BOOK OFABSTRACTS

International Conference on Agro-Environmental Science

14th December 2023 at Yokoi Hall of Setagaya Campus, Tokyo University of Agriculture, Japan

International Society of Environmental and Rural Development
ISERD
FOUNDED IN 1891
TOKYO UNIVERSITY OF AGRICULTURE

International Conference on Agro-Environmental Science

BOOK OF ABSTRACTS

14th December 2023, Tokyo NODAI, Japan

at Yokoi Hall of Setagaya Campus, Tokyo University of Agriculture, Japan

Organized by: International Society of Environmental and Rural Development

Co-organized by: Graduate School of Agro-Environmental Science, Tokyo University of Agriculture

Collaborated with:

- Center for Global Initiatives, Tokyo University of Agriculture, Japan
- Research Center, Institute of Environmental Rehabilitation and Conservation, Japan

PREFACE

It is very gratefully to hold the International Conference on Agro-Environmental Science under the collaboration between the International Society of Environmental and Rural Development, ISERD, and the Graduate School of Agro-Environmental Science, Tokyo University of Agriculture, Japan.

ISERD holds the official conference annually, which is the International Conference on Environmental and Rural Development, shortly ICERD, around in March every year. The hosts as well as venues are rotating among the collaborative organizations, so far 6 times were held in Cambodia, 5 times in Thailand including coming the 15th ICERD in March 2024, 2 times in Philippines, and once in Myanmar and Tokyo, respectively. Even during the Covid Pandemic in 2020 and 2021, ISERD held the 12th ICERD online hosted by the Bohol Islands State University in Philippines in 2020, and the 13th ICERD online by the Research Center, Institute of Environmental Rehabilitation and Conservation in Tokyo in 2021. We have been prioritizing to have an academic interactions/ communication through holding ICERD for discussing the effective connection between research outcomes and agricultural and rural development in each site, in addition to the directions of the society for deepening further collaboration among the collaborative organizations.

Separately from the official conference, ICERD, it is the first time for ISERD to hold the International Conference on Agro-Environmental Science with the Graduate School of Agro-Environmental Science, Tokyo University of Agriculture, Japan. Tokyo University of Agriculture, shortly Tokyo NODAI founded in 1989, is one of the long historic and strong universities in Japan. Tokyo NODAI has wide and deep educational and research fields in agriculture and related fields with 23 departments in 6 faculties/ graduate schools.

With the collaboration of the Graduate School of Agro-Environmental Science, Tokyo University of Agriculture, we do believe this event would offer more international academic experiences to the graduate school students and scientists.

December 14, 2023

Prof. Dr. Machito MIHARA,
Executive Secretary,
International Society of Environmental and Rural Development

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Thursday, 14th December, 2023

13:00-13:10 Opening Remarks

Prof. Dr. Hiroya OBAYASHI,

Dean, Graduate School of Agro-Environmental Science,

Tokyo University of Agriculture, Japan

Associate Prof. Dr. Narong TOUCH,

Secretary for International Affairs,

Graduate School of Agro-Environmental Science,

Tokyo University of Agriculture, Japan

13:10-13:30 Keynote Presentation

Associate Prof. Dr. Placid Mpeketula

School of Natural and Applied Sciences,

University of Malawi, Malawi

13:30-14:30 **Presentation Session 1**

14:30-15:00 Coffee Break

15:00-16:00 **Presentation Session 2**

16:00-16:15 Closing Remarks

Prof. Dr. Machito MIHARA,

Executive Secretary, International Society of Environmental and Rural Development

PRESENTATIONS

Keynote presentation

Autonomous Rural Innovations and Environmental Sustainability in Lake Malawi National Park's Ecosystems: The Case of Chembe Enclaved Villages

