BOOK OF ABSTRACTS

6TH INTERNATIONAL MULTIDISCIPLINARY CONFERENCE FOR YOUNG RESEARCHERS

"Science and Innovation: Advancing the Path to a Sustainable Future"

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MCYR

MULTIDISCIPLINARY CONFERENCE FOR YOUNG RESEARCHERS

ABOUT MCYR

The MCYR conference provides a dynamic platform for early-career researchers to present their work, exchange ideas across disciplines, and engage in meaningful scientific discussions. It aims to cultivate an open and supportive environment that encourages constructive feedback, collaboration, and professional growth. Beyond showcasing research, MCYR offers valuable opportunities for networking, helping participants connect with peers, experts, and institutions that can inspire future partnerships and advance their academic and professional journeys.

The annual MCYR conference is held in Prague at the Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague.

BioResources & Technology · siris · AgriSci-UA · COMUNIDAD · bío capital · unicom

MCYR 2025

The 6th Multidisciplinary Conference for Young Researchers (MCYR) was held on 9–10 October 2025 in Prague, Czech Republic, hosted by the Czech University of Life Sciences Prague (CZU) and organised by the BioResources & Technology Division (BRT) of the Faculty of Tropical AgriSciences (FTZ). Bringing together early-career researchers from around the world, the conference explored the subtheme "Science and Innovation: Advancing the Path to a Sustainable Future."

MCYR fostered inspiring discussions on sustainable agriculture, circular bioeconomy, artificial intelligence, open science, and climate resilience, providing a platform for young researchers to present their work and build cross-disciplinary connections. Supported through the AgriSciences Platform for Scientific Enhancement of HEIs in Ukraine by the Czech Republic's Development Cooperation and the Ministry of Foreign Affairs, the event embodied purposeful cooperation. Key partners, including AgriSci-UA, OSIRIS, COMUNIDAD, BIO-CAPITAL, and UNICOM, enriched the programme with diverse approaches to open science, bioeconomy, and university–community collaboration. MCYR 2025 reaffirmed its mission to empower young researchers and promote innovation for a more sustainable future.

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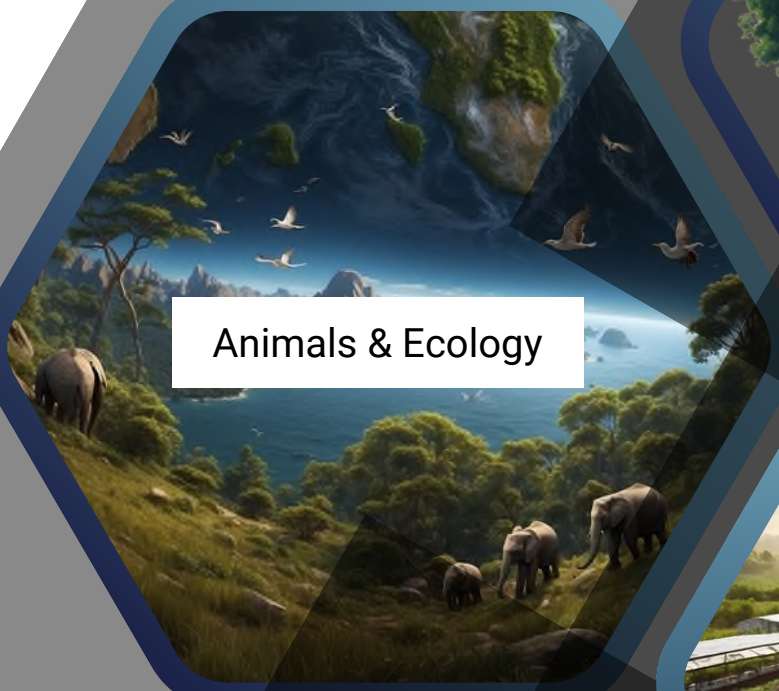
University of Agriculture and Forestry, Hue University, Hue city, Vietnam

MCYR 2025 SCIENTIFIC SESSIONS

This year's MCYR conference features a range of thematic sessions that cover key aspects of global and societal challenges:

Society & Culture



Animals & Ecology

Plants & Agriculture

Technology & Innovation

Climate & Sustainability

MCYR

MCYR 2025 KEYNOTES

The keynote speeches explored how curiosity drives purposeful and transparent research, the value of equitable North–South collaboration in advancing global knowledge, and the need to embrace change in academia with openness and innovation. Together, they inspired early-career researchers to pursue science that is ethical, connected, and impactful.

Beyond Curiosity: Building Purposeful Research for a Changing World

Assoc. Prof. Dr. Hynek Roubík
Czech University of Life Sciences Prague, Czech Republic

The Partnership Opportunities for Global North-South Cooperation

Dr. Nils Haneklaus
University for Continuing Education Krems, Austria

Who's Afraid of Change

Dr. Inge Stegeman,
Utrecht University, Netherlands

MCYR 2025 SESSION CHAIRS

Dr. Nils Haneklaus,
University for Continuing Education Krems, Austria

Expertise: environmental scientist and policy expert.

Dr. Sandipan Banerjee,
BRT Postdoctoral Researcher
CZU, Czech Republic

Expertise: plant-gut microbe interaction and environmental biotechnology.

Dr. Aishwarya Chaure,
BRT Postdoctoral Researcher,
CZU, Czech Republic

Expertise: natural product chemistry and ethnobotany.

Dr. Adam Hruška,
BRT Researcher,
CZU, Czech Republic

Expertise: food security and machine learning.

Dr. Inge Stegeman,
Utrecht University,
Netherlands

Expertise: clinical researcher and open science advocate.

Ing. Antoine Bercy,
BRT Junior Researcher; PhD student, CZU, Czech Republic

Expertise: waste management technologies and open science practices.

Ing. AbdulAzeez Shobajo,
BRT Junior Researcher; PhD student, CZU, Czech Republic

Expertise: sustainable recycling of organic and industrial waste.

MCYR
Multidisciplinary Conference for Young Researchers

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MCYR 2025
SCIENTIFIC SESSIONS

CLIMATE & SUSTAINABILITY

Thermal Valorization of Sewage Sludge and Gypsum Wastes for Sustainable Fertilizer Development

Chhorth Chhiengputheavy [1]*, Filip Mercl [2], Leidy Marcela Ulloa Murillo [2], Hynek Roubík [1]

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Abstract: The overuse of synthetic fertilizers and pesticides poses environmental risks, while waste materials such as biomass ash (BA), sewage sludge (SS), flue gas desulfurization gypsum (FGDG), and phosphogypsum (PG) present opportunities for nutrient recovery. This study investigates the co-pyrolysis of these materials to produce recycled PSK fertilizers. Three feedstock mixtures (TA: SS+BA+FGDG; TB: SS+BA+FGDG+PG; TD: SS+BA+PG) were pyrolyzed at 500°C and 900°C. Biochar yield, pH, macronutrient and micronutrient content (total and available), and concentrations of potential toxic elements (As, Cd, Cr, Pb) were evaluated. Higher pyrolysis temperature reduced biochar yield but increased pH (from ~9 to 11–12) and total nutrient content (P, K, S). Although nutrient availability was greater at 500°C, arsenic concentrations were below detection at 900°C in all samples. The results demonstrate that co-pyrolysis conditions significantly affect nutrient solubility and contaminant immobilization, supporting the safe and efficient recovery of fertilizer components from mixed waste streams.

Keywords: co-pyrolysis; biomass ash; flue gas desulfurization gypsum; phosphogypsum; sewage sludge

Acknowledgement: The authors acknowledge the Technology Agency of the Czech Republic for supporting this project (grant no. TH79020003) under the ERA-MIN3 action, funded by the European Union through the Horizon 2020 Program (grant agreement no. 101003575). Support from the Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague (IGA grant no. 20253132).

Urban Public Space Crisis in Ulaanbaatar: Overcoming Challenges and Unlocking Green Potential

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Abstract: Public spaces in Ulaanbaatar are under intense pressure due to rapid urbanization, climate change, and socio-economic transformations. Despite the adoption of the Green Development Policy and Ulaanbaatar 2020 Master Plan, green space availability remains critically low—between 0.12 and 5 m² per capita—far below global recommendations. This study explores the policy and institutional challenges inhibiting the development of public green spaces and investigates innovative strategies to address these issues. The study employs a qualitative approach, including critical analysis of policy documents and semi-structured interviews with institutional stakeholders. These methods are used to assess systemic barriers and identify practical interventions for enhancing urban green space. The research identifies four key institutional challenges: poorly designed action plans, weak coordination among stakeholders, lack of financial resources, and the absence of a comprehensive urban planning framework. It further highlights the city's latent potential to expand green spaces through targeted interventions such as converting underused areas into pocket gardens, redesigning schoolyards, and integrating greenery into redevelopment plans. To improve green space equity and urban sustainability in Ulaanbaatar, the city must adopt an adaptive, inclusive, and resource-efficient planning approach. Small-scale but strategic interventions can meaningfully increase per capita green space and enhance urban quality of life.

Keywords: urban green space; public policy; institutional barriers; informal settlements; sustainable planning

Biogas-Oriented Pretreatment of Lignocellulosic Substrates

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Abstract: Lignocellulosic biomass, such as agricultural residues, presents a promising feedstock for biogas production due to its abundance and renewable nature. However, its complex structure, primarily composed of cellulose, hemicellulose, and lignin, poses challenges for microbial degradation during anaerobic digestion. Effective pretreatment methods are essential to improve substrate accessibility and enhance biogas yield. Various pretreatment techniques were analysed, including physical (milling, steam explosion), chemical (alkaline and acid hydrolysis), and biological (enzyme-based or microbial) approaches. The focus was placed on their effectiveness in enhancing substrate digestibility, improving methane yields, and their practical applicability in biogas systems. Particular attention was given to combined or synergistic methods, which demonstrated notable improvements in lignocellulosic breakdown and overall process efficiency. Alkaline pretreatment and steam explosion proved to be the most effective individual methods for boosting methane yields. Combined approaches, such as alkaline treatment with enzymatic hydrolysis, further enhanced biogas production by over 50%. Biological methods were eco-friendly but slower and less consistent. Effective pretreatment significantly improves the digestibility of lignocellulosic biomass. Combined strategies offer the greatest potential for increasing biogas output and advancing sustainable energy production.

Keywords: pretreatment methods; lignocellulosic biomass; anaerobic digestion; biogas production

Non-native Crop Diversification with Pitahaya: Climate Adaptation Panacea or Pandora's box for Philippine Agriculture?

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Abstract: Pitahaya (*Hylocereus undatus*), commonly known as dragon fruit, is rapidly emerging as a significant crop in the Philippines, with production volumes increasing more than tenfold between 2012 and 2024. Farmers and agricultural authorities view Pitahaya as a promising diversification option, particularly given growing uncertainties around climate change affecting traditional cash-crops like mango and pineapple. Yet the environmental implications of introducing this non-native species remain poorly documented. This study aims to evaluate Pitahaya's economic, social, and environmental implications to guide evidence-based climate-adaptive diversification policies. Data were collected between 2023 and 2025 through semi-structured interviews with 30 key informants, including farmers and agricultural officials, complemented by statistical data sourced from the Bureau of Plant Industry (BPI) and Philippine Statistics Authority (PSA). Interview transcripts and statistical data were analyzed using thematic analysis via Atlas.ti software to identify key economic, social, and environmental themes. Findings indicate strong economic and social support for Pitahaya cultivation among both farmers and government authorities, citing its potential resilience against climate variability and economic profitability compared to traditional crops. However, respondents largely overlooked potential environmental risks, notably the introduction of new pests and diseases, significant water management challenges due to the crop's sensitivity to drought and excess moisture, and waste management issues related to fruit processing. While Pitahaya presents an economically and socially attractive strategy for agricultural diversification in response to climate pressures, careful evaluation and mitigation of environmental risks are urgently needed to ensure sustainable agricultural practices.

Keywords: crop diversification; climate change; sustainability; Pitahaya; Philippines

Acknowledgement: We gratefully acknowledge Guimaras State University in the Philippines for creating excellent data-collection conditions and arranging direct access to our interviewees.

Turmeric Growers' Livelihood Vulnerability to Climate Change: Index based Evidence from Mizoram in North Eastern Himalayan Region of India

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Abstract: Although climate change is a global issue, its adverse effects are often experienced at local and regional levels. India's two-third population lives in villages, most of whom mostly rely on farming and forestry which are largely sensitive to climate. This study aims to understand how local communities perceive the impact of climate change on their livelihoods and to recognize and assess the factors contributing to livelihood vulnerability. Using household survey, primary data was collected from 332 randomly selected households in the Lunglei and Mamit districts of Mizoram, located in India's North Eastern Himalayan (NEH) region. The livelihood vulnerability index (LVI-IPCC) framework, developed by the Intergovernmental Panel on Climate Change, was employed to assess the climate change-induced vulnerability of livelihoods. The study revealed that lack of irrigation facilities, lack of advanced health facility-sensitivity, bamboo houses, absence of institutions for higher education were some of the hindrances in adapting strategies to the changing climate. Although both the districts experienced nearly equal exposure, less adaptive capacity and more sensitivity made Lunglei comparatively more vulnerable than Mamit district. Diversified indicators strengthened our study and vulnerability assessment would favor decision makers, institutions, organizations etc., in identifying the vulnerable households at village level and helps to bring in some good interventions.

Keywords: climate; vulnerability; adaptation; turmeric; Mizoram

Acknowledgement: We sincerely thank "Indian Council of Social Science Research (ICSSR)" for giving us the opportunity to work under "Spice based rural economy and livelihood under climate change in Himalayan region of India: Economics of adaptation measures". We heart fully thank our Mizo friends Malsa, Sawma, Zara and many who helped us throughout our research.

Eco-Friendly Photocatalytic Dyes Removal Using CuO/ZnO Nanoparticles Incorporated into Metal Organic Framework-5

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Abstract: Industrial wastewater containing synthetic dyes poses significant environmental hazards. Conventional treatment methods often lack efficiency or sustainability. This study aims to develop an eco-friendly photocatalyst by incorporating bimetallic CuO/ZnO nanoparticles into MOF-5 to enhance dyes removal from wastewater. CuO/ZnO nanoparticles were synthesized via a green method and incorporated into MOF-5. The nanocomposite was characterized using UV-Vis spectroscopy, FTIR, SEM, XRD, and EDX. Photocatalytic degradation of methyl orange and crystal violet dyes was optimized using response surface methodology, varying pH, catalyst dosage, irradiation time, and dye concentration under UV light. The CuO/ZnO@MOF-5 nanocomposite exhibited outstanding photocatalytic activity, achieving 92% degradation of methyl orange and 89% degradation of crystal violet under optimized conditions. Characterization confirmed successful incorporation of CuO/ZnO nanoparticles within MOF-5, which enhanced charge separation and promoted the generation of reactive oxygen species. These factors contributed to the rapid and efficient breakdown of dye molecules under UV light irradiation. This study demonstrates that CuO/ZnO-incorporated MOF-5 is a promising, cost-effective, and sustainable photocatalyst for dyes removal in wastewater treatment. Further research is needed to elucidate fundamental mechanisms and apply this technology to real wastewater systems.

