chain, co-design, aspiration, participation, voice

RD-16-50

Biomass Blending Approach: Availability and Potential of Agricultural Residues as Energy Source in Thailand

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Abstract

The biomass blending approach became a great scheme for biomass pellet production. With widely available agricultural residues in Thailand, the research took this approach to produce biofuel from five-type residues including Rice Stubble (RB), Rice Straw (RW), Sugarcane Leaves (SL), Cassava Leaves (CL), and Cassava Rhizome (CR). Due to the high variation of the material properties and seasonal availability, the biomass blending approach can provide the alternative use of agricultural waste to produce energy and value-added products. For the consideration of the local potential availability of agricultural residues, many methods did not take into consideration the local factors that can affect the fluctuations of residue production. This study, therefore, aims to examine the availability of the crop residues by taking into account the local factors e.g., plant species, cultivation and harvesting processes, socioeconomics, etc. Utilizing one sub-district in Maha Sarakham province as a case study, the crop and residue data were collected and compiled from 100 farmers via questionnaire survey. The potential of using these crop residues as an energy was assessed. According to the seasonal availability, RB, RW, and SL were categorized as a group of high-producing materials. Meanwhile, CL and CR were a group of low-producing residues and can be used as a supplement material to improve energy efficiency. The study showed the Surplus Availability Factor (SAF) that indicated the annual availability of materials after subtracting the local uses for other purposes. The SAF of SL and CL were among the highest values of 1.00 and 0.91 respectively. It means that 100% and 91% of residues produced are available for biofuel production. On the other hand, high-producing materials like RW had the lowest SAF because of their demand for local use and commercial possibilities. The data showed that one typical sub-district in North-East Thailand produced the available crop residues approx.5,508.90 tons/year and accounted for 5,909.93 MWh or 2.53 Ktoe. Using agricultural residues as biofuel will provide great benefits to the environment; by reducing harvesting burning, providing a source of carbon-neutral fuel, and promoting a circular economy.

Keywords: agricultural residues, biomass blending, renewable energy, energy potential, surplus availability factor

RD-16-53

Understanding Resilience Needs and Livelihood Dynamics of Small-Scale Farmers and Fishers in Post-Typhoon Rai: Recommendations for Policy

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Abstract

This study synthesizes key findings from the project "Restoring Livelihoods and Enhancing Resilience of Farmers and Fisherfolk Affected by Typhoon Rai". It analyzes beneficiaries' socioeconomic profiles focusing on their educational backgrounds, farming and fishing assets, and income-generating activities to establish a baseline understanding of the farmers' and fishers' resources and capacities. Both farmers and fishers rely on traditional methods, which faced severe disruption from Typhoon Rai, leading to significant income loss. Based on these findings, the study recommends comprehensive capacity-building for Community-Based Organization members, improved resource access, enhanced disaster preparedness, livelihood diversification, and collaboration with local government to strengthen community resilience and sustainable recovery efforts.

Keywords: typhoon rai, community-based organizations, resilience needs, livelihood dynamics

RD-16-56

Financial and Economic Viability of Milkfish Farms in Dumangas, Iloilo Using Earthen Pond Technology

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Abstract

Milkfish farming is essential to the Filipino diet and local economy, particularly in Dumangas, Iloilo, where earthen pond technology is preferred for its cost-effectiveness and sustainability. This study assesses the financial and economic viability of milkfish farming in Dumangas by examining crucial indicators of profitability and economic stability. Data collected from structured questionnaires and interviews with local farm operators allowed for an evaluation of financial indicators, including net profit margin, return on investment (ROI), and payback period, along with economic viability metrics such as net present value (NPV), internal rate of return (IRR), and break-even analysis. The study's findings provide critical insights into the cost structure, revenue potential, and long-term feasibility of pond-based milkfish farming. With data from five respondents, the study showed an average total sales figure of PHP 228,354.05 and a net farm income of PHP 72,852.56, resulting in a 30.17% net profit margin. The financial analysis indicated a robust ROI of 33.86% and a payback period of 3.69 years, while the economic viability was further supported by an IRR of 30.89% and a positive NPV of PHP 332,087.85. These results highlight the strong profitability and sustainability of milkfish farming in Dumangas, underscoring its potential to improve food security and support regional economic stability. This research offers valuable recommendations for farmers, investors, and policymakers, promoting sustainable aquaculture practices that can drive economic growth and enhance the livelihoods of those involved in this vital industry.