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Abstract

Farmer-led agricultural innovations are increasingly viewed as a potential approach to sustainable agriculture especially promoting rural revitalization, soil fertility improvement and mitigating agricultural non-point source pollution. The complex nature and formidable challenges that characterize social-ecological systems especially in developing countries and rural landscapes, demands a transformation towards sustainable futures. Improving the well-being of vulnerable people in rural areas while simultaneously promoting sustainable resource management and building resilience to shocks, are global challenges that require identification of sustainable pathways, effective processes and trajectories with the potential to facilitate the transformation of the social-ecological systems. Autonomous agricultural innovations that are immerging in rural areas can help in achieving sustainable agriculture and enhance ecosystem services by improving multiple indicators of human well-being while creating synergies among various ecosystem components and enhancing their supporting services. Despite the potential role of autonomous agricultural innovations, very few cases have documented on their impact on various natural resources, and wider environmental ramifications. Using data from Lake Malawi National Park's enclaved villages of Chembe in Mangochi District, Southern Malawi, we investigated the role of an autonomous innovation in agriculture, a community garden and evaluated its impacts on one of the key natural resources, soil and consequential implications of the innovation on wider ecosystem components. We analyzed soils for micronutrients to obtain baseline data and provide a benchmark study for long term monitoring and management. A selected panel of micronutrients in soils were measured using Atomic Absorption Spectrometry (AAS) after acid block digestion with a mixture of concentrated nitric acid (70% HNO_3) and Hydrogen peroxide (30% H_2O_2). Measured micronutrients included zinc (Zn), manganese (Mn), copper (Cu), iron (Fe) and selenium (Se) from soil samples obtained from the autonomous innovation and contrasted with other ecosystem types within the study area namely; continuous maize farm, dambo wetland, bare land and forest land. Our findings indicated that mean soil Zn and Mn concentration from the autonomous innovation were significantly high (1.51, 663 mg/kg respectively) compared to the rest of the ecosystem types ($p<0.0001$). Soils of the community garden also showed remarkable improvements in pH (5.6) compared to the maize farm and bare land (4.6, 4.8 respectively). Apart from improving the quality of life of the community through routine distribution of vegetables to vulnerable households, thereby offsetting the burden to overharvest resources from the forest or lake ecosystems, there were apparent benefits of the innovation on wider ecosystem components. While different forms of agricultural innovation have radically different outcomes in diverse landscapes, our findings on the autonomous innovation in Chembe indicate positive outcomes and underscore the relevance of similar innovations as potential pathways for sustainable and positive farmer-led agro-environmental initiatives.

Keywords: Autonomous innovation, micronutrient, ecosystem, soil management, social-ecological systems

Scientific presentation

Synergistic Sheep Manure and Di-ammonium Phosphate: Countering Nutrient Deficiencies, Enhancing Soybean Photosynthesis and Yield

Abdul Alim Osmani[a], Mohammad Wasif Amin[a,e], Zabihullah Farid[a], Shafiqullah Aryan[b], Naveedullah Sediqui[d,e], Khalid Joya[a], Habibullah Hazim[c], Hakimullah Amini[a]

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Abstract

Severe climate changes in arid and semi-arid regions, for example rising summer temperatures, lowering winter temperatures, and a lack of rainfall, have made calcareous soils' fertility concerns, more specifically nitrogen and phosphorus deficits, progressively worse. This study investigated the effects of sole and combined application of SM and DAP fertilizer namely FT1 (SM = 0%, DAP= 0%), FT2 (SM= 100%, DAP= 0%), FT3 (SM = 0%, DAP= 100%), FT4 (SM = 50%, DAP= 75%), FT5 (SM = 50%, DAP= 50%), and FT6 (SM = 50%, DAP= 0%) on growth, photosynthesis, and yield parameters of soybean cultivar (LD 04-13265 USD) in calcareous soil of a semiarid region in Parwan, Afghanistan. The results indicated that plant height and nodule number were unaffected by fertilization treatments, however growth features including leaf number, root length, and shoot biomass affected significantly. The photosynthesis parameters except intercellular CO2 concentration were found to be significantly higher in FT4 and FT5, compared to FT1 (control). As a result, combined application of SM and DAP fertilizations such as FT4 and FT5 revealed better growth performance, higher photosynthesis efficiency as well as producing more seed yield compared to sole fertilizations. Ongoing studies can investigate the long-term effects of combining SM and DAP fertilizer on soil health parameters in calcareous soils. This can include assessing changes in soil pH, organic matter content, microbial activity, and nutrient cycling processes. Understanding these dynamics will contribute to sustainable agricultural practices and long-term soil fertility improvement.