Keywords: cuO/znO; mof-5; photocatalysis; dyes removal; wastewater treatment

Acknowledgement: The author acknowledges the support of the Government College Women University Sialkot for facilitating this research.

Ruminal Impaction due to Plastic Pollution: Possible Measures and Legal Consequences

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Abstract: Plastic pollution has emerged as a global environmental crisis, significantly impacting ecosystems and biotic health with a severe impact and irreversible damage caused to the rumen in animals. The issue is exacerbated by the persistence of plastics in the environment, as it takes hundreds of years to degrade, leading to long-term ecological harm. The adopted method is purely doctrinal in nature based on an extensive review and analysis of existing literature, including statutes, academic writings, and authoritative commentaries. It examines the existing legal and policy frameworks along with Organization for Economic Co-operation and Development reports designed to mitigate, curtail, and manage plastic waste, highlighting stringent penalties imposed worldwide to curb its environmental consequences. Several critical insights of plastic pollution and its multifarious impacts on both the environment and biota are revealed. Specific to ruminants, its consumption poses severe health risks leading to ruminal impaction, bloat, indigestion, and fatal gastrointestinal blockages and polybezoars. Plastic accumulation in the digestive system can further be complicated by the release of toxins, which may enter the food chain through meat and milk. Legal measures such as bans on single-use plastics, adherence to Extended Producer Responsibility regulations, and the imposition of civil penalties and sanctions under trade and international law are being implemented. By delving into principles of sustainability, the polluter pays principle, and international treaties aimed at environmental protection, the paper underscores the urgent need for a global action plan to regulate plastic use and disposal effectively.

Keywords: plastics; ruminant; Organization for Economic Co-operation and Development; extended producer responsibility

Acknowledgement: We would like to express my sincere gratitude to the ICMR for providing necessary infrastructure and resources to access the journals, articles, circular, guidelines and rules which are instrumental to complete the present work.

Hydropower's Sustainability and Environment Conflict: Insights from Ravi River Basin in Himachal Pradesh, India

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Abstract: The Ravi River basin in Himachal Pradesh hosts several large hydropower projects, including Chamera-I (540 MW), Chamera-II (300 MW), Chamera- (230 MW), and Holi Bajoli (180 MW). While these projects contribute to national energy demands III, field observations indicate significant socio-environmental consequences. Local communities express increasing concern not only about displacement and inadequate compensation but also the loss of traditional practices and ecological resources. field observations indicate significant socio-environmental consequences. Traditional cropping systems have declined, water mills (gharats) have been abandoned, and rare ethnobotanical species are disappearing. Deforestation, microclimatic shifts, and biodiversity loss have affected both ecological balance and livelihoods. Himachal Pradesh lies within a seismically active zone, where large reservoirs and intense construction may induce seismic activity. This poses serious risks to dam safety and downstream populations. A risk assessment index calculated for the four projects 2.68, 1.94, 2.38, and 2.15 respectively highlights these vulnerabilities. Public resistance has emerged in response to issues such as forest diversion, excessive muck dumping, drying of natural springs, blasting-induced structural damage to homes, and increased landslide activity. These conflicts are part of a broader pattern of infrastructure-driven land use change, which is compromising the ecological stability of the fragile Himalayan landscape. These findings derived from primary data on socio-economic disruptions and primary data on measurable environmental impacts highlight the critical need to embed sustainability within hydropower planning processes. There is an urgent imperative to reexamine prevailing development paradigms to ensure they align with ecological thresholds, strengthen community resilience, and promote long-term environmental governance.

Keywords: environmental conflict; hydropower; Ravi River; sustainability

Acknowledgement: The author received grant from ICSSR, New Delhi.

Energy Efficiency and Innovativeness of The Application of Fibers in Road Cement Concrete

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Abstract: Currently, in addition to asphalt concrete roads, cement concrete roads are becoming increasingly popular. In this regard, the relevance of increasing their physical and mechanical indicators arises to increase durability, reliability, economy, environmental friendliness, and resource conservation. Such an increase is possible due to the use of various types of fibers, in particular polypropylene and basalt. The former are a synthetic product of waste processing. The latter correspond to inorganic, natural, environmentally friendly material. The study established the influence of different basalt and polypropylene fibers dosages in a wide range of concentrations on the main physical and mechanical indicators of road cement concrete. It was established that the introduction of the optimal amount of polypropylene and basalt fibers allows for increase in flexure strength by 1,38 and 1,30 times, respectively. Due to such a significant increase of flexure strength, the fibers introduction into the cement concrete composition can reduce the amount of cement, one of the most energy-intensive and costly components of cement concrete. In addition to reducing the cost and energy intensity of the road cement concrete production with using fibers, the environmental factor is additionally improved due to the processing using polypropylene fibers and the use of natural ecological basalt fibers. This approach to construction can contribute to overall energy efficiency in the global industry. According to the baseline scenario "Perspective of the World Energy Situation" of the International Energy Agency for the implementation of energy-efficient measures and technologies, increasing waste recycling can reduce energy consumption in industry in 2050 to 45 EJ (excluding the use of fuel as a raw material). The results of this study emphasize the importance of using energy-efficient technologies in the production of road cement concrete with the addition of fibers, which can not only increase efficiency and energy efficiency in combination with ensuring improved properties of this material, but also contribute to the energy efficiency of the global industry.

Keywords: basalt fibers; energy efficiency; flexure strength; polypropylene fiber; cement concrete

A Comprehensive Examination of the Neglected and Missing Thread Between the Formulation and Execution of Biogas Policies in the Global South, Resulting in the Sustainable Adaptation of Biogas Technology

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Abstract: Biogas technology is praised for waste management, renewable energy, and producing organic fertilizer, supporting circular economy principles. Yet, in many Global South countries, biogas adoption and sustainability remain low despite policies. Analyzing the gap between policy creation and implementation is essential to finding public-serving solutions and strategies. The study reviewed biogas policy research using the PRISMA 2020 protocol, providing insights for policymakers and researchers. It analyzed peer-reviewed, open-access English articles from Scopus (2007-2025), identifying 220 articles, with 14 meeting the inclusion criteria. The review shows that 57% of articles identify policy formulation challenges, which include focusing narrowly on a single biogas function, a lack of participatory methods, and data accuracy. For policy implementation, 14% note challenges like inadequate frameworks and poor coordination. A significant issue, highlighted in 71% of articles, is the absence of integrated, transdisciplinary processes affecting policy alignment and innovation. There's also a lack of monitoring, outdated policies, and missing links between academia, industry, and society. The Global South, per 36% of articles, faces specific issues such as limited technical expertise, governance problems, and political instability. To address these challenges and limitations, it is proposed that the integration of market-based policy instruments and mechanisms, in conjunction with policy tools for energy synergy within the context of the Global South, serves as an effective solution.

Keywords: anaerobic digestion; technological adoption; policy analysis; developing countries

Acknowledgement: The research was supported by the OSIRIS project, which is funded by the European Union's Horizon Europe research and innovation programme under grant agreement No. 101094725. Furthermore, it was supported by the IGA FTZ CZU (no. 20253132).

The Impact of Organic Loading Rate on the Effectiveness of Co-Digestion of Leachate from Composting of Biowaste and Waste Gylcerine

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Abstract: Closing the loop in the composting process by the treatment of its high-strength liquid waste by-product, i.e. leachate (LB) is essential for aligning with circular economy principles. Anaerobic co-digestion was used for its treatment. To increase the pH and the COD/TKN ratio of LB, a carbon-rich waste glycerine (WG, 3% v/v) from saponification, was introduced. This study evaluated the impact of organic loading rate (2, 4 and 6 kg COD/(m^3·d)) on the effectiveness of mesophilic co-digestion of LB and WG under continuous feeding conditions in an up-flow anaerobic sludge blanket reactor (UASB). The results showed that at OLR of 2 kg COD/(m^3·d), the specific biogas production and methane content from co-digestion of LB and WG were 236 NL/kg COD and 69%, respectively. Increasing the OLR to 4 and 6 kg COD/(m^3·d) resulted in an improvement in methane content in biogas by 3.8 and 8.4%, respectively, and a notable rise in specific biogas production by 12% at both OLRs, while maintaining a high removal efficiency of organic compounds (COD), exceeding 96%. Moreover, the cumulative daily biogas volume at OLR of 4 and 6 kg COD/(m^3·d) was 1.21-times and 2.33-times higher, respectively, compared with that at OLR 2 kg COD/(m^3·d) (0.87 NL/day). The COD and VFA concentrations in the post-digestion effluent increased from 656.8 to 1525.7 mg COD/L and 600.8 to 1059.7 mg VFA/L as the OLR increased. In contrast, both pH and N-NH_4 concentrations in the post-digestion effluent decreased with increasing OLRs. These results indicate at OLRs in the range 2-6 kg COD/(m^3·d) effective co-digestion of LB and WG was noted. Increased OLRs effectively enhanced biogas yield and methane content in biogas while maintaining high organic matter removal, highlighting the strong potential of these substrates for efficient waste-to-energy conversion.

Keywords: anaerobic treatment; highly biodegradable leachate; waste glycerine; biogas production; organic loading rate; UASB reactor

Predicting CO_2 Concentrations in University Cafeterias Using Regression-Based Machine Learning Models

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Abstract: Maintaining acceptable CO_2 concentrations is crucial for ensuring occupant comfort and well-being, especially in densely populated settings such as university cafeterias. Elevated CO_2 concentrations indicate poor ventilation, leading to discomfort and respiratory issues. While Machine Learning (ML) has been widely applied to air quality monitoring, research specifically focused on predicting CO_2 concentrations in cafeteria settings, particularly in naturally ventilated environments, has been limited. This study develops regression-based ML models to predict CO_2 concentrations in two distinct open types of university cafeterias. A total of 300 samples were collected from both cafeterias during the summer season (June-August). The dataset comprises 22 features covering inhabitant thermal comfort metrics, environmental parameters, demographic data, and architectural design characteristics. Three regression-based ML models, specifically Decision Tree (DT), Random Forest (RF), and XGBoost were applied to predict CO_2 concentrations. Model performance was assessed using Mean Squared Error (MSE), Root Mean Squared Error (RMSE), and the coefficient of determination (R^2). Additionally, cross-validation was employed to systematically tune hyperparameters and improve predictive accuracy. From the findings, all three models achieved over 85% accuracy including the evaluation metrics, with XGBoost performed very well (R^2 = 0.91, MSE = 0.18, and RMSE = 0.42). This performance indicates that ML-driven models can effectively support environmental monitoring and improve indoor air quality management in university cafeterias. These findings can assist the inhabitant's comfort and the better architectural design by optimizing ventilation and promoting sustainability. Future studies should include more comprehensive features and collect data across various seasons to enhance model applicability.

Keywords: machine learning; naturally ventilated cafeterias; CO_2 concentration prediction; air quality monitoring

Analysis of the Impact of Stakeholder Groups on the Implementation of Sustainable Development on the Global Market

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Abstract: Sustainable development is one of the most critical challenges facing modern society, which requires global cooperation and transformation of traditional systems. The purpose of the study is to investigate the impact of different stakeholder groups, such as governments, investors, consumers, corporations and other organizations, on the sustainability of the global market, with a focus on defining key drivers and bottlenecks affecting sustainable development. The research employs methods of analysis and synthesis to examine the alignment of stakeholder groups interests, while generalization and systematization are used to highlight the core issues within modern market mechanisms. The findings reveal a significant gap between the interests of the key actors in the global economy, which slows down the progress of sustainable development and creates substantial market barriers for environmentally friendly initiatives. The key stakeholder groups of sustainable development are currently not sufficiently motivated or engaged in the implementation of new practices, as the modern market has only begun to shift from pursuing mostly economic gains to focusing on their balance with social and ecological dimensions. This research contributes to a broader understanding of the changes that are required in order align stakeholders' interests and advance the achievement of the Sustainable Development Goals and offers recommendations for adapting market regulations to the new global challenges.

Keywords: sustainable development; stakeholder engagement; market mechanisms; value

From Waste to Energy: Thermo-chemical Properties and Combustion Performance of Coffee Pulp Biomass

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Abstract: Coffee production generates substantial amounts of by-products, with coffee pulp being particularly noteworthy as a currently underutilized resource for bioenergy applications. Given that Colombia's coffee sector predominantly cultivates the disease-resistant *Coffea arabica* L. var. Cenicafé 1, this variety's pulp presents a significant opportunity for valorization. This study focused on characterizing the thermo-chemical properties of dried coffee pulp to evaluate its potential as a renewable energy source. Fresh coffee pulp (200 kg batches) was dried in a parabolic solar dryer to evaluate drying kinetics and yield, followed by comprehensive characterization including proximate and ultimate analysis, calorific value determination, and ash behavior assessment. The results revealed appropriate fuel properties: a high net calorific value (16.51 MJ kg^{-1}), substantial volatile matter content (87.5%), moderate ash content (3.5%), and favorable elemental composition with low sulfur (0.10%) and chlorine (0.05%) concentrations. Combustion tests in a static-bed mechanical dryer demonstrated practical applicability, showing that 2.6 kg of dry pulp could effectively reduce the moisture content of 1 kg coffee beans from ~53% to 11 ± 0.5% (wb), with a conservative field recommendation of 3.0 kg to account for operational variability. The study concludes that dry coffee pulp represents a technically viable and environmentally sustainable biofuel alternative for decentralized coffee processing, offering energy autonomy to smallholder farmers while contributing to waste valorization in the value chain, supporting the integration of coffee by-products into circular economy models for coffee-growing regions.

Keywords: biomass energy; renewable fuels; agricultural waste valorization; sustainable coffee production.

Acknowledgement: This research was conducted with support from the National Coffee Research Center - Cenicafé, and the National Federation of Coffee Growers of Colombia.

Predicting Temperature Variations in Laboratory Environments Using Regression-Based Machine Learning Models

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Abstract: Maintaining the proper temperature in laboratories is essential for occupant comfort, cognitive performance, and equipment efficiency. It is important to find out the suitable temperature based on both objective and subjective variables for sustainability. The aim of this study is to construct regression-based machine learning (ML) models for temperature prediction in the laboratory, which takes into account variations across different climates, populations, and building characteristics. A total of 341 samples were collected from the laboratories of a university located in Dhaka, Bangladesh, which includes 24 variables such as demographic data (e.g., Gender, Age), environmental factors (e.g., Lighting, Air Quality, and CO2 levels), etc. Three ML models, such as Decision Tree (DT), Random Forest (RF), and XGBoost were used to predict the temperature. Model performance was evaluated using Mean Squared Error (MSE) and Root Mean Squared Error (RMSE). Additionally, GridSearchCV was employed for cross-validation. The results revealed that all models performed satisfactorily with an accuracy of more than 80%. DT outperforms XGBoost and RF with an accuracy of 90%, an MSE of 0.22, and RMSE of 0.47. Importantly, factors such as lighting conditions, air quality perception, CO2 levels, and air conditioning presence were found to be crucial in regulating the temperature and enhancing occupant comfort and productivity. These results highlight the capacity of machine learning models in contributing to temperature control and mitigating conditions in laboratory environments. Future developments may involve extending the model to different situations, real-time updates, or seasonal variations.