Keywords: milkfish farming, economic viability, financial performance, profitability analysis, investment feasibility, aquaculture sustainability

RD-16-57

How Have the Women's Roles in Community Forest Management Changed? Cases of Two Cotu Ethnic Villages, Central Vietnam

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Abstract

Women play a crucial role in community forestry management (CFM) by using their knowledge of NTFPs for household livelihoods and biodiversity conservation. However, little is understood about the process that changes women's role in CFM in Vietnamese mountainous villages where patriarchic ethnic minorities have lived for generations. This study therefore assessed the process of changing women's participation and roles in CFM in two remote villages in central Vietnam. The relevant information was collected in two Co Tu ethnic villages in Tay Giang district, Quang Nam province, between May and September 2024. A total of 38 sampled households were interviewed, alongside participatory and observational methods to examine women's roles, labor division, and the village-level socioeconomic structure and governance. In-depth interviews with village elders were also conducted to understand the historical context of women's roles among the Co Tu ethnic group in the past. The collected data were analyzed chronologically. The result first found that both villages experienced a similar path for socioeconomic change: tighter forest regulations (i.e. banning slash-and-burn agriculture and commercial timber harvest), market development of NTFPs, and the increase in male migrant workers moving to cities, all of which provided rooms for women's participation in CFM. Second, women's actual empowerment processes were largely dependent on the village level. In one village, women's voices became more influential after a woman gained villagers' trust and was nominated as a member of the executive committee on CFM. In another village, women's role in linking forest resources and cultural tourism was increasingly recognized by the villagers. These findings demonstrate the importance of micro, meso, and macro factors affecting the change toward inclusive and gender-balanced forest governance.

Keywords: women, community forest management (CFM), ethnic minority, NTFPs

RD-16-60

Lived Experience: Exploring Social Life and Personal Relationships of Marileños in Brgy. Patubig Using Narratives and Images

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Abstract

The absence of accessible and well-designed social spaces has become a common issue in large cities and urbanizing rural municipalities. Without shared spaces and organized networks, it may result in social isolation, inequalities, and disconnection within the community. The purpose of this qualitative descriptive study was to understand the social life and personal relationships of Marileños in Brgy. Patubig through their lived experiences. This phenomenological study collected qualitative data mainly through semi-structured interviews, with a literature review, and photographs of the observed community used for triangulation. The key informant was purposively selected from residential communities within the barangay. The transcribed data gathered through a semi-structured in-depth interview was analyzed using Colaizzi's seven-step approach. Six themes describing the lived experiences of Marileños emerged: "Fostering Social Cohesion," "Facing Urbanization and Accessibility," "Flourishing Livelihood Stability,""Furthering Memories and Emotional Value," "Finding Public and Recreational Spaces," and "Feelings of peace and security." Findings reveal that enhancing the public realm through well-designed public spaces and inclusive urban planning can bridge gaps and promote equity among residents. Recommendations include the development of a multi-purpose community-oriented hub that provides a positive ripple effect enhancing the communal, economic, and environmental life of Brgy. Patubig. This study contributes to urban design literature by highlighting the importance of community-centered planning and participatory approaches in improving the quality of life in urban areas like Marilao.

Keywords: phenomenological exploration; human-built environment; public spaces; cultural identity; subjective well-being; Marilao, Bulacan

RD-16-61

Assessing the Financial and Economic Viability of Artisanal Salt Production Methods: A Case Study of Miag-ao's Budbud and Guimaras' Tultul Salts