Keywords: Sheep manure, di ammonium phosphate, soybean; photosynthesis, soil fertility, seed yield

Relationship between Natural Soil Area and Tree Species Richness in Urban Green Spaces

Victor Agagi[1*], Nanako Suzuki[2], Kako Matsunaga[2], Satoru Tanaka[2], Aggrey Adimo[1], Kojiro Suzuki[2], John Bosco Mukundi[1], Annika Keeley[3],

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Abstract
Urban green spaces (UGS) remain significant refuge for biodiversity conservation in highly urbanized areas. However, the invariable anthropogenic interference in the UGSs driven by economic incentives and partial interdisciplinary implications have led to increased soil sealing. We examined the extent of soil sealing, natural soil area, tree canopy cover, and tree species number of 26 UGSs in Tokyo Metropolitan Area, Japan, and established the are-species relationships. The number of tree species across the UGSs were intermediate and strikingly similar across the UGSs, ranging from 143 – 19. Compared to other UGS types, The proportion of sealed surfaces was significantly different across the different UGS types (<.000), ranging from 58.82% - 0%. Japanese style gardens and conservation areas exemplified low proportion of sealed surface. Correlations between natural soil area, tree canopy cover, and tree species richness were highly significant at $p<0.01$; natural soil area and tree species (*rho = 0.754 **, n=26*), tree canopy cover and tree species richness (*rho = 0.766 **, n=26,*), natural soil area and tree canopy cover (*rho = 0.986 **, n=26*). These findings have significant implication on urban planning policy and biodiversity conservation.

Keywords: Urban green spaces, soil sealing, tree species richness, tree canopy, biodiversity conservation, urban planning

Effect of LED Lighting on Growth, Vitamin C and Phenols in Ethiopian Kale (*Brassica carinata*) Microgreens

Ruth Nyambura Maru[a], John Wesonga[a], Dickson Mazibuko[b], Satoko Akiyama[c], Ayako Sekiyama[d], Shotaro Kawakami[d], Sarvesh Maskey[d], Agnes Kavoo[a], Johnstone Neondo[a] and Hiromu Okazawa[d*]

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Abstract

Microgreens are innovative vegetable products due to their novelty and health-promoting benefits. However, media and light conditions affect microgreens' growth and nutritional content, which may limit their production in rural community settings. *Brassica carinata* is an essential local Kenyan vegetable, but its production and full utilization are limited by its early maturity. The potential of using *B. carinata* as a microgreen would be an excellent alternative production technique to circumvent its early maturity limitation. This study investigated the influence of white and blue light on Vitamin C and phenols content in *B. carinata* microgreens. Microgreens were grown for 14 days in a growth chamber using plastic punnet containers filled with cocopeat and sand under white and blue light. The capillary wick watering technique was used for irrigation. Temperature and relative humidity were monitored and maintained at 25ºC and 60%, respectively. The photoperiod and intensity of light were also maintained at 12 hr and 160 ± 2.5 µmol $m^{-2}s^{-1}$) respectively. After 14 days, microgreens were harvested and freeze-dried to analyse phenols and Vitamin C. Data was subjected to ANOVA and means separated by Tukey's multiple comparison test. Results indicated that light had no significant effect on *B. carinata* phenol content. However, microgreens grown in sand showed statistically higher amounts of phenol content than those grown using cocopeat. For vitamin C content, media and light showed no significant effect. Based on our results, sand, as a locally available medium and in either light, can equally be used to produce microgreens for phenols and Vitamin C for *Brassica carinata.*

Keywords: Microgreens, LED light, growing media, functional foods, nutraceuticals

Understanding the Diversity and Status of Urban Trees and Herbaceous Plants of Setagaya Ward