Keywords: machine learning; sustainability; regression model; laboratory environment; climate

Acknowledgement: I would like to express my sincere gratitude to the university laboratories in Dhaka for providing the data used in this study, and to my supervisors and colleagues for their invaluable guidance and support.

Recycled Cotton Insulation Boards: A Sustainable Alternative for Thermal and Structural Applications

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Abstract: The construction industry is under growing pressure to adopt sustainable materials and reduce its environmental footprint. Traditional insulation materials are often energy-intensive and non-renewable. This study explores the use of recycled cotton fibers from textile waste as a bio-based alternative for thermal insulation boards, aiming to combine effective insulation properties with improved mechanical strength. Thermal insulation boards were produced from post-consumer recycled cotton fibers combined with eco-friendly adhesives: dispersive PVAc and modified corn starch. Test specimens were prepared in varying densities (300–340 kg/m³) and evaluated for thermal conductivity, specific heat capacity, moisture resistance, compressive and tensile strength using standardized methods (e.g., EN ISO 29469, EN ISO 29766). The boards showed thermal conductivity values between 0.0710–0.0739 W/mK and increasing mechanical strength with density. The combination of adhesive types ensured material cohesion while minimizing environmental impact. Despite higher water absorption (21–22%) compared to other natural fiber composites, mechanical performance was significantly improved, supporting potential use in structural applications. Recycled cotton insulation boards represent a sustainable and scalable alternative to conventional materials. They offer a promising balance between thermal performance, structural integrity, and environmental responsibility. Further improvements in moisture resistance and production standardization could enhance their application range.

Keywords: sustainable materials; bio-based composites; recycled cotton

Acknowledgement: This research was supported by the Internal Grant Agency of the Faculty of Forestry and Wood Sciences, Czech University of Life Sciences Prague, under project no. A_09_23: "Development and analyses of thermal insulation materials based on cellulose fibers".

Developing a Socioeconomic Assessment Tool for Biogas Adoption of Sugarcane Farmers in Nigeria

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Abstract: This study involves the design and implementation of a structured questionnaire developed to investigate the socioeconomic determinants influencing biogas technology adoption among sugarcane farmers in Oyo State, Nigeria. The tool was formulated through an integrative process involving literature review, expert consultation, and preliminary field tests with target respondents. It included variables spanning demographic characteristics, farm operations, energy use, and perceptual factors. The questionnaires were administered 120 farmers, and logistic regression analysis revealed that education level (OR = 7.08), perception (OR = 12.72), farming experience (OR = 1.12), and age (OR = 0.94) are significant predictors of willingness to adopt biogas. In addition to statistical results, the survey identified significant knowledge gaps and policy-related barriers to the implementation of decentralised biogas systems. The findings highlight the necessity for targeted policy interventions, including farmer education and youth engagement, to drive biogas technology adoption and ensure the effective valorization of sugarcane bagasse. This would have significant contribution toward sustainable energy generation and improved waste management in Nigeria.

Keywords: biogas adoption; questionnaire; socioeconomic survey; sugarcane; logistic regression; Nigeria

Acknowledgement: This research was funded by the Technology Agency of the Czech Republic (grant number TH79020003); support for this project was offered under the coordination of the ERA-MIN3 action, which has received funding from the European Union under the Horizon 2020 Program (European Commission Grant Agreement no. 101003575). In addition, it was supported by the Internal Grant Agency of the Faculty of Tropical AgriSciences, Czech University of Life Sciences, Prague (number 20253132).

The Role of Agricultural Cooperatives in Sustainable Value Chains: Evidence from Battambang Province, Cambodia

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Abstract: Agricultural cooperatives (ACs) play a vital role in promoting sustainable agricultural value chains by enhancing farmers' productivity, market access, and bargaining power while encouraging environmentally responsible practices. In Cambodia, the Sustainable Rice Platform (SRP) provides a framework for sustainable rice production, with cooperatives central to its implementation. However, the role and effectiveness of ACs within SRP value chains remain underexamined. This study explores the role of ACs in the SRP value chain in Battambang province to identify key success factors, challenges, and opportunities for scaling sustainable rice production. Data were collected through Key Informant Interviews (KIIs) with leaders from 10 BUAC-member cooperatives, local NGOs, and Commune Agricultural Officers. Interviews were conducted in Khmer, transcribed using Transkriptor software, reviewed for accuracy, and thematically analyzed with MAXQDA. Results indicate that all SRP rice producers are cooperative members who benefit from access to inputs, training on sustainable practices, premium prices, and direct sales to Amru Rice., one of the largest rice exporters in Cambodia. Despite these advantages, only a small proportion of members' rice is sold under SRP standards due to limited drying capacity at the rice mill and payment delays. These constraints lead some farmers to sell immediately to middlemen at lower prices. While cooperatives are key facilitators of SRP, challenges related to post-harvest infrastructure and payment delays hinder broader participation. Scaling SRP requires investment in mill capacity and financial support for cooperatives to advance payments to members, strengthening their role in sustainable value chains.

Keywords: agricultural cooperatives; sustainable rice platform; value chains; smallholder farmers; market access

Acknowledgement: This research was supported by the Erasmus+ program and the SmartAgriCambodia project, which funded the field research.

The Role of Educational Stands in Preserving Ecosystems of Hydrological Objects on the Example of Sumy, Ukraine

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Abstract: Urbanised areas with a developed network of water bodies have a significant potential for combining recreational functions with environmental education of the population. In this context, the study aims to investigate the hydrological objects of Sumy, analyse their current state, identify environmental problems, and develop tools for environmental education, including the creation of information stands. The objects of analysis were the Psel, Sumka, Strilka, Popadka rivers, Chekha, Blue Lakes, Durovshchyna lakes and the Kosivschynske Reservoir. The following research methods were used to accomplish the tasks: field research (visual inspection of water bodies); search and analysis of literary and electronic sources of information; generalization and systematization; statistical analysis; comparative and geographical research method. Typical problems were identified: pollution by domestic wastewater, siltation, bank erosion, and violation of water protection zones. Stands were created containing up-to-date information about the hydrological features of water bodies, flora and fauna, environmental challenges, and rules for responsible visiting. They perform the function of environmental education and can be an effective means of raising the level of consciousness of the local population and visitors. Based on the findings, recommendations are made to modernise the recreational infrastructure, strengthen control over the condition of water bodies, and introduce interactive digital solutions. The study emphasises the importance of combining environmental education initiatives with practical environmental protection measures, which contributes to the conservation of water resources and supports the sustainable development of the urban environment.

Keywords: hydrological objects; recreation; tourism; environmental education; educational stands

The Spread of the Invasive Species *Acer Negundo* L. with Climate Change: Results of Climate Modelling for 17 European Countries

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Abstract: Modelling the distribution of the invasive species *Acer negundo* L. is important as a theoretical basis for monitoring and managing invasions caused by climate change. They will help to assess the risks and pathways of invasion in new territories, priorities for preventing invasion, and summarise data on already invaded regions that require restoration and urgent management measures. The aim of the study is to model the potential spread of *A. negundo* in 17 European countries using 19 bioclimatic variables from WorldClim version 2.1 website, two additional variables (terrain elevation; human population density) and the MaxEnt 3.4.4 software package within the Java Runtime Environment. The study of the spread of invasive plant species includes changes in their ranges and ecological niches under projected global temperatures. We used the MaxEnt model to estimate the potential distribution of *A. negundo* (29243 locations from the Gbif database), 19 bioclimatic variables, terrain elevation (SRTM data), and human population density, which is one of the indicators of urbanisation. We used 2 temperature change scenarios for Europe up to 2100 - ssp126 and ssp585 (IPCC, 2021: Climate Change 2021). According to the model, the greatest impact on the distribution of the taxon is the average temperature of the coldest quarter, the average temperature of the driest quarter, population density, and the annual temperature range. The species is predicted to expand its range by 17.1% (ssp585 - 2041-2060) and 20.2% (ssp585 - 2081-2100). The largest expansion is expected in the northern and north-eastern countries of Europe, and in the countries of the eastern coast of the Black, Azov Seas.

Keywords: alien plants; biological invasions; biodiversity; MaxEnt modeling

Phytoremediation of Pharmaceutical Wastes: A Safer Approach for Sustainable Environment

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Abstract: Encapsulation, incineration and acid leaching are few of the common methods the pharma-industry utilize in treatment of pharmaceutical waste. These methods were found to pose threat to the environment. Thus, there is a need for exploration of sustainable approaches such as phytoremediation, whereby green plants can accumulate and degrade pollutants. This study was designed to assess the potential of *Urena lobata* (UL), *Panicum maximum* (PM), *Chromolaena odorata* (CO), and *Eleusine indica* (EI) to uptake four common pharmaceuticals: carbamazepine (CBZ), metronidazole (MTZ), paracetamol (PCM), and ibuprofen (IBU). Plants were grown in soils pre-exposed to these drugs. Roots and leaves were harvested, freeze-dried, and blended. Extracts were obtained via cold maceration and solid-phase extraction using C18 Bakerbond cartridges. Analytes were separated on silica gel TLC F254 plates using optimized mobile phases: hexane:ethyl acetate (3:7) for CBZ, chloroform:methanol (9.5:0.5) for MTZ, chloroform:ethyl acetate (7:3) for PCM, and hexane:ethyl acetate with glacial acetic acid (1:9) for IBU. Visualization was done under UV light (254 nm) and quantified using qTLC.app. Carbamazepine showed higher concentration in UL leaves (237.08µg/mL) than its roots (61.75µg/mL). Metronidazole showed higher concentration in the root of UL (550µg/mL) than in root of PM (127.2µg/mL). Paracetamol was more concentrated in the root of CO (259.56µg/mL) than its leaves (43.35µg/mL). Ibuprofen showed concentration of 245.96µg/mL in CO root. These findings indicated that the selected plant species can absorb pharmaceutical residues from soil, with uptake apparently specific to plant species and drug type. This supports their potential application in environmentally sustainable waste treatment strategies.

Keywords: pharmaceuticals; phytoremediation; sustainability; waste treatment

Evaluation of Antimicrobial Effects of Natural Essential Oils in Fermented Meat Products

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Abstract: The growing demand for clean-label and naturally preserved foods has encouraged the search for alternatives to synthetic preservatives. Fermented meat products are highly susceptible to microbial spoilage and foodborne pathogens, which compromise safety and shelf life. This study investigates the antimicrobial potential of thyme and rosemary essential oils against key spoilage and pathogenic bacteria associated with meat products. Antimicrobial activity will be assessed using an in vitro broth microdilution method according to CLSI guidelines. Bacterial strains will be sourced from certified collections (e.g., CCM, DSMZ). Minimum inhibitory concentrations (MICs) of the oils will be determined through serial dilutions. Additionally, model fermented sausages incorporating essential oils will be produced to evaluate microbial stability, sensory attributes, and overall product quality. It is expected that thyme and rosemary essential oils will demonstrate significant antimicrobial activity, with MIC values within effective ranges for practical application. Incorporation into sausage formulations is anticipated to improve microbial stability without negatively affecting sensory quality. The findings will support the application of essential oils as viable, clean-label alternatives to conventional preservatives, aligning with consumer preferences and contributing to safer, more sustainable preservation strategies for fermented meat products.

Keywords: essential oils; antimicrobial activity; fermented meat; thyme; rosemary

Investigating the Effect of Different Organic Materials on the Reclamation of Salt Affected Soils

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Abstract: Soil salinization is a major factor causing soil degradation globally. In Hungary, approximately 15% of the land mass is covered by salt-affected salts majorly caused due to saline ground water. This poses a threat to food production causing urgent need to employ suitable and sustainable measures to rehabilitate the agricultural soils. We conducted a pot experiment to investigate the effect of mulch and compost in salinity in the water leached from the soil. A pot experiment was designed with three treatments: organic mulch, compost incorporated in the soil and control in sand and clay soils. Both sand and clay compost significantly reduced the salt content, leachate amount, and EC of the soil across the experimental period. The evaporation rate was also reduced as bare soil indicated high rate of evaporation. Therefore, incorporation of compost in salt-affected soils is recommended for reducing the salinity of the soil. In conclusion, a combination of compost and mulch in future studies could be the best solution to soil salinization, reduced evaporation and enhancement of soil water holding capacity.

Keywords: soil salinization; leachate; evaporation; soil salinity; electrical conductivity (EC); sustainable agriculture; sandy soil; clay soil; organic materials

Fog Dynamics in the Sumy Region (Ukraine) in the Context of Changing Weather Patterns

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Abstract: Fog is a significant meteorological phenomenon that affects visibility, transportation safety, air quality, and overall atmospheric processes. This study focuses on the Sumy region in northeastern Ukraine. The purpose of the research is to analyze the temporal dynamics and meteorological drivers of fog formation based on long-term observations at two meteorological stations. The analysis is based on two stations: Sumy and Khutir-Mykhailivskyi. Fog in the region predominantly occurs from October to March, with peaks in November and December. Summer fogs are rare and irregular. Most fog events are recorded in the morning (6:00 and 9:00 a.m.). Average fog duration on foggy days is 6–7 hours, with an annual total of 500–600 hours. The most frequent temperatures during fog range from 1–2°C. The results confirm that fog formation in the Sumy region is closely linked to cold-season weather conditions and specific microclimatic parameters. While the general seasonal pattern remains stable, interannual variability suggests a sensitivity to broader atmospheric changes. Continued monitoring of fog characteristics is essential for understanding local-scale manifestations of climate variability.

Keywords: fog occurrence; Sumy region; seasonal variability; meteorological conditions; fog duration

Carbon Storage in Family-Run Cocoa Agroecosystems: A Spatial Assessment of an Agricultural Landscape Influenced by a Ramsar Site in Coastal Ecuador

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Abstract: While carbon sequestration has been widely assessed in tropical agricultural systems, limited attention has been given to how carbon storage varies in family farming contexts. This study evaluated soil organic carbon (SOC) and biomass carbon (BOC) in cocoa family farms (FF) located within the agricultural landscape of influence of Abras de Mantequilla, a designated Ramsar site in coastal Ecuador. The aim was to assess how crop diversity and farm typology influence carbon stocks in structurally diverse FF. A total of 131 farmers were surveyed. Three FF typologies were identified using k-means clustering, a statistical method that groups farms into categories based on similarities. A fourth group of non-family farms (Non FF) was also considered. SOC and BOC were estimated using standardized default values provided by the Intergovernmental Panel on Climate Change for use when detailed local measurements are unavailable. These data were mapped at 30 m resolution using Landsat-9 imagery and vegetation indices. Generalized additive models were applied to evaluate associations between carbon indicators, crop diversity and typology. The results showed that SOC was significantly associated with crop diversity, with higher stocks observed in FF type 3 and Non FF. However, the combined effect of crop diversity and farm typology explained a limited portion of the joint variation in SOC and BOC, suggesting that additional factors such as soil properties, management history, and microclimatic conditions may influence carbon storage. The integration of satellite data with farm-level information proved suitable for carbon monitoring and may support climate-smart planning in agricultural systems.