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Abstract

Salt is an essential mineral with broad applications across industries, yet the Philippines relies on imports for 93% of its annual demand. Amid this paradox, traditional salt-making methods, such as Budbud in Miag-ao, Iloilo, and Tultul in Guimaras, are vital yet endangered due to climate change, which shortens coastlines and disrupts weather, alongside a decline in interest from younger generations. This research investigates the production processes, financial viability, and sustainability of these artisanal salt methods, aiming to bridge the gap between tradition and economic sustainability. The study employs qualitative and quantitative methods, including narrative analysis, descriptive statistics, key informant interviews, and focus group discussions with local salt producers. The Budbud process involves saturating sand with seawater, filtering it with organic extracts, drying it on bamboo beds under the sun, and roasting it with lemongrass for enhanced flavor. The Tultul process involves burning driftwood for ash, filtering seawater, and boiling it in multiple stages to produce blocks of salt. The financial analysis highlights exceptional viability for both practices. Using accounting tools such as net profit margin, return on investment (ROI), internal rate of return (IRR), and break-even analysis, the study reveals that Budbud achieves a net income of ₱257,100.00, a net profit margin of 40.58%, and an ROI of 105.43%, with an IRR of 205.43%. The Tultul production outperforms, with a net income of ₱554,249.00, an 80.19% profit margin, an ROI of 18,012.64%, and an IRR of 1,260.00%. The study highlights the urgent need for concerted efforts to preserve Budbud and Tultul salt production. Beyond their economic viability, these artisanal methods are essential to cultural heritage and local livelihoods. Addressing environmental challenges and revitalizing interest in these practices among younger generations will ensure their sustainability and empower local communities, reducing dependence on imported salt and safeguarding an important part of Philippine tradition.

Keywords: Budbud, Tultul, artisanal salt, profitability, economic viability, sustainability

RD-16-62

Organic Amendment Improved Soil Property and Water Usage Efficiency in Pomelo Orchards Affected by Drought and Salinity in the Mekong Delta

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Abstract

Saltwater intrusion and irrigation water shortages during dry seasons have posed significant challenges to crop cultivation in recent years in the Mekong Delta. This study investigated the effects of water-saving irrigation techniques combined with various soil amendments on soil properties and water use efficiency in Da Xanh pomelo orchards in Vinh Long province, Mekong Delta. A field experiment was performed from 2021 to 2023 with seven treatments, including conventional irrigation (control), water-saving irrigation based on soil water holding capacity, and water-saving irrigation based on soil water holding capacity combined with different organic amendments (rice straw mulch, organic compost, and biochar) in various combinations and quantities. Results demonstrated that treatments combining water-saving irrigation with organic amendments significantly improved soil physico-chemical properties, including pH, water holding capacity, organic matter content, bulk density, saturated hydraulic conductivity, macro-porosity, and overall porosity in both 0-15 cm and 15-30 cm soil layers. The application of 5-10 tons ha -1 year -1 of organic fertilizer and biochar, combined with straw mulching, substantially reduced irrigation water requirements during the dry season by 1,413-1,966 m^3ha^{-1} and increased pomelo yield. These findings suggest that integrating water-saving irrigation with organic soil amendments offers an effective strategy for improving soil properties and water use efficiency in Da Xanh pomelo cultivation, potentially mitigating the impacts of water scarcity and soil degradation adapting to climate change in the Mekong Delta.

Keywords: water holding capacity, saving irrigation, organic compost amendment, climate change, soil compaction

RD-16-63

Exploring the Path to Cooperative Enterprise in Madagascar: A Case Study of the Cooperative Fanamby

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Abstract

Agricultural cooperatives in Madagascar are experiencing a resurgence, and a new law has been introduced following two decades of stagnation. The National Strategy for Cooperative Development (SNDCOOP) has provided the framework for this transformation. At the microeconomic level, cooperatives face challenges such as poverty among members, poor economic performance, and governance and management weaknesses, which hinder long-term success (SNDCOOP, 2021). This study explores the transition of traditional cooperatives into sustainable cooperative enterprises, focusing on six key dimensions: governance, management, introduction, commercial, financial, and social/environmental impacts. A qualitative approach involved interviews with cooperative members, agribusiness specialists, and international collaborators. Using the Diagnostic and Monitoring of Organization Capacity (DMOC) tool, the study assessed the operations of Cooperative Fanamby (CF), located in a rural area of the Vakinankaratra region in Madagascar, across these dimensions. We examine the relationships between the dimensions through a correlation matrix, revealing that poor management and weak financial structures are critical bottlenecks. Management and financial performance exhibited the strongest correlation (0.90), underscoring their interdependence. The lack of professional development, internal controls, and financial documentation hampers growth. Strengthening management and financial skills is essential for Cooperative Fanamby's transformation into a sustainable cooperative enterprise. These findings offer actionable recommendations and serve as a reference for cooperatives facing similar challenges in Madagascar and in a global context.