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Abstract
Urban areas present a challenge of imbalance in the diversity of the planted species of trees and other planted herbaceous plants. The limited planting space therefore depicts urban areas as locations of low biodiversity. This research focused to compare the diversity of trees and herbaceous plants growing in selected green children's parks and street lanes of Setagaya ward. This research also highlighted the regeneration mechanism and relevance of herbaceous plants species surveyed in the selected survey sites of Setagaya. Six urban street lanes stretching a distance of 18.3 km, and 18 green children public parks covering an area of 21,045.5 m^2 were surveyed. A total of 49 tree species belonging to 28 families were surveyed. Of these, 15 species are exotic while 34 species are native to Japan. A total of 26 tree species and 38 tree species were surveyed on street lanes and in public parks respectively, 15 tree species were surveyed in both land uses. Also, a total of 46 herbaceous plant species were surveyed. A total of 33 herb species and 29 herb species were surveyed on street lanes and in public parks respectively. 16 herbaceous plant species were surveyed in both land uses. Six herb species are dispersed by birds, one species by explosion mechanism, seven species by humans, 12 species by water and 14 species by wind. 60 % of herbaceous species have medicinal value, 40% have food value, 57.5% have ornamental value, 7.5% have materials value. The parks surveyed have higher Shannon-Weiner species diversity index of 3.1452 and that of street lanes is 2.5312. Street tree species include *Liquidambar formosana, Liriodendron tulipifera, Ginkgo biloba* and so forth. Park tree species include *Osmanthus fragrans, Zelkova serrata, Quercus myrsinfolia* and so forth.

Keywords: Urban forestry, trees, herbaceous plants, diversity, regeneration

The Dynamics of Physical, Chemical Properties and Greenhouse Gas Emission in Food Waste Composting

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Abstract

Rapid growth in the global population leads to increased consumption and generation of waste that ends up in dumpsites and landfills, which are the most common ways to dispose of waste throughout the world. Municipal solid waste's life-cycle activities and breakdown contribute significantly to greenhouse gas emissions (GHGs). Composting is an environmentally friendly method of managing organic waste, but it has a substantial downside in the form of greenhouse gas emissions; including carbon monoxide (CO), nitrous oxide (N_2O), methane (CH_4), and carbon dioxide (CO_2). The aim of this study was to access the dynamics of (GHGs) i.e., CO_2 and CH_4 emission, the physical and chemical characteristics of food waste during composting. Five treatments comprised of; T0 = 100% cow dung (CD); T1= 75% CD + 25% FW; T3= 50% CD+ 50% FW and T4=100% food waste (FW)+0% CD were set up. GHG emission and physical properties not limited to; soil moisture, soil organic matter (SOM) and soil organic carbon (SOC) were sampled and measured weekly. Chemical properties analyzed included total nitrogen (TN), total Phosphorus (TP) using a spectrophotometer, pH, electrical conductivity, K^+, Na^+ and Ca^{2+}. The results indicated that there was no correlation between GHGs emission, physical and chemical properties of the compost. However, there was a strong correlation at between TN, SOM, and SOC $p<0.01$ during the fifth week of the composting.

Keywords: Food waste, greenhouse gas emission, composting

Long-term Hydrologic Analysis of Malawian River Basins; A Case Study of Diamphwe Basin

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Abstract

Developing countries suffer severe socio-economic consequences from extreme weather events, including livelihood losses and increased costs. Identifying climatic and hydrologic events through trend analysis is essential for managing water resources. The study focuses on the Diamphwe River basin in central Malawi, a crucial area supporting wetland (dambo) ecosystems, agriculture (rainfed and vegetable-irrigated winter cropping), and water supplies for the Dedza and Lilongwe districts. Using statistical analysis methods such as Mann-Kendall, Pettit, and Standardized Precipitation Index (SPI), the study examined hydrologic trends from 1975 to 2010 to identify long-term hydrologic trends in the region that are important for improving agricultural productivity. The research findings revealed a high correlation between rainfall and increased land user time. However, rainfall significantly impacts river discharge only during the rainy season. In the dry season, water for river discharge comes from sources like aquifers and subsurface flow. Through the Pettit test and SPI, it was discovered that 1989 was a transition year, and the 1991-2000 decade was the dryer decade with the worst drought during the 36-year project period. The study concludes that decreasing trends in rainfall and river discharge, along with a sudden drop in 1989 and drought, indicate a changing climate in the river basin. This change is linked to increased land use, reducing forest land. The research offers essential insights to water and environmental stakeholders, helping them develop region-specific policies based on research to mitigate and adapt to the potential negative impacts of climate change on society and the environment. The research is also valuable for farmers and local authorities, as it provides helpful information on tackling climate change challenges in agriculture in order to improve the efficiency of the proposed multi-purpose dam project on the river.