Keywords: carbon storage; cocoa agroecosystem; Ramsar site

Evolution of Land Use in Albanian Coastal Wetlands Focusing on Remote Sensing Techniques

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Abstract: Coastal wetlands provide critical ecosystem services but face increasing pressure from human activities and environmental changes. In Albania, these wetlands are undergoing significant land use transformations due to agricultural expansion, urbanization, and climate changes. Understanding the evolution of land use in these sensitive areas is essential for sustainable management. This study employs remote sensing technologies to analyze spatial and temporal patterns of land use change in Albanian coastal wetlands. Satellite images from Landsat and Sentinel missions were used to monitor land use changes over multiple decades. Geographic Information Systems (GIS) facilitated spatial analysis of land cover dynamics. Vegetation indices such as NDVI were calculated to assess changes in vegetation health and distribution. Temporal trends were identified to understand the progression and drivers of land use change. The analysis revealed progressive conversion of natural wetlands into agricultural and urban areas, resulting in habitat fragmentation and degradation. Vegetation health indicators decreased in areas of intensive land use. These changes are attributable not only to socio-economic developments but also to climate change, reflected in shifts in temperature, rainfall, and precipitation patterns observed over the study period. Remote sensing is a valuable tool for detecting and monitoring land use changes in Albanian coastal wetlands. The study highlights the need for integrated land management policies to mitigate negative impacts and preserve wetland ecosystems. Continuous monitoring using satellite data can inform effective conservation strategies.

Keywords: land use change; coastal wetlands; climate impact; remote sensing

MWAZACO - Building Zambia's First Mine Water Atlas: An Integrated Approach to Mapping, Risk Assessment, and Reuse of Mine-Affected Water Resources

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Abstract: Zambia's Copperbelt Province faces severe water challenges due to decades of mining, including contamination from tailings dams, acid mine drainage, and heavy metals. Soil and water analyses from sites such as Kitwe, Mufulira, and Chingola reveal dangerously high levels of copper, cobalt, and trace elements. In 2025, a tailings dam failure released 50 million liters of acidic effluent into the Kafue River, impacting water security for nearly 5 million people. To address these risks, the MWAZACO (Mine Water Atlas of Zambian Copperbelt) project was launched under the Czech Development Cooperation. It aims to create Zambia's first Mine Water Atlas: an open-access geospatial platform combining satellite data, hydrogeological models, and community-sourced mapping to identify pollution hotspots and reuse potential. Maintained by the Mines Safety Department and Copperbelt University, the platform supports regulatory enforcement and local engagement. The project also pilots a modular water treatment unit linked to an aquaculture–vegetable demonstration farm, showcasing a closed-loop reuse system for irrigation and food production. Designed for scalability using local materials, this system aligns with WHO and FAO guidelines. Backed by reactive transport modelling and site-specific remediation plans, it demonstrates how contaminated mine water can be transformed into a safe, productive resource. This poster outlines the project's technical design, stakeholder-driven approach, and early results, offering a replicable model for post-mining water management in sub-Saharan Africa.

Keywords: Mine water; groundwater contamination; water reuse; reactive transport modelling; GIS, Copperbelt; Zambia

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MCYR 2025 SCIENTIFIC SESSIONS

TECHNOLOGY & INNOVATION

Utilization of Cocoa Pod Husks for the Generation of Renewable Energy in Ghana

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Abstract: The study sought to determine whether, at a 70% recoverable rate for waste cocoa pod husks (CPHs), rural communities in Ghana can be supplied with electricity by using CPH as a feedstock for a small-scale gasifier system. The energy potential of CPHs in the Edwenase community was therefore measured. A total of 12 samples were collected, comprising four predominant species, each represented by three samples. The sample batches were characterized through ultimate and proximate analysis. An assembly of licensed buying companies and local farmers was also convened to aggregate data on annual cocoa production and other socio-economic factors that may influence the production, availability, and management of cocoa. A social class system and an energy consumption model were used to estimate the electrical power requirements for Edwenase at a household level. The study revealed that the CPHs have a high heating value of 18.28 MJ/kg, which is comparable to widely used feedstock, such as wood, bagasse, rice husk, and straw. With fewer heritage farmers, the total electricity producible per annum was 80,772 kWh with an average contribution of 198.12 kWh per participating farmer. The low levels of Nitrogen and Sulphur observed, together with the high heating value, suggest that CPHs are eco-friendly feedstock that can be used to power rural communities in Ghana, which can help bridge the poverty gap between urban and rural areas. As low-income users, CPHs produced in Edwenase have three times the potential to supply the community with electricity annually, as they only require 24,300 kWh at the household level. It is eco-friendly and will be a great way to manage and control the waste residue problem in Edwenase.

Keywords: valorization; biochemical process; biopower

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Evaluating Urban River Water Quality in Dhaka Using Geographic Information System and Machine Learning

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Abstract: Pollution from industrial discharges, sewage, and urban runoff is increasingly threatening urban rivers, particularly in fast-growing city like Dhaka, Bangladesh. Among various water quality indicators, transparency is a key indicator of river ecosystem health and directly impacts aquatic life. There is a shortcoming with the conventional monitoring methods, as they fail to accurately assess transparency due to the complex and uneven impact of urban river pollution. A total of 486 samples were collected from drains, drainage discharge points, and the river midpoint of the Turag River during June 2024 to February 2025. The dataset included physicochemical parameters (e.g., pH, temperature, turbidity) and environmental parameters (e.g., humidity, precipitation, surface pressure, wind speed). The GIS was adopted to map and analyse the spatial distribution of water quality factors and identify areas where transparency is impacted by drainage pollution and surface runoff. Data were analysed using three ML models: Random Forest (RF), Decision Tree (DT), and XGBoost. Feature importance and model sensitivity were determined using SHAP (SHapley Additive exPlanations) analysis. This study showed that the three ML models achieved over 85% accuracy. It also showed that GIS contributed to the most influential zone of transparency and turbidity has a greater effect on the prediction model. This study demonstrates the potential of AI-driven monitoring for urban water quality. It suggests integrating scalable AI models, satellite infrastructure, and real-time sensor networks to enhance water management and public health.

Keywords: geographic information system; machine learning; transparency

Digital Empathy as the New Language of Leadership

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Abstract: In the context of digital transformation, automation, and the growing role of artificial intelligence, traditional leadership models are becoming insufficient to ensure effective interaction within hybrid human-machine collaboration. This brings digital empathy to the forefront - defined as a leader's ability to sense, understand, and appropriately respond to human needs in technology-mediated environments. This study aims to analyze digital empathy as a core competence of Leadership 4.0 and its role in fostering trust, ethics, and inclusion within AI-integrated organizations.

Theoretical and review-based methods were used in this study. The research includes a qualitative analysis of current academic literature on digital leadership, emotional intelligence, human–AI interaction, and the ethics of technology. The literature review reveals that digital empathy manifests in leadership practices such as transparent communication, ethical decision-making, adaptability in digital contexts, and creating psychologically safe environments. Moreover, such leaders facilitate innovation and coordination between humans and intelligent systems. Digital empathy is a critical component of Leadership 4.0 and should be viewed as a new language of leadership in a technology-driven world. It enables the combination of algorithmic efficiency with human sensitivity, laying the groundwork for ethical and inclusive leadership in the age of augmented intelligence. Further research should focus on developing tools for measuring digital empathy and practical strategies for cultivating it in organisational settings.

Keywords: leadership; digital empathy; artificial intelligence; emotional intelligence; ethics

Advances in Anaerobic Digestion: Substrate Treatment and Process Modernization, A Scoping Review

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Abstract: Anaerobic digestion is a key technology for renewable energy production, yet its efficiency is highly dependent on substrate characteristics and appropriate pretreatment methods. This review builds upon previous research systematically categorising AD. The focus is put on substrate categorisation with the pretreatment strategies and reactor usage. This work use an adapted PRISMA 2020 methodology. Research articles published between 1945 and 2024 were analysed and the substrate, pretreatment and reactor used were retrieved. Supporting material was also created using powerbi, sqlite to demonstrate modernisation potential. The results highlight a significant shift in research priorities towards lignocellulosic substrates, with increasing interest in thermal, alkaline, and enzymatic pretreatments. Waste activated sludge also remain a dominant topic, with ultrasonic and chemical pretreatments gaining prominence. Reactor selection is shown to be substrate-dependent, with high-rate reactors (e.g., UASB) preferred for liquid waste and two-stage reactors for recalcitrant or heterogeneous substrates. The study also underscores the need for standardized classification systems and data-sharing platforms to improve reproducibility and optimize AD performance. Modernization efforts, including the integration of machine learning for predictive analysis and the creation of open-access AD databases, could revolutionize process optimization and standardization. Many different Substrates are researched, but maturity is seen in pretreatment and reactor choice. Accurate reporting is hindered by current science state and modernisation efforts can greatly enhance research sharing and efficiency. Data-sharing and standardisation would also allow for untapped potential with new technologies, such as machine learning.

Keywords: anaerobic digestion; PRISMA; pretreatment; substrate; reactor; scoping review

Acknowledgement: The research was supported by OSIRIS project, which is funded by the European Union's Horizon Europe research and innovation programme under grant agreement No. 101094725.

Subcritical Water Extraction as an Emerging Green Technology for Waste Valorisation in the Bio-Circular Economy: A Review

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Abstract: Rapid population growth and urbanization have significantly increased organic waste generation, exacerbating social and environmental challenges in sustainable waste management. A recent report by the United Nations Environment Programme states that global waste generation is expected to increase by 70% over the next 30 years, potentially reaching 3.8 billion tonnes by 2050. This escalating crisis highlights the urgency for innovative waste valorisation strategies that align with circular bioeconomy principles while minimizing environmental impact. Conventional extraction methods, including Soxhlet extraction, maceration, and simple distillation, are widely used due to their operational simplicity and cost-effectiveness. However, these methods face limitations like high solvent consumption, poor selectivity, and inconsistent product quality. In contrast, green extraction technologies, such as supercritical water extraction (SWE), present a more environmentally friendly and sustainable alternative. SWE utilizes water as a solvent under supercritical conditions (temperature 100-374°C and pressures above 10 MPa), enhancing the solubility and mass transfer of various bioactive compounds. The current study reviews and underscores SWE's potential to extract valuable compounds like phenolic compounds, flavonoids, terpenoids, oligosaccharides, and proteins from organic waste. These compounds have numerous applications in pharmaceuticals, nutraceuticals, cosmetics, animal feed, and fertilizers. In comparison to conventional methods, SWE offers cleaner, safer high-purity by-products. However, its large-scale application is constrained by high equipment costs, energy consumption, and the risk of degrading heat-sensitive compounds. Therefore, future research on improving thermal control and system efficiency will be essential to enable broader, cost-effective implementation.

Keywords: circular bioeconomy; green extraction technologies; supercritical water extraction; sustainable waste management

Acknowledgement: This project was supported by deSalSea (Novel Sustainable Forward Osmosis Seawater Desalination Process) and by IGA FTZ CZU (20253132).

Democratizing Monitoring in Sport: A Practical Proposal, Low-Cost Training-Load Monitoring System for Young Judokas

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Abstract: How can a digital monitoring system bridge the gap between scientific evidence and daily practice in combat sports, fostering sustainable and safe development of young athletes? Based on Gabbett's four monitoring pillars (external load, internal load, wellness, and performance), we developed a low-cost monitoring system using freely available Google tools. Data were collected via Google Forms, managed in Google Sheets, and visualized with Looker Studio. Short questionnaires were filled before and after the training sessions in order to obtain the metrics. Then, the data were stored and curated in specific calculation sheets. Lastly, it was processed into dashboards, which enable visualization of key variables, in order to easily obtain the most meaningful data for decision making. The system provides real-time tracking across the four pillars enabling coaches to detect discrepancies between expected and actual performance. This supports data-drive adjustments to workload and recovery helping maintain internal load within safe, effective thresholds and improving understanding of athlete progression. Preliminary use indicates that the system can facilitate more sustainable athlete development by reducing the risks of overtraining and injury. Further development is needed in order to add judo-specific tests and technical–tactical assessments. While formal data analysis is still pending, early evidence suggests its promising utility and highlights its potential as a scalable, evidence-based tool adaptable to broader sport contexts and even to other professional fields.

Keywords: training load monitoring; dashboard system; combat sports; youth athletes; performance tracking

Valorization of Biogas Digestate and Phosphogypsum through Pyrolysis for Biochar-Based Fertilizers

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Abstract: This research aims to combine phosphogypsum with biogas digestate to produce valuable biochar fertilizer through pyrolysis at 800°C within a residence time of 2 hours. The derived biochar materials were characterized using ICP-OES for metal elements analysis, nitrogen adsorption/desorption isotherms, scanning electron microscopy (SEM), Fourier transform infrared (FT-IR) spectroscopy, and X-ray diffraction (XRD). The biochar exhibited a porous structure with a diameter ranging from 100 to 200 nm. The BET surface area of the biochar ranged from 47.24 to 74.40 $m^2 \cdot g^{-1}$. Furthermore, the obtained biochar retained significantly higher levels of essential nutrients compared to the original feedstock, including nitrogen, phosphorus, calcium, potassium, iron, and zinc. The C/N ratio ranged from 27.05 to 29.72, while C/H ratio varied between 29.85 and 43.65. This process produces nutrient-rich biochar, facilitating the recycling of large quantities of biogas digestate waste and phosphogypsum.

Keywords: biogas digestate biochar; biochar fertilizer; biogas digestate; phosphogypsum; pyrolysis

Acknowledgement: This research was supported from the Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague (IGA grant no. 20253132).

Sustainable Innovations in Wet Coffee Processing: Photovoltaic Energy, Zero Water Discharge, and Byproduct Valorization

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Abstract: Traditional wet coffee processing is resource-intensive, consuming large amounts of water and energy while generating significant organic waste. These inefficiencies pose environmental and economic challenges, especially for smallholder farmers with limited access to sustainable technologies. This study presents the design and implementation of a sustainable coffee processing facility that integrates photovoltaic (PV) energy systems, rainwater harvesting, vetiver-based wastewater treatment, and byproduct valorization. The facility operates off-grid with solar-powered depulping and fermentation units, battery storage for nighttime operations, and a closed-loop water management system. Rainwater replaces external water inputs, and wastewater is treated using vetiver grass to enable reuse or safe discharge. Coffee husks serve as a renewable fuel for drying, reducing dependence on fossil fuels. Byproducts such as coffee pulp are composted, contributing to soil enrichment and waste reduction. Manual monitoring of water and energy use, along with coffee quality assessments, demonstrated the system's efficiency and product integrity. The integrated approach significantly lowers environmental impact, reduces operational costs, and supports circular resource use. This model offers a scalable solution for sustainable wet coffee processing, particularly for smallholder farmers in remote or off-grid areas. The findings underscore the potential of combining renewable energy, water conservation, and organic waste management to enhance environmental sustainability and economic resilience in the coffee sector. Future work should focus on optimizing performance, expanding adoption, and evaluating long-term benefits across diverse production contexts.