Keywords: cooperative enterprise, Madagascar, management, financial performance, sustainability

RD-16-64

Consumer (Co-) Ownership in Renewables as a Learning and Empowerment Tool in The Asian Energy Transition: The Examples of Pakistan and India

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Abstract
The developing Asia following sustained high growth rates has become an important energy market which also poses the question of its CO2 emissions. Half of humans without electricity access and some 70% lacking clean cooking fuels reside in this region. When electrifying these so far unserved end-users, Asia faces a complex challenge: Avoiding being locked in dirty fossil fuels while raising and implementing future investment in renewables that at the same help mitigate energy poverty. One important means of fighting energy poverty would be to increase disposable household income. When consumers become prosumers of decentralized RE-systems, they produce not only for self-consumption, reducing their overall energy expenses, but may sell excess production providing them with an additional source of income. In a paradigm shift, the Indian government introduced "Electricity Rights of Consumers Rules" including the right to prosume in December 2020 with implementation decrees following in 2021. This paper investigates to which extent Consumer Stock Ownership Plans (CSOPs) can be implemented in developing countries, where the demand for energy is growing, and rural areas have limited grid access. Our comparative analysis from Indian and Pakistani best practice cases shows evidence of two key elements fostering RE-consumer (co-)ownership: (i) stimulation of local resources through active involvement of shareholders and stakeholders; and (ii) access to capital credit for investments through support policies and funding programs. In the context of gender dimension and inclusion measures, we also discuss which (external) factors accompanying the implementation of RE, in particular electricity projects, can mutually reinforce gender equality (SDG 5) and access to clean energy (SDG 7).

Keywords: sustainable development, consumer stock ownership plan, prosumership, renewable energy, inclusion, and gender dimension, Indian and Pakistani case studies

Special Session Report 1

A Quarter Century of International Development Cooperation at the Institute of Environmental Rehabilitation and Conservation (ERECON): Achievements and Future Challenges towards ESD

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Abstract

Education for Sustainable Development, ESD aims the empowerment of learners to make decisions and take responsible actions for environmental integrity, economic viability, and social/ community development for present and future generations. It is holistic and transformational education for all people to learn the values, behavior and lifestyles required for a sustainable future and for positive societal transformation. Since the beginning of the United Nations Decade of Education for Sustainable Development from 2005 to 2014, the Institute of Environmental Rehabilitation and Conservation (ERECON) has been promoting ESD through its various extension and research activities, including the establishment of RCE Greater Phnom Penh. For promoting ESD, ERECON has been collaborating with many governmental and non-governmental organizations in Asian countries. Various ERECON extension projects are related to afforestation and organic farming based on natural resource circulation, which are aiming to promote carbon capture and storage in forest and agricultural areas as well as sustainable rural development with income generation for local people. Always, Education for Sustainable Development is the fundamental purpose for approaching to local people. Accordingly, ERECON holds various workshops and trainings with local people before implementing the extension activities. Additionally, the academic and scientific activities through the International Society of Environmental and Rural Development (ISERD) managed and steered by the Research Center of ERECON has been in the line of ESD. In 2025, ERECON celebrated a quarter century anniversary from the foundation. Under the new global framework 'ESD for 2030' by UNESCO for the period of 2020-2030, the Institute of Environmental Rehabilitation and Conservation (ERECON) continues to challenge on promoting ESD toward achieving the Sustainable Development Goals (SDGs) in the target local communities of Asian countries.

Keywords: international development cooperation, ERECON, ESD, SDGs

Special Session Report 2

Structure and Financial Characteristics of ERECON Institute: Extension and Research Integration

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Abstract

The financial landscape of the Institute of Environmental Rehabilitation and Conservation (ERECON) highlights its unique positioning among Japanese NGOs. Since its establishment in 2000 and transition to a Non-Profit Organization (NPO) in 2002, ERECON has relied primarily on donations and grants, with revenue exceeding 100 million yen in both 2018 and 2023. Compared to other Japanese international cooperation NGOs, ERECON operates within the typical budget range, as indicated by the Japan NGO Center for International Cooperation (JANIC), where 15.9% of NGOs have annual budgets between 100 million and 300 million yen. A distinctive financial feature of ERECON is its ability to generate research-related revenue, which is rare among NGOs. From 2013 onward, after being designated as a MEXT-accredited research institution, ERECON began securing Grants-in-Aid for Scientific Research, contributing to financial diversification. Unlike most NGOs that solely depend on external funding for extension programs, ERECON has successfully integrated academic funding into its operational model, ensuring financial stability while maintaining its mission in environmental rehabilitation and rural development. Despite challenges such as limited financial and human resources, ERECON's structured financial approach—balancing traditional NGO funding with research grants—sets it apart in the sector. Moving forward, its ability to sustain and expand financial resources is critical in reinforcing its role as a leading model for Japanese NGOs integrating research budgets and extension ones for practical development purposes.