Keywords: Climate change, trend, river discharge, rainfall, Mann-Kendall test, Pettitt test

Assessment of Hydroponic Suitability for Malawian Indigenized Vegetables: *Amaranthus retroflexus* and *Phaseolus vulgaris* (common bean)

Dickson M. Mazibuko[a, b], Antonio Fuentes[a], Kazuha Wakasugi[a], Sarvesh Maskey[c], Hiromu Okazawa[c]

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Abstract
Adoption of improved crop cultivation technologies has been to be slow in Sub-Saharan Africa (SSA), leading to lower yields and starvation. This study examined the adaptation of two vegetables indigenized in Malawi, *Amaranthus retroflexus* (Vegetable Amaranth) and two cultivars of *Phaseolus vulgaris* (common bean), to hydroponic cultivation. Yield and growth were compared using a Nutrient Film Technique (NFT) hydroponic system in Yokohama, Japan. Amaranthus showed excessive growth with a marked apical dominance. Both bean cultivars were successfully grown under hydroponics with no significant differences. The hybrid cultivar however had significantly lower specific leaf area (SLA), suggesting a genetic predisposition. These two vegetables can be further tested in hydroponics. For amaranth, it needs to be investigated if de-budding can suppress apical dominance and promote above-ground biomass.

Keywords: Amaranth, common beans, cultivation technologies, hydroponics, vegetables

Recycling of Nitrogen and Phosphorus from Urban Wastewater using Calcium-silicate-hydrate (CSH): Case Study in Cambodia

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Abstract

The effluents from wastewater contain nutrients that have been identified as the primary causes of eutrophication in natural waters. A case study from Cheung Ek, an urban wastewater lake in Cambodia, has indicated polluted with NH_4^+ (18-22 mg/L) and PO_4^{3-} (2.3-4.6 mg/L). Even though phytoremediation through water morning glory cultivation was introduced into the lake, only a certain amount of nutrients can be removed from the lake's water (65.22% and 17.36% for NO_3^- and PO_4^{3-}, respectively). Hence, this wastewater's lake must receive suitable treatment before being discharged into other water bodies. Low-cost and high-performance materials or techniques that could synergistically remove pollutants in a simple manner are highly desired. Therefore, the main goal of this research study is to evaluate the CSH synthesized from calcium hydroxide $Ca(OH)_2$ and rice husk ash as a promising strategy both economically and environmentally friendly for wastewater treatment as well as nitrogen and phosphorus recovery. The CSH material was prepared by combining calcium hydroxide $Ca(OH)_2$ and rice husk ash with a ratio (1:4) and mixing with 75% deionized water. Following the process with a vibrator from 1 to 3 minutes, the CSH was kept in the mold for 3 weeks at room temperature before starting the experiment. The absorption experiment considers parameters such as pH, EC, Ca, K, NH_4^+, and PO_4^{3-} in 2 weeks period. Results of the absorption experiment indicated that CSH can effectively remove nutrients from wastewater, achieving removal rates of 97% for $PO_4^{3-}$and 98% for NH_4^+. The absorption capacity of CSH is 0.11 mg-PO_4^{3-}/ g-CSH and 0.065 mg-NH_4^+/g-CSH. These results suggest that CSH, derived from $Ca(OH)_2$ and rice husk ash, could serve as a cost-effective solution to water pollution in Cambodia, given the material's affordability and widespread availability throughout the country.

Keywords: Nutrients recycling, CSH, Cambodia

International Society of Environmental and Rural Development

Philosophy of 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 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.

Purposes of ISERD:

The primary purposes of ISERD 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.

In order to enhance the realization of the primary purposes of ISERD, the secondary purposes are;

- to facilitate interaction among international, governmental, non-governmental organizations and local communities,
- to hold conferences or symposia on environmental and rural development,
- to edit the International Journal of Environmental and Rural Development,
- to confer some awards based on scientific achievement, research paper or poster presentation, and
- to encourage and develop local awareness concerning sustainable rural development.

Membership:

There shall be two categories of membership.
(a) Individual
(b) Organizational
An application for membership of ISERD shall be submitted to the secretariat of ISERD, where is located in the Research Center at Institute of Environmental Rehabilitation and Conservation (Japan) by writing or by other appropriate means.

Also, every presenter who attends the International Conference on Environmental and Rural Development (ICERD) is registered as an Individual Member of ISERD.

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