Keywords: solar energy; wastewater treatment; coffee byproducts; off-grid processing

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Assessing the Role of Expert Systems in Medical Diagnosis and Treatment Planning

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Abstract: Expert systems are increasingly applied in healthcare to support medical diagnosis and treatment planning, yet their adoption remains limited by workflow and ethical challenges. This study investigates healthcare professionals' perceptions of expert systems, their effectiveness in clinical practice, and barriers to implementation. A quantitative descriptive survey was conducted among 102 healthcare and health technology professionals. Data was analyzed using descriptive statistics, correlations, t-tests, and reliability assessment (Cronbach's alpha) to evaluate perceptions and associations between familiarity, role, and perceived benefits. Results indicate generally positive perceptions: participants agreed that expert systems enhance diagnostic accuracy, reduce human error, and improve treatment efficiency. Familiarity significantly influenced perceptions, with physicians and AI developers expressing the highest confidence. However, ease of integration into clinical workflows received more neutral ratings, and concerns regarding trust, transparency, data privacy, and the need for clinician oversight were identified. The survey instrument demonstrated strong internal consistency (Cronbach's alpha = 0.84). In conclusion, expert systems are viewed favorably for improving diagnostic and treatment outcomes, particularly by those familiar with the technology. Successful adoption, however, requires enhanced training, seamless integration into clinical workflows, and robust ethical safeguards. These findings provide evidence for healthcare institutions seeking to implement AI-based decision support tools effectively.

Keywords: expert systems; medical diagnosis; treatment planning; clinical decision support; artificial intelligence; healthcare technology

Innovative Design and Smart Implementation of a Parabolic Trough Solar Distiller

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Abstract: This study addresses freshwater scarcity, driven by climate change, population growth, and overexploitation of water resources, through the developing an innovative, energy-efficient parabolic trough solar distiller, aiming to enhance thermal performance and promote sustainable, technology-driven water purification solutions. The system was designed using SOLIDWORKS and MATLAB, built with low-cost materials, and tested experimentally with air, tap water, and saline water using a solar tracking-enabled parabolic trough concentrator. The developed parabolic trough distiller achieved a peak focal temperature of 350 °C and an average thermal efficiency of 70.3%. Distillation tests produced 150 L of tap water (pH 6.77) and 160 L of saline water (pH 7.02) over 10 hours. The system showed strong accuracy with an R^2 of 0.99 and minimal errors (RMSE: 0.401). Seasonal tests confirmed consistent performance, and the solar tracking system increased efficiency by over 30% compared to fixed systems. The innovative parabolic trough solar distiller demonstrated high thermal efficiency, effective solar tracking, and strong water purification performance. Its low-cost, portable design makes it a promising solution for sustainable freshwater production, especially in off-grid or arid regions.

Keywords: parabolic concentrator; solar desalination; thermal efficiency; solar tracking system

Acknowledgement: This work was supported by the Stipendium Hungaricum Program and by the Doctoral School of Mechanical Engineering, Hungarian University of Agriculture and Life Sciences, Gödöllő, Hungary.

Assessment of Water Quality of Al-Sin Lake Using the Iranian Water Quality Index (IRWQI_sc) and Artificial Neural Networks (ANN)

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Abstract: Prediction in Artificial Intelligence leverages historical data and is widely employed across various domains. It is particularly useful for estimating the quality of Surface water (Rivers and lakes), which are considered a vital resource for human life, where recently their quality has declined due to water pollution often stemming from industrialization and economic growth. This paper focuses on the use of neural network modeling to predict the surface water quality of Al-Sin Lake using the Iranian Water Quality Index (IRWQI_sc) and artificial neural networks (ANN). The assessment utilized an indicator based on ten quality parameters at three monitoring sites. The evaluation revealed that the water quality of the lake was good (55.1-85 on the Index scale) at each site. The model employs physicochemical parameters, which are dissolved oxygen (DO), chemical oxygen demand (COD), total hardness, turbidity, electrical conductivity, fecal coliforms (FC), pH, nitrates, ammonium, and phosphates as inputs, with the WQI as the output. Data for these parameters were collected from three sampling stations at AL Sin Lake over the period from 2021 to 2023. Best results were obtained using neural networks with 43 neurons in the first hidden layer and 23 in the second. The models demonstrated a high correlation coefficient (R = 0.99) and low mean squared error (MSE) across all subsets (training, testing, and validation), indicating a close match between the predicted and actual data. This confirms the efficacy of the ANN models in predicting the surface WQI, making them suitable for environmental monitoring to assess water conditions.

Keywords: Artificial Neural Networks; correlation coefficient; Mean Squared Error (MSE); water quality; Iranian Water Quality Index

Empirical Analysis of Iterated Correlation Matrices

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Abstract: In many applied disciplines—psychometrics, machine learning, and signal processing—analysts iterate correlation to reveal structure in multivariate data: starting from a square matrix, they center it, replace it by its correlation matrix, and repeat. This practice traces to the CONCOR procedure in social network analysis and was later popularized through Chen's Generalized Association Plots (GAP), yet its convergence and dynamics remain largely unproved. We present a large-scale empirical study. Using custom C and R implementations, we ran random uniform initializations for matrix sizes from 3×3 to 2000×2000, with 1,000 trials per size. At each step we recorded the Frobenius norm and the maximum element-wise difference between consecutive iterates, and we declared convergence at a fixed tolerance. Three robust empirical laws emerge. (1) A universal initial contraction occurs with high probability: the first iteration yields a sharp reduction across all dimensions and trials. (2) The trajectory is nearly monotone: stepwise differences decrease overall; occasional oscillations are small and diminish as the iteration proceeds. (3) The time to convergence is essentially independent of dimension: a uniform iteration bound holds across sizes and random starts at the same tolerance. These observations consolidate long-standing practice and provide a clear baseline for subsequent theoretical analysis of the iterative correlation operator.

Keywords: iterative correlation; CONCOR; generalized association plots; matrix convergence; Frobenius norm; random matrices; convergence analysis

Silicon Nanoparticles Synthesis using Non-Thermal Plasma Method

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Abstract: Silicon nanoparticles (SiNPs) are a highly promising material due to their large specific surface area, high specific capacity, and the possibility of precise chemical and morphological modification. Through surface functionalization and the formation of core–shell structures, their chemical stability and conductivity can be further improved, which broadens their application potential to photovoltaics, sensors, biomedical technologies and electrochemical energy storage. Non-thermal plasma method provides an efficient and versatile technique for synthesizing SiNPs with controlled physicochemical properties. Conducting the process at low carrier gas temperatures reduces thermal degradation of precursors and allows accurate control over particle size, chemical composition, degree of crystallinity, and morphology. Plasma discharge excites and dissociates silicon-containing precursors (such as silane and its derivatives), initiating nucleation followed by the growth of SiNPs typically ranging in size from a few to several tens of nanometers. We report our findings on SiNPs synthesis using non-thermal plasma, focusing on reactor geometry, electrode configuration and synthesis parameters. The synthesized SiNPs were extensively characterized by a variety of analytical techniques, including particle size determination, assessing their degree of crystallinity, and evaluating their surface chemistry (specifically the ratio of Si–Hx bonds). Luminescence properties were also investigated when observable. Our results demonstrate that adjusting reactor design and process parameters allows fine control of SiNPs properties. These findings highlight the potential of non-thermal plasma as a scalable method for producing SiNPs with tunable properties suitable for energy storage, photovoltaics, sensors, and biomedical applications.

Keywords: non-thermal plasma method; non-thermal plasma reactor; silicon nanoparticles

Isenyas: A Basic Filipino Sign Language Educational Mobile Application for Deaf and Mute

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Abstract: Communication is a fundamental aspect of human interaction, yet deaf and mute individuals often face challenges due to the lack of awareness and knowledge of sign language among the general population. Filipino Sign Language (FSL) is distinct from both English and Filipino, requiring dedicated learning tools. To address this, the iSenyas mobile application was developed as an educational tool to assist deaf and mute individuals in Odiongan in learning basic FSL. The app aims to provide accessible and interactive learning through images and videos of basic FSL gestures. Developed using Cordova, the application is compatible with Android devices running Nougat to Android 11, designed to function offline with a minimum of 2GB memory for optimal performance. The development process involved rigorous testing, including functionality testing, user acceptance testing, and evaluation based on ISO 21500:2011 standards. The iSenyas application successfully provides an interactive and accessible platform that allows users to learn FSL through visual demonstrations, enhancing their ability to communicate using sign language. The development of iSenyas contributes to bridging the communication gap between deaf and mute individuals and the broader community. By offering an offline and user-friendly educational tool, the application promotes the learning of FSL and fosters inclusivity. The successful implementation and testing of iSenyas demonstrate its potential as an effective resource for learning basic Filipino Sign Language.

Keywords: inclusive education; mobile learning application; digital literacy; deaf community empowerment; educational innovation

Acknowledgement: The proponents extend their gratitude to Romblon State University for the support and resources provided in the development of this research. Special thanks to the local government of Odiongan and the Persons with Disabilities Affairs Office (PDAO) for their insights and assistance in testing the application with the target users.

Assessing the Role of Expert Systems in Medical Diagnosis and Treatment Planning

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Abstract: Expert systems are increasingly applied in healthcare to support medical diagnosis and treatment planning, yet their adoption remains limited by workflow and ethical challenges. This study investigates healthcare professionals' perceptions of expert systems, their effectiveness in clinical practice, and barriers to implementation. A quantitative descriptive survey was conducted among 102 healthcare and health technology professionals. Data was analyzed using descriptive statistics, correlations, t-tests, and reliability assessment (Cronbach's alpha) to evaluate perceptions and associations between familiarity, role, and perceived benefits. Results indicate generally positive perceptions: participants agreed that expert systems enhance diagnostic accuracy, reduce human error, and improve treatment efficiency. Familiarity significantly influenced perceptions, with physicians and AI developers expressing the highest confidence. However, ease of integration into clinical workflows received more neutral ratings, and concerns regarding trust, transparency, data privacy, and the need for clinician oversight were identified. The survey instrument demonstrated strong internal consistency (Cronbach's alpha = 0.84). In conclusion, expert systems are viewed favorably for improving diagnostic and treatment outcomes, particularly by those familiar with the technology. Successful adoption, however, requires enhanced training, seamless integration into clinical workflows, and robust ethical safeguards. These findings provide evidence for healthcare institutions seeking to implement AI-based decision support tools effectively.

Keywords: expert systems; medical diagnosis; treatment planning; clinical decision support; artificial intelligence; healthcare technology

Integrating Systems Engineering and Artificial Intelligence for Sustainable Economic Stability

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Abstract: Modern economic systems are increasingly exposed to complexity, uncertainty, and sudden shocks that traditional models often fail to anticipate. This study seeks to integrate systems engineering and artificial intelligence to enhance resilience and provide more reliable early-warning mechanisms for financial instability A hybrid framework was developed by combining the Input–Process–Output model with Causal Loop Diagrams to capture reinforcing and balancing feedback dynamics. Simulation-based scenario analysis and empirical illustrations were applied to validate the proposed approach. The study identifies critical feedback loops that drive systemic instability and demonstrates how the proposed framework can transform early-warning systems into dynamic decision-support tools. These results highlight its potential for improving proactive risk management and long-term stability in complex financial systems. The study concludes that integrating systems engineering with artificial intelligence provides an effective framework for anticipating and mitigating banking fragility. The proposed approach enhances early-warning systems, offering policymakers practical tools for strengthening resilience and ensuring financial stability.

Keywords: artificial intelligence; banking fragility; causal loop diagrams; resilience; systems engineering

Clean Cooking and Beyond: Multi-Sectoral Impacts of Household Biogas Adoption on Health, Environment, and Energy Behaviors in Uganda's Eastern Districts of Kapchorwa and Mbale.

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Abstract: Access to clean cooking remains a serious development challenge in sub-Saharan Africa, where reliance on traditional biomass fuels contributes to environmental degradation and adverse health outcomes. Uganda's clean cooking agenda, launched on 9 August 2024, seeks to accelerate sustainable energy transitions. This study investigates how household-level biogas adoption influences energy behaviour and well-being in Kapchorwa and Mbale districts. A structured survey, semi-structured interviews, and direct observations were conducted across 123 households. Data were analysed using SPSS, applying descriptive and inferential statistical techniques to examine associations between demographic characteristics, fuel choices, and behavioural changes in meal preparation and fuelwood collection, alongside perceived health and environmental outcomes. Findings indicate a partial transition from traditional biomass, with wood fuel usage declining from 83.7% to 57.7% and charcoal from 55.3% to 37.4%, but with persistent fuel stacking. Health outcomes were perceived positively (n = 78), but with no significant associations with behavioural changes. In contrast, environmental outcomes were significantly linked to reduced meal preparation time ($\chi^2 = 234.611$, $p < .001$; Cramér's V = .977), but not statistically significant with fuelwood collection. Subgroup analyses revealed that education and livelihood influenced fuel diversification, though low expected cell counts limited statistical precision. The study concludes that while biogas adoption offers clear benefits, its broader impact is constrained by infrastructure and entrenched behavioural practices. Strengthened supply chains, integration into educational institutions, and coordinated multi-sectoral taskforces are needed to align clean energy efforts with Uganda's SDG 7 and SDG 13 targets.

Keywords: biogas adoption; clean cooking; fuel stacking; health & environmental outcomes; energy behavior

Acknowledgement: I would like to acknowledge the invaluable support of the BioResources and Technology members under the Department of Sustainable Technologies, Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague, whose guidance and expertise shaped every stage of this work. Also, special appreciation is also extended to the Ugandan communities of Kapchorwa and Mbale districts, whose openness, cooperation, and willingness to share critical household-level information were fundamental to the success of this study.

Strategies to Reduce Coffee Rewetting in On-Farm Solar Dryers

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Abstract: Coffee rewetting during solar drying poses a significant challenge to maintaining bean quality, particularly in regions with high relative humidity and frequent cloud cover. This phenomenon prolongs drying times, increases the risk of microbial deterioration, and may negatively affect the physical and sensory attributes of the final product. The objective of this study was to evaluate the effectiveness of seven on-farm mitigation strategies aimed at minimizing nighttime rehydration of parchment coffee during solar drying. The treatments included nighttime storage in jute sacks (TC), plastic fiber sacks (TE), and plastic bags (TB); conical stacking (TA); covering the coffee layer with plastic only underneath (TPI) and both underneath and on top (TPII); as well as an untreated control (C). The drying process began at an initial moisture content of 53.04% (wet basis) and was monitored gravimetrically until samples reached the recommended final moisture content between 10% and 12% (wet basis). All treatments progressively reduced the moisture content, although with varying drying durations. The control (C) and TPII treatments required the longest drying times (147 and 146 hours, respectively), whereas TC achieved the fastest drying (142 hours). Despite the slightly longer drying time, TPII exhibited the greatest stability in moisture retention throughout the process, indicating a reduced susceptibility to nighttime rewetting. These results provide practical guidance for improving solar drying protocols through low-cost, adaptable techniques that enhance drying uniformity and reduce quality losses in humid tropical environments.