Keywords: organizational structure, financial characteristics, extension, research

Special Session Report 3

Challenges on Sustainable Forest Management in Cambodia

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Abstract

In Cambodia, forest cover has decreased from 73% in the 1960s to 43% in 2020. The causes of deforestation and forest degradation include forest clearing and agricultural expansion during the Khmer Rouge era in the 1970s, large-scale illegal logging and timber trade in the 1990s, and further agricultural expansion and illegal deforestation following the issuance of Economic Land Concessions (ELCs), particularly during the early 2010s. Since 2014, some ELCs have been reclaimed by the government, however, the impact of deforestation continues due to overexploitation of forest resources by the growing population and unofficial ELCs. The massive forest loss in Cambodia has increased the risk of natural disasters, declined biological and genetic diversity of indigenous trees, and jeopardized the local livelihoods where the residents traditionally relied on forest resources. Therefore, the Institute of Environmental Rehabilitation and Conservation, ERECON, has been addressing the challenges of forest loss with the aim of sustainable community development across provinces in Cambodia. The initiatives are formed through integrating all three organizational programs, including: 1. Environmental Rehabilitation and Conservation – promoting participatory reforestation and management activities, enhancing carbon sequestration through agroforestry, conserving biodiversity through mixed planting of native tree species, and promoting genetic diversity through seedling production. 2. Utilization of Natural Resources – enhancing natural resource circulation through agroforestry, compost making using locally available organic resources, and promoting sustainable forest resource utilization. 3. Environmental Education– promoting capacity building of local communities through workshops, training sessions, and participatory rural appraisal methods; formulating management groups that play a central role in managing planted seedlings; strengthening the capacity of school teachers and promoting environmental education in elementary schools. In the program year of 2024, the project on promoting school environment greening aiming for forest environmental education in Tbong Khmum Province, as well as the project on promoting reforestation and education for sustainable development in Siem Reap Province were promoted. Based on the cases implemented in both provinces, the achievements and challenges for sustainable forest management in Cambodia are discussed.

Keywords: reforestation and forest conservation, natural resource circulation and utilization, and environmental education

Special Session Report 4

Challenges on Community Development through School Construction and Renovation in Cambodia

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Abstract

In rural areas of Cambodia, the educational environment is inadequate, and local residents have low awareness of the importance of education. Also, educational facilities, especially school buildings are apparently insufficient. Additionally, in the rural societies, due to the experiences of the Pol Pot era, the concept of community has not been matured. Therefore, this project aims to promote local self-help efforts, establish a sustainable educational environment, and contribute to improving the livelihoods of local residents. In other word, through school construction, the project is seeking to foster a sense of ownership among local residents through school construction, create a sustainable school environment, and promote the sustainable development of the community. Through 2 years project implementation, 6 schools were built and the educational environment was improved. In addition, the school construction committee, which is made up of teachers and local residents, appealed to local residents about the importance of education and the need for school buildings, raised sufficient donations, and encouraged local residents to perform labor service for school construction, which led to an improvement in the capacity building of the committee members. Through these various activities during construction, the awareness of education among teachers and local residents was improved. The committee has been making reports on construction progress at least once a week, ensuring transparency. After construction, the donations are used as a community development fund to implement community projects. So far, community projects in small businesses such as microfinance, chicken raising and the fertilizer sales have been implemented with the community development fund. The aim is to create a system in which a portion of the sales from these small businesses will be returned to education, contributing to a sustainable school environment. It is expected that participation in school construction fosters a sense of ownership, which leads to the formation of self-sustaining communities. It is also hoped that local residents gain a deeper understanding of the importance of education and take initiative to improve the educational environment. Ultimately, it is expected that the community will envision a sustainable development model and take action to achieve growth on its own.

Keywords: community development, school construction and renovation, self-sustaining community, importance of education