Keywords: equilibrium moisture content; humidity; parchment coffee; plastic cover; postharvest

Acknowledgement: The authors would like to thank the discipline's research auxiliaries for their help during the development of this study.

The Potential of Second-Generation Hornbeam Wood for Structural Applications

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Abstract: Climate change is reducing the availability of softwood and the potential for more climate-friendly hornbeam wood for structural applications. A possible solution is to change the approach to wood production, by switching from traditional first-generation growing systems to second-generation, or sapling, systems. This can make the production function of hornbeam wood more efficient with the potential for achieving structural quality while reducing cultivation costs. The subject of this study is the determination of the quality of young wood for structural applications. The subject of this study is to determine the quality of hornbeam sapling wood for structural applications based on the determination and comparison of the bulk density, bending strength and static flexural modulus of elasticity between hornbeam wood from first-generation high-stem and coppice second-generation low- to medium-stem stands. The characteristics of the bending strength perpendicular to the fibers in the radial or tangential direction were compared, and a difference was demonstrated. The resulting values of wood from coppice second generation hornbeam stands compared to the values of wood from the first-generation high-stem stands were always demonstrably lower, at the 0.95 significance level. Bulk density on average by 3.89%, bending strength on average by 11.20% and static flexural modulus of elasticity on average by 8.23%. However, this difference was only within the statistical error for hornbeam wood from first-generation high-stem and coppice second-generation low- to medium-stem stands. Analyses of the mechanical behavior of wood from young hornbeam forest stands show comparable results compared to wood from first-generation stands from low to medium-sized forests, thus offering potential for structural applications.

Keywords: Hornbeam; coppice wood; mechanical properties; structural applications

Acknowledgement: The research was carried out as part of the project Development of a system of efficient use of wood from low and medium forest into final products with high added value, no. SS06020121 of the Program Prostředí pro život, Technologická agentura ČR.

Biodegradation of Polyurethane Odour Carriers in Natural Environment: Microbial Degradation and Material Breakdown

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Abstract: In this study, we tested the biodegradability of two polyurethane (PU) foam samples used in wildlife management and road ecology. The foams are used as odour carriers to avoid wildlife-vehicle collisions in Central Europe. Aliphatic PU-1 and aromatic PU-2, were buried in field soil for a period of four months and retrieved at 30-day intervals to investigate the changes through weight loss, Fourier Transform InfraRed (FTIR) spectra and Scanning Electron Microscopy (SEM). The bacteria attached to the PU samples were isolated and identified using MALDI-TOF MS and 16S rRNA gene sequencing. Weight loss analysis revealed a maximum of 11.70 % reduction in weight for the aliphatic PU foam carrier (PU-1), and only up to 1.85 % for the aromatic one (PU-2). FTIR analysis confirmed more pronounced degradation in PU-1 showing reduced absorption peaks for characteristic functional groups. SEM analysis revealed surface alterations and microbial colonization on both PU samples. Eight isolated bacterial strains identified as PU degraders belonged to taxa *Klebsiella aerogenes, Pseudomonas chlororaphis, Pseudomonas corrugata, Pseudomonas monachiensis, Pseudomonas lini, Bacillus pseudomycoides,* and *Bacillus cereus.* These results highlight the need for understanding polymer-microbe interactions and material susceptibility in order to decrease their environmental persistence.

Keywords: polyurethane; odour carriers; vehicle-wildlife collision; biodegradation; bacterial isolates

Acknowledgement: The presented work was financed by the project BIOCIRKL (reg. no. TN02000044), supported by the Czech Recovery Plan and the Technology Agency of the Czech Republic within the National Centres of Competence Programme in years 2023–2028.

Research into the Influence of the Evenness of Cargo Placement in the Body of a Freight Vehicle on Stability

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Abstract: The stability of a vehicle during movement is a rather relevant issue. First of all, the stability of a vehicle affects the safety of the driver and the safety of the cargo. The cargo placed in the body affects the load on the vehicle axles and the stability of the vehicle during movement. The purpose of the study is to develop a calculation algorithm for finding the optimal parameters for placing the load in the body of a vehicle or trailer. To conduct this study, a model was developed that allows determining the optimal parameters for placing the load in the body of a vehicle. This mathematical model also allows you to determine the reactions of the soil on the wheels of the vehicle. As a result of the research, the mathematical algorithm and model obtained allow you to quickly find the most rational parameters for placing cargo in the body of a vehicle. We can find the wheel loads on the soil and determine how the density changes under the vehicle wheels. We have a car that increases its stability during movement by up to 20%. Also, in this case, the car is safer for the environmental component because it reduces the compacting effect of the wheels on the soil by 10-15%.

Keywords: cargo; soil compaction; vehicle stability

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Use of Plant-Based Ingredients to Reduce the Nitrite Compounds in Meat Products

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Abstract: The article presents the results of research on the use of plant ingredients to reduce the content of nitrite compounds in meat products. To determine the pH of meat products, a potentiometric method was used to determine the activity of hydrogen ions in the form of a hydrogen indicator pH. The role of nitrates and nitrites in the technology of meat products was analyzed. The effect of sodium nitrite on the formation of taste and aroma, the preservation of the red-pink color of meat, as well as on their microbiological stability was analyzed. The ways of reducing the content of nitrite compounds in meat products without worsening the quality and safety indicators of the finished product and the feasibility of using an aqueous extract of honeysuckle leaves as a natural preservative for meat products were investigated. The dynamics of pH values in samples with the addition of aqueous extract of honeysuckle leaves was established, which gradually increased, but not rapidly. This indicates the antibacterial properties of the introduced plant component. In the control samples, the pH value did not change during the studied period, since the addition of sodium nitrite salts provided their bacteriostatic properties. The use of an aqueous extract of honeysuckle leaves with an antibacterial purpose is proposed.

Keywords: sodium nitrite; honeysuckle leaves extract; meat products; bacteriostatic properties; quality

Parameter Estimation of an Equivalent Circuit Model for a 45Ah LTO Battery Using the Least-Squares Method

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Abstract: Lithium-ion batteries have become a cornerstone technology for electric vehicles (EVs) due to their high energy density, long cycle life, and efficiency. Ensuring safe and reliable battery performance requires accurate models capable of predicting dynamic behaviors under diverse conditions. This study addresses parameter estimation for an Equivalent Circuit Model (ECM) representing a 45 Ah lithium-titanate oxide (LTO) battery. Experimental tests were carried out across a range of temperatures, states of charge (SoC), and discharge profiles to capture the electrochemical and transient dynamics of the cell. An optimization framework was developed by deriving an analytical solution of the ECM and applying the Least-Squares method to minimize discrepancies between measured and simulated responses. This approach enabled accurate identification of the key parameters in a two-layer ECM, ensuring the model's ability to replicate transient discharge behavior. Validation against experimental data confirmed that the model reproduced voltage responses with high accuracy, particularly for 10-second discharge tests across varying SoC levels and thermal conditions. The results highlight the robustness and adaptability of the methodology, demonstrating that combining analytical solutions with Least-Squares optimization yields a reliable parameterization strategy. Furthermore, the approach can be generalized to other battery chemistries and operational scenarios, offering a scalable tool for enhancing battery management systems. By providing accurate parameter identification, the proposed method contributes to improved predictive performance, energy management, and safety in EV applications. This research underscores the importance of model-based optimization frameworks for advancing next-generation battery technologies.

Keywords: LTO battery; equivalent circuit model; parameter estimation; electric vehicles; least-squares method

CFD Analysis of Air Vortex Formation Induced by Vehicular Traffic for Wind Energy Applications

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Abstract: Vehicle wakes represent a potential source of kinetic energy for roadside microgeneration. This study investigates their structure and energy potential using CFD simulations. Two approaches were applied: (1) a steady-state model to characterize wake structure, velocity gradients, and recirculation zones; and (2) a transient overset-mesh simulation, where a moving vehicle passed a fixed cylindrical obstacle representing a vertical-axis wind turbine (VAWT). Both cases were implemented in OpenFOAM v2312 with the k–ω SST turbulence model. The steady-state results showed that the 15° rear-slope configuration generated narrower, more stable wakes, while the 25° case produced wider and more turbulent vortices. In transient simulations, vehicle overtaking produced velocity peaks ranging from 2.2 to 9.7 m/s depending on approach speed (3–15 m/s). Near the obstacle, velocities varied from 1.8 m/s at low speeds to 8.7 m/s at higher speeds. These values indicate that flow alignment during passing can create favorable inflow conditions for VAWT operation without significantly disturbing the background mesh. Overall, the study confirms that vehicle-induced wakes contain usable kinetic energy. Combined steady and transient CFD analysis provides practical guidance for VAWT placement, considering vehicle geometry, speed, and local velocity distribution. These insights support the integration of small wind turbines into urban and highway environments for decentralized energy harvesting.

Keywords: air vortex; CFD simulation; vehicular traffic; urban highways; vertical-axis wind turbine

Prediction of Biogas Production Rate from UASB Reactor by Artificial Neural Network and Nonlinear Regressions Models

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Abstract: In this study, a multi-layer artificial neural network (ANN) and nonlinear regression models were developed to predict the biogas production performance of the UASB reactor. First, the performance of the **Upflow Anaerobic Sludge Blanket (**UASB) reactor for fermenting cow manure with food waste at different mixing ratios of 10%, 20%, 40%, and 60% of food waste, a batch feeding method, and a hydraulic retention time (HRT) of 31 days under moderate temperature conditions (31±1°C) was investigated. Experimental data were used to estimate the biogas production rate using models developed using both artificial neural networks and nonlinear regression methods. Furthermore, independent variables such as water pH, chemical oxygen demand (COD), total suspended solids (TSS), volatile suspended solids (VSS), C/N, and Feedstock Moisture were selected as model inputs. Finally, artificial neural network (ANN) and nonlinear regression models were developed to describe the biogas production rate. The R2, MSE, and CV values of the ANN and nonlinear regression models were found to be 0.98, 0.07, 0.05, 0.85, 0.6, and 0.14 for the 10% experiment, respectively. The ANN model generally demonstrated greater potential than the nonlinear regression in determining the relationship between the input data and the biogas production rate according to statistical criteria. The results demonstrated that the proposed ANN and nonlinear regression models performed well in predicting the biogas production rate from UASB reactors.

Keywords: biogas; cow manure; ANN; Nonlinear regression models

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The Wanderers Path: Implementation of Educative and Interactive AR Game for Introducing ITENAS Bandung DKV Photography Lab in The Digital Culture Era

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Abstract: The design building has long been established as a center of academic and creative activities on campus, but not all students, visitors, or prospective students know the existence and function of each room in it, including the ITENAS's DKV Photography Laboratory. For this reason, a Scavenger Hunt project based on Augmented Reality (AR) was designed to introduce the existence of the ITENAS's DKV Lab facilities interactively and fun. The purpose of this design is to introduce the Photography Lab and the facilities in the ITENAS's DKV Building Photography Lab in an educational way but still giving a fun impression, providing an interactive experience based on AR technology, strengthening DKV's identity as part of the creative-innovative industry, and encouraging active participation of users within the campus scope in the digital culture era. The methods used include reference studies, puzzle-based game concept design and marker scanning, character design and visual interfaces, and content implementation using AR technology. The resulting application allows users to explore the DKV lab space in an informative and enjoyable manner. It increases engagement and understanding of the campus environment, especially for new students and visitors. As the conclusion, the project potentially expected to help new students and visitors easily locate the DKV photography lab. It demonstrates how technology can enhance users' understanding in capturing information while providing an enjoyable and innovative educational experience.

Keywords: augmented reality; scavenger hunt; interactive media

Acknowledgement: Thank you to the Visual Communication Design Study Program of ITENAS Bandung, especially the Interaction Design course for the discussion process and dissemination of research outputs at the Interex 2025 exhibition.

A Comparative Analysis of the Temperature Data for Fresh Beef Products within the E-Commerce Supply Chain

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Abstract: The quality and microbiological safety of fresh beef are strongly influenced by maintaining cold chain integrity throughout the supply and distribution process. Temperature measurement upon receipt serves as a practical indicator of cold chain performance and may reveal handling differences linked to product origin and production scale. In the growing e-commerce sector, understanding these variations is essential for enhancing quality assurance practices. Temperature data of fresh beef products were collected at the point of receipt in an e-commerce logistics centre over an extended monitoring period. Standardised protocols were applied, using both contact and non-contact thermometers. Products were categorised based on origin (domestic vs. imported) and producer scale (small-scale vs. industrial-scale suppliers), enabling comparison across supplier categories. Statistically significant differences were identified in receiving temperatures between domestic and imported products, as well as between small-scale and industrial-scale suppliers. These findings suggest potential risk patterns associated with certain supply chains and highlight variability in cold chain performance based on supplier characteristics. The results underline the importance of supplier-related factors in maintaining cold chain integrity. Identifying supplier categories with higher temperature deviations can help pinpoint critical control points in the fresh beef supply chain. These insights support the development of targeted quality assurance strategies for e-commerce food distribution systems.

Keywords: cold chain; fresh beef; receiving temperature; e-commerce; supplier differences

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Wireless Sensor Networks for Energy Systems and Environmental Monitoring

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Abstract: In the context of global challenges associated with energy consumption increase and escalating environmental issues, technologies that enable effective real-time monitoring and process control are becoming particularly important. Wireless sensor networks represent one of the most promising solutions for these tasks, as they enable the creation of an extensive infrastructure for collecting data on the state of power grids and the environment. The aim of the study was to explore the potential of integrating sensor systems into the structure of distributed energy networks and environmental monitoring platforms. The research included modeling sensor nodes with varying energy consumption parameters and routing algorithms, as well as evaluating the efficiency of their interaction with cloud-based data analysis services. The results demonstrated that optimizing network topology and applying energy-efficient protocols can significantly reduce resource losses and improve the reliability of data transmission. In the field of power networks, this creates conditions for timely fault detection and load balancing, while in environmental monitoring it ensures prompt responses to changes in environmental parameters. The findings confirm that wireless sensor networks can serve as a fundamental component of technological innovation, contributing to sustainable development and enhancing the resilience of critical infrastructure.

Keywords: sensor networks; energy systems; environmental monitoring; energy efficiency; innovation

Robotic Fruit Picking Using AI and Robotic Arms: A Novel Technological Approach

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Abstract: Labor-intensive manual fruit harvesting faces challenges with efficiency, labor shortages, and product quality. Integrating robotic arms with artificial intelligence (AI) offers a technology-driven solution to automate selective and gentle fruit picking under varying orchard conditions. Advanced robotic manipulators equipped with 3D vision sensors and adaptive end-effectors were combined with AI algorithms for real-time fruit detection, ripeness assessment, and motion planning. Human operators guide the system via gesture controls, enabling precise robotic picking while retaining operational flexibility. The AI-enabled system achieved over 95% accuracy in detecting ripe fruit and reduced picking time by 20–30% compared to manual harvesting. Robotic grasping minimized fruit damage through controlled force application. Operation was reliable day and night, adaptable to lighting variations and orchard complexity. The synergy of robotic arms and AI significantly improves fruit harvesting efficiency, quality, and labor productivity. This human-robot collaborative approach enhances orchard automation and paves the way for broader adoption of intelligent agricultural robots.

Keywords: artificial intelligence; automation; fruit harvesting; precision agriculture; robotic arm

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Applications of MALDI-TOF MS in Peptide Profiling and Quality Assessment of Commercial Yoghurt

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Abstract: Commercial yoghurt is a dairy product obtained by bacterial fermentation of milk using standard starters. Accurate and reliable analytical methods are essential for ensuring the quality of these products. This study aims to expand and maximise the benefits of using Matrix-Assisted Laser Desorption/Ionisation Time-of-Flight Mass Spectrometry (MALDI-TOF MS) for monitoring and quality assurance of fermented yoghurts. It also seeks to analyse peptide pattern profiles to gain a comprehensive understanding of yoghurt composition. During the MALDI-TOF MS analytical process, peptides are extracted from yoghurt samples. These peptides are prepared on a target plate and covered with a matrix solution (HCCA). During the analysis, the mixture evaporates and becomes ionised. The resulting ions are accelerated through a flight tube, and their time-of-flight is measured based on their mass-to-charge ratio (m/z). This generates a mass spectrum that displays peaks corresponding to the various peptides and proteins present in the sample. Analysing mass spectral patterns in commercial yoghurt enables us to determine the final characteristics of the fermented product, identify unexpected peaks that may indicate contamination or spoilage, and verify the type of milk used (cow, goat, sheep, etc.) as well as the bacterial strains involved in fermentation. This also offers the possibility of detecting adulteration, such as the addition of non-dairy proteins or non-traditional fermentation processes. Utilising MALDI-TOF MS to analyse yoghurt components provides a promising approach to enhance our understanding of how milk components affect yoghurt's nutritional and sensory properties. This method supports the maintenance of high-quality standards in commercial yoghurt production.

Keywords: MALDI-TOF MS; yoghurt; peptides; profiling

The Impact of Different Composition and Delignification Methods on the Optical Properties of Transparent Wood

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Abstract: Nowadays, emphasis is placed on using environmentally friendly materials, both in construction and in applying protective agents or design elements. For this reason, it is advisable to treat wooden products such as transparent wood with care, even though its production requires chemicals. Environmental friendliness is why the nitrate-alkaline method was used to produce transparent wood. Transparent wood is mainly used indoors as a design element. This research deals with producing transparent wood from beech (Fagus sylvatica) with the addition of fluorescent pigments and its effect on optical properties. The optical properties were very positive, especially regarding opacity, which had a zero value. The ISO Whiteness and ISO Brightness was lower than the commonly used soda method for producing transparent wood. In addition to optical properties, selected fire resistance characteristics were also determined, precisely because of the use of transparent wood in interiors. This research's results serve to understand better the production of transparent wood, which can be used as a design material.

Keywords: nitrate-alkaline delignification; epoxy resin; fluorescence; opacity; fire resistance

Investigation of the Technological and Sensory Properties of Various Plant-Based Egg Substitutes

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Abstract: In recent years, there has been a growing body of research on food ingredients that serve as substitutes for hen eggs. This study provides a comprehensive review of the techno-functional and sensory properties of plant-based egg alternatives. Our aim was to summarize the findings of existing research to support the development of food products—both in the food industry and in home kitchens—that are healthy, allergen-free, vegan, and cost-effective. Relevant publications were identified and included a wide range of ingredients such as pea, rice, chickpea, soybean, chia seed, yellow pea, fava bean, mung bean, lentil, and aquafaba—the cooking water of legumes. Aquafaba was found to exhibit desirable foaming, gelling, emulsifying, and thickening properties, making it a viable egg substitute in sauces, baked goods, and confectionery products. Its functional attributes are influenced by several factors including legume soaking time, water-to-legume ratio, cooking temperature, pressure, duration, added ingredients, and legume type. In general, egg substitutes performed well in the preparation of cakes, sponges, puddings, and scrambled-egg-style dishes. However, when compared to egg-based controls, they often showed inferior results in both sensory and nutritional aspects. One of the main challenges in using egg alternatives lies in replicating the multifunctional properties of eggs. Consequently, different ingredients are recommended for different food applications. Some studies reported the most favorable results not with complete substitution, but when only 50% of the egg content was replaced. These findings suggest that partial substitution may be a more effective strategy when the product type allows it.

Keywords: egg substitute; technological-functional property; plant-based foods

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Comparative Evaluation of Gaseous and Microbubble-Based 1-Methylcyclopropene Treatments on the Postharvest Ripening of Green-Harvested Tomatoes

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Abstract: Tomato (*Solanum lycopersicum*), as a climacteric fruit, ripens rapidly after harvest due to ethylene activity, which reduces shelf-life and market quality. 1-Methylcyclopropene (1-MCP) is a known ethylene inhibitor. This study compares conventional gaseous 1-MCP treatment with microbubble (MB) applications—an emerging, potentially more efficient delivery method. The experiment involved 160 tomato samples divided into eight treatment groups, including a control, a 12-hour gaseous 1-MCP treatment, and MB treatments (5, 10, and 15 minutes) with or without ultrasound. Non-destructive measurements were conducted over a 7-day period under cold storage. Ripening was assessed using DA-Meter®, Minolta CR-400 chromameter, respiration intensity and AWETA AFS firmness analyzer. Gaseous 1-MCP treatment proved most effective in delaying ripening, showing significantly higher DA-index values, reduced a* color components, lower respiration rates, and slower softening compared to the control. Among MB treatments, the 15-minute variant was the most effective, producing moderate ripening inhibition. Ultrasound-assisted treatments did not show additional benefit and, in shorter durations, were comparable to the control. While gaseous 1-MCP proved most effective in inhibiting ripening, microbubble-based treatment—particularly at 15 minutes—showed promising results. Further investigation is recommended to assess the impact of longer MB exposure durations or higher 1-MCP concentrations to enhance efficacy in postharvest tomato preservation.

Keywords: 1-MCP; tomato; microbubble; ripening inhibition; postharvest

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Investigation of Effects of Ultrasound-Assisted Dry Curing on Pork Loin Quality

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Abstract: Dry curing is a traditional method used in meat preservation to enhance shelf life, improve taste, and ensure food safety. Dry-cured meat cuts are rubbed with a mixture of sodium chloride (NaCl) and sodium nitrite (NaNO2), which is called curing salt. The dissolved salt and nitrite penetrate meat tissue by molecular diffusion, which is time-consuming and may lead to uneven salt distribution in cured meat. Therefore, different alternative techniques such as ultrasound, high hydrostatic pressure, and cold plasma have been examined to enhance salt diffusion. This study investigated the effect of ultrasound-assisted dry-curing (UAC) compared to normal curing (NC) on pork loin (m. Longissimus dorsi), focusing on salt uptake and diffusion, moisture content, color, and hardness. Pork loin slices with a thickness of 30 mm were rubbed with curing salt and laid down on an ultrasonicated (36 kHz, 30 W) surface from 15 to 120 minutes. After ultrasonic treatment, salt content and diffusion, moisture, color (CIELab), and hardness were measured. At the end of the curing processes, the UAC resulted in 35% higher salt content and 4,9% lower moisture content compared to NC. The UAC significantly improved the redness (a*) ($p<0.001$) and hardness of slices ($p<0.001$). These are attributed to the cavitation effects of ultrasound, which facilitate diffusion and induce structural changes in muscle fibers. While UAC offers advantages in efficiency and product quality, temperature increases during ultrasound treatment may pose microbiological risks, thus requiring cooling systems for safety. This study shows that ultrasound can be a valuable technology to accelerate the curing process and enhance meat quality attributes.

Keywords: diffusion; dry curing; meat quality; pork loin; ultrasound

Can Fungi Clean the Ocean? Exploring the Oil Sorption Potential of Mycelium Biocomposites

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Abstract: The rise of sustainable materials has brought attention to mycelium-based biocomposites (MBBs) bio-derived materials grown from fungal mycelium on lignocellulosic substrates. These composites are lightweight, low-cost, biodegradable, and possess favourable mechanical and thermal properties. While widely studied for insulation and packaging, their ability to selectively absorb oil over water has not been sufficiently explored. This study investigates the oil sorption capabilities of MBBs grown on various wood-based substrates, including industrial recycled wood and lignin-enhanced recycled wood, using different fungal strains of Ganoderma and Trametes species. Specimens were produced by a precise and controlled growing process and tested for their sorption behaviour following the ČSN EN ISO 16535 protocol, typically applied to water absorption in insulation materials. After 24hour immersion, the results revealed significantly higher oil uptake ($w = 371.85 \pm 10.11\%$) compared to water ($w = 116.91 \pm 3.16\%$), representing an increase by a factor of 3. No statistically significant correlation was found between the fungal strain or substrate type and sorption efficiency. These findings suggest that MBBs could be repurposed for novel ecological applications such as biodegradable aroma diffusers, odour barriers in wildlife management, and bio-based sorbents for marine oil spill remediation. Further research is needed to optimise material formulations and develop scalable production strategies for targeted environmental use.

Keywords: mycelium; biocomposite; recycled wood; oil sorption; fungi; sustainable materials

Strategic Approaches to Facilitating Real-World Asset (RWA) Adoption

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Abstract: With the advancement of blockchain technology, the tokenization of Real World Assets (RWA), such as real estate, gold, artworks, and bonds, has attracted increasing attention. RWA tokenization addresses challenges in traditional asset markets, including illiquidity, inefficiency, and high entry barriers. However, the RWA market remains in its early stages due to legal uncertainties, limited technical infrastructure, and economic obstacles, resulting in few practical use cases. To address these issues, systematic research on strategic approaches to facilitating RWA adoption is required. This study analyzes RWA tokenization cases and conducts in-depth interviews with technology and legal experts, including blockchain specialists and financial professionals. Combining case analysis with expert insights, the study explores solutions for overcoming legal and technical challenges and proposes a strategic roadmap for successful RWA adoption. This study presents strategic measures to facilitate the adoption of Real World Assets (RWA) by clarifying legal and regulatory frameworks, strengthening technical infrastructure, reducing economic barriers, and enhancing market acceptance. Through case analyses and in-depth interviews, the findings highlight the necessity of regulatory harmonization, ensuring blockchain security and scalability, lowering financial entry thresholds, and improving public awareness. Based on these results, these efforts will promote the digitalization of physical assets, improve market liquidity, and contribute to the integration of global asset markets.

Keywords: Real World Asset (RWA); Tokenization; Blockchain; Decentralized Finance (DeFi)

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The Potential of Geometric and Radiometric Airborne LiDAR Features in Determining when the Standing Trees Died – Case Study Bohemian Switzerland National Park, Czech Republic

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Abstract: Determining the timing of tree mortality is vital in risk scenarios like wildfires due to the buildup of combustible material and concerns over tree stability. Additionally, understanding natural succession in protected areas relies on linking ecological processes to the occurrence of dead trees. In Bohemian Switzerland National Park, increased dead trees from bark beetle infestations and a 2022 wildfire underscore the need to map the timing of tree deaths. This research utilized an area-based analysis of airborne LiDAR data acquired in November 2021. Three hypotheses were examined: (i) whether the exact year of tree mortality can be classified, (ii) the possibility of categorizing dead trees into two periods, those that died earlier (2018-2019) and more recently (2020-2021), and (iii) if classification is only feasible for areas showing substantial temporal differences in mortality. Findings indicated that airborne LiDAR was insufficient for pinpointing the precise year of tree death (hypothesis i). However, it was successful in differentiating temporal mortality groups (hypotheses ii and iii), with the highest classification accuracy (87% overall) achieved when separating areas with marked temporal differences (hypothesis iii). The approach developed enables effective large-area mapping of tree mortality, which is critical for prioritizing management actions such as wildfire risk reduction and monitoring the effects of climate change. These results highlight airborne LiDAR's potential as a tool for assessing forest health and informing forest management decisions.

Keywords: airborne LiDAR; bark beetle outbreaks; dating tree mortality; forest disturbance mapping; forest fire risk

Acknowledgement: This study was funded by the project Mapping of forest health, species, and forest risks using Novel ICT Data and Approaches (4Map4Health), by the Technology Agency of the Czech Republic (reference number: TH74010001). The author Rorai Pereira Martins-Neto was partially founded by the grant FORESTin3D.

Kraft Lignin-Enhanced Urea-Formaldehyde Resin as a Renewable Binder for Particleboard Production

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Abstract: Kraft lignin, an abundant by-product of pulp and paper production, contains phenolic groups and carbon-forming aromatic compounds that can replace petroleum-based binders while also improving fire safety. Hardwood kraft lignin (0–40 % w/w solids) was blended into an industrial urea–formaldehyde resin (UF), then applied to furnish for 12 mm single-layer particleboards pressed at 140 °C and 3.5 MPa for 5 min. Resin rheology, cone calorimetry, formaldehyde emission testing, and standard mechanical evaluations were performed. Lignin increased viscosity but remained processable up to 30% substitution, confirming industrial feasibility. Particleboards containing up to 20% lignin met the requirements of EN 312-P2 for internal strength and bending strength. Free-formaldehyde emissions declined modestly at lignin substitutions up to 20–30 wt %, but exceeded the reference level when the substitution reached 40 wt %, indicating a shift from scavenging action to steric inhibition of resin cross-linking. Cone-calorimeter tests revealed that the peak heat-release rate fell progressively (by roughly 20–40 %) as lignin content increased, a reduction attributed to the formation of a thermally insulating char barrier. Moderate replacement of kraft lignin in UF resin leads to mechanically compliant particleboard with lower emissions and significantly improved fire resistance through an industrially compatible modification process.

Keywords: wood-based composite; flame retardancy; emission control; mechanical performance

Acknowledgement: The project was supported by the DDL Lukavec and Mondi AG, which provided materials.

Evaluation of Curd Desserts with Different Protein Supplements

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Abstract: The aim of the study is to find out what type of proteins can be added to the traditional Hungarian dessert, Túró Rudi, in order to maintain the optimal texture. Curd desserts (Túró rudi) were prepared using the following ingredients: curd, sugar, dextrose, butter, modified starch, inuline, and 5 types of protein supplements (beef collagene peptide, egg white powder, brown rice protein, soy protein and mung beans protein). The pH was measured with a Testo 206 portable pH meter. The Konica Minolta CHROMA METER CHR-400 tristimulus color measuring system was used to measure the corpus color of the samples in CIELAB values (lightness, L*; redness, a* and yellowness, b*). A texture analyzer (Stable Micro System TA.xT Plus) was used to analyze with spreadability test of the corpus. All the samples were analyzed in triplicate. The pH value was between 4.5 and 4.7. The protein supplementation did not change significantly the pH. The color values were significantly affected when different protein powders were added to the samples (original corpus lightness is L*=93). The vegetable proteins made the samples darker (L*=83-85) and coloured the corpus a light brown. Only the soy protein significantly changed the texture. The texture of the soy protein sample became softer, more spreadable and stickier. In summary animal protein samples were similar to the original sample in both colour and texture. In the opposite case, plant protein samples showed more differences. In this study, animal protein samples showed better texture and colour properties than plant protein samples.

Keywords: túró rudi; curd; protein supplement; colour; texture

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Natural Language Processing for Stakeholder Requirements Analysis: Bridging Communication Gaps in Cross-Disciplinary Sustainable Technology Projects

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Abstract: Sustainable technology initiatives increasingly demand collaboration across disciplinary boundaries, engaging domain specialists, software engineers, environmental scientists, and policymakers who often lack a shared technical vocabulary. This research addresses the critical challenge of requirements elicitation and analysis in cross-disciplinary projects by developing an advanced natural language processing (NLP) system designed to bridge communication gaps and strengthen stakeholder collaboration. Our approach integrates transformer-based language models with domain-specific ontologies to automatically translate, disambiguate, and reconcile requirements from diverse professional backgrounds. The system employs a fine-tuned BERT architecture with domain adaptation techniques, trained on a curated corpus of 156,000 sustainability-focused project documents spanning renewable energy, circular economy, smart cities, and environmental monitoring. The framework introduces three key innovations: (1) a multi-domain translation module that converts technical jargon into accessible yet semantically precise language, (2) an automated conflict detection system surfacing contradictions across disciplinary perspectives, and (3) a collaborative synthesis engine producing unified specifications incorporating insights from all stakeholder groups. Evaluation across 28 sustainable technology projects involving 847 stakeholders from 12 disciplines demonstrated 91.3% translation accuracy, a 34% reduction in requirement-related project delays, and an average 2.7-point improvement in consensus scores. Qualitative analysis further reveals enhanced engagement and more innovative solutions when communication barriers are systematically addressed. This work delivers the first comprehensive NLP solution for cross-disciplinary requirements engineering, contributing to both software engineering and sustainability science, and establishes new benchmarks for inclusive, AI-enabled collaboration in complex environmental innovation processes.

Keywords: natural language processing; sustainable technology projects; requirements elicitation; transformer models; multidisciplinary software requirements engineering

IoT and Wireless Sensor Networks Integration for Renewable Energy and Smart Grid Systems

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Abstract: The development of renewable energy requires innovative approaches to managing energy production and consumption, as the variability of solar and wind power often causes network imbalances. An effective strategy for addressing this challenge is the integration of Internet of Things technologies with wireless sensor networks, which enable continuous monitoring and rapid data exchange between system components. The purpose of this study was to explore how such integrated technologies can improve the efficiency and reliability of energy systems. The study involved simulating the operation of sensor nodes and evaluating the performance of data exchange algorithms with respect to energy consumption and resilience to overloads. The approach also examined the integration of sensor systems with energy storage units and Smart Grid infrastructure. The analysis demonstrated that optimizing network topology and applying energy-efficient protocols not only reduced resource losses but also enhanced the stability of data transmission. Integrating sensor systems with energy storage and Smart Grid infrastructure allowed for swift responses to demand fluctuations and contributed to maintaining balance within the power network. The findings confirm that integrated IoT and wireless sensor network solutions can serve as the foundation for intelligent energy systems. Such systems are capable of reducing dependence on traditional resources while supporting the long-term sustainable development of the energy sector.

Keywords: internet of things; sensor networks; smart grid; renewable energy; energy storage

Development of Egg White-Based Sweets for Athletes

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Abstract: Sports nutrition has been receiving increasing attention within the context of various dietary approaches. Diets characterised by high protein content and reduced carbohydrate intake are becoming a conscious choice for an expanding segment of health-conscious consumers. Moreover, within a lifestyle structured around regular physical activity, the adequate intake of macronutrients plays a critical role in supporting metabolic and physiological functions. Colour and texture (TPA) analysis was carried out, and an untrained panel of 20 people investigated the sensory attributes of the examined candies on a hedonic scale (between 1 and 10). In the present study, an egg white-based confectionery product was developed with the aim of meeting these emerging consumer demands. The research focused on the formulation of protein-enriched gummy candies, evaluating both their sensory characteristics and techno-functional properties. The findings indicate that a single portion (30–50 g) of the developed product can provide the recommended protein intake per meal for individuals in younger (between 25 and 30 and between 30 and 35) age groups. Additionally, the products contain little to no added sugar and exhibit sensory and functional attributes comparable to those of conventional gummy candies.

Keywords: gummy candies; sports diet; techno-functional properties; sensory attributes

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Phosphorus from Waste to Resource: A Review of Complementary Technologies in Aquaculture Management

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Abstract: Environmental sustainability is a growing priority in the face of the increasing depletion and pollution of resources. In Turkey, the aquaculture sector produces significant volumes of phosphorus-rich waste, which, if not managed, threatens ecosystems but simultaneously offers an untapped potential for resource recovery. This review addresses the dual challenge of phosphorus scarcity and environmental degradation by exploring integrated strategies for phosphorus recovery and waste valorization within a circular economy framework. The methodology consists of a comprehensive analytical review of current technologies with a focus on their synergistic potential in the recovery of phosphorus from aquaculture waste. The analysis synthesizes findings from the recent literature on anaerobic digestion (AD), solid-phase dissolution (SPD), and the reuse of chemical by-products, evaluating how these methods can be effectively combined. Particular attention is given to technological complementarities, for example, using AD as a pre-treatment to enhance SPD efficiency, and applying phosphogypsum to intensify phosphorus release under AD. The findings show that, while individual technologies have limitations, their integration offers significant environmental and economic advantages. AD contributes to biogas production and mineralization of nutrients, while SPD ensures efficient phosphorus extraction. Together, these approaches improve recovery rates, reduce emissions, and support agricultural productivity. This integrated approach supports Turkey's sustainability goals by closing nutrient loops, generating renewable energy, and promoting sustainable agricultural practices.

Keywords: environmental sustainability; bioenergy; waste management; phosphorus recovery

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The Role of Geoinformation Technologies in the Formation of Ecotourism Skills on the Example of Sumy Region, Ukraine

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Abstract: Geographic information technologies have significant potential for the development of ecotourism skills. In this context, the study is aimed at using GIS technologies to develop eco-tourism skills. The objects of analysis were geographic information technologies that allow creating an information base that would contain data on the origin, location, condition and safety of visiting certain tourist sites in Sumy region. Methods used: analysis (geoinformation technologies, objects of natural and anthropogenic origin), synthesis (assessing the tourist potential of the region), cartographic (demonstrating the location of tourist sites and routes). The analysis of GIS products made it possible to determine the GIS technologies, among which the following components were selected: ArcGis, QGis, Google Earth, Google Earth Pro, My maps, and the ArcGis Field Maps mobile application. They are widely used to visualize the location of objects and to plot routes. The use of GIS technologies helps to make ecotourism more efficient, sustainable and safe, as well as to raise environmental awareness among tourists and local residents. The introduction of GIS technologies in the process of developing ecotourism skills is a very popular area today, starting with Covid-19, and especially during the military invasion, when most areas are inaccessible to visitors. These tools can be recommended for geography teachers and educators, as well as representatives of protected areas.

Keywords: eco-tourism; GIS technologies; Sumy region

Assessing Competitiveness of Broiler Production in Umzingwane, Zimbabwe: A comparative analysis with South African Poultry Imports

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Abstract: In this study, we seek to determine how competitive broiler chicken meat farms perform against the South African imported frozen chicken. Umzingwane district is located in regions 4 and 5 of Zimbabwe, which is a predominant livestock farming region (intensive and extensive) as witnessed by its low rainfall patterns. In collecting and analyzing our data, we used the typical farm approach, which conceptualizes an empirically grounded "representative" or "typical" farms that have similar features, focusing on the most common or modal characteristics of its systems rather than an average. The typical farm approach data was collected from 10 farms with similar characteristics and evaluated using the typical farm approach. Collected primary data included, the grow-out period, breed, point of sale weight, production costs, efficiency metrics, and profit margins, to mention a few. For data on South African broiler chicken industry, we used secondary sources, and preliminary results show that South Africa exports significant tons of frozen chicken per year to Zimbabwe. Therefore, in this study, we provide a comparative analysis at the farm level to understand the competitiveness in terms of market prices and production dynamics of broiler farms in the Umzingwane district of Zimbabwe. This analysis is used to determine what measures and decisions farmers could adopt to improve the competitiveness of the small-scale broiler farms.

Keywords: broiler chicken; competitiveness; production costs

The Silent Revolution: How AI is Rewriting the Rules of Organizational Power

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Abstract: Current research predominantly frames AI as a neutral enabler of efficiency, neglecting its potential to restructure authority dynamics and assume managerial responsibility. AI-driven decision frameworks introduce a new locus of power, where authority is no longer derived solely from hierarchical position but from algorithmic influence and data control. This study explores the notion that AI is increasingly acting as a force that actively reshapes managerial authority, governance structures, and expertise hierarchies. AI's growing influence in organizational decision-making necessitates rethinking theoretical and managerial perspectives. Recognizing AI as a decisional actor highlights the need for a structured framework to navigate shifting power dynamics while enhancing AI literacy among managers, which will be crucial in maintaining a balanced governance model. Through the Power Dynamics Framework, this research demonstrates how AI shifts power from positional authority traditionally held by managers to informational and algorithmic governance. This transition will fundamentally alter how decisions are made, challenging long-standing hierarchical structures and promoting networked, AI-augmented decision ecosystems. Managers will increasingly evolve from direct decision-makers to meta-governors in charge of aligning AI-driven insights with corporate goals. The power structure within organizations could become more fluid and relational rather than static and top-down. AI does not simply decentralize decision-making; it reconfigures governance by embedding decision logic into automated algorithmic systems. However, while this shift enables greater synergetic efficiency, it also introduces significant governance challenges, particularly regarding accountability, transparency, and ethical alignment.

Keywords: Artificial Intelligence (AI); algorithmic governance; decision-making

Operational Optimization of a Rotative Bean Seed Shelling Machine

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Abstract: In the post-harvest process of bean crops, shelling is performed manually or by beating the harvested crop, which means a delay in sheaf removal and a high dependence on the number of available days and high physical effort. For this reason, an experimental prototype of an electrically powered mechanical sheller was designed and built. It can quickly separate the grain from the sheaf into different bean varieties, with minimal mechanical damage and fewer work days. During the design phase, an analysis of low-cost and easily acquired materials was carried out, as well as an ergonomic and operator safety analysis. The bean sheller consists of a roller with paddles and vibrating screen systems. The results compared to manual labor show a significant improvement in productive performance, with lower work days and less physical effort. The machine represents a scalable alternative for bean postharvest processing, reducing losses, improving shelling performance, enhancing the processing time and also reducing ergonomic threats to the farmers.

Keywords: agricultural work; manual means; mechanical damage; physical effort; shelling

Acknowledgement: The team would like to thank the postharvest discipline's team and the National Coffee Research Center of Colombia, for the help provided during the development of this research.

Green Composites from Agro-Waste: Exploring the Potential of Banana Pseudo-Stem and Pineapple Leaf Fibers

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Abstract: Green composites offer advantages such as biodegradability, reduced carbon footprint, and enhanced mechanical properties for lightweight industrial applications. Agro-waste fibers like Banana Pseudo-Stem Fiber (BPSF) and Pineapple Leaf Fiber (PALF) are promising candidates, supporting a circular economy. BPSF, with a Young's modulus of 3.49 GPa and tensile strength of 54 MPa, is recognized for its stiffness and biodegradability. PALF, with tensile strength of 290.61 MPa and tensile modulus of 5.83 GPa, is suitable for high-performance composites. This study evaluates the mechanical performance of composites made from BPSF and PALF, reinforced with Epoxy resin LH 288 and hardener H 282. Tensile properties at 5%, 10%, and 15% fiber content were tested using a Universal Testing Machine, based on ASTM D3039/D3039M-08 standards. The tests measured tensile strength, Young's Modulus, and failure mechanisms. Scanning Electron Microscopy (SEM) was used to analyze fracture surfaces and fiber-matrix interaction. Composites with 10% fiber content achieved the highest Young's Modulus (3126.42 N/mm² for BPSF and 3085.34 N/mm² for PALF), indicating optimal mechanical performance. SEM analysis confirmed improved fiber-matrix bonding and more uniform fracture surfaces compared to 5% and 15% fiber content. In conclusion, this study demonstrates that both BPSF and PALF have strong potential as sustainable reinforcements in green composites, particularly at 10% fiber content. Their application supports sustainable material development in eco-friendly industries, offering a viable alternative to synthetic fibers.

Keywords: green composites; natural fibers reinforcement; polymer matrix; Banana Pseudo-Stem Fiber; Pineapple Leaf Fiber; mechanical properties

Development and Analysis of Structural Element Based on Oriented Strand Board

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Abstract: The research focuses on the development of a construction element made from recycled residual parts of OSB (oriented strand boards), which could serve as a functional, technically feasible, and environmentally friendly alternative to conventional building materials. The motivation lies not only in the more efficient management of wood waste, but also in exploring new possibilities for creating solid-wall structural components from so-called "low-value" material—without compromising mechanical integrity or structural performance. The results of the research are primarily intended for use in timber buildings and prefabricated construction systems, where sustainability, modularity, and material innovation are key priorities The increasing pressure for sustainability in the construction industry is driving the need for innovation in materials engineering, particularly in the efficient use of secondary raw materials. This study focuses on the development of a new solid-wall structural element made from residual parts of oriented strand boards (OSB), sourced from production waste or demolition debris. The element is designed as a sustainable alternative to conventional solid timber or glued laminated systems, with an emphasis on circular economy principles and the preservation of key mechanical performance characteristics The research is conducted in three phases. The first phase involves a detailed material characterization of the input agglomerated material—focusing on density analysis, directional homogeneity, moisture content, and the orientation structure of the wood strands. In the second phase, a modular joining system is being developed to enable the transformation of individual segments into a compact, solid-wall structure. Two strategies are applied: mechanical joining (e.g., screw connections, bolts) and chemical bonding using polyurethane and phenol-formaldehyde adhesives. The third phase focuses on experimental verification of the element through destructive testing—primarily assessing bending strength, shear strength, and the modulus of elasticity in the longitudinal direction. Preliminary findings indicate potential for practical application in lightweight load-bearing structures and prefabricated systems. The outcome may be a technically functional and environmentally beneficial product that supports material recycling in the construction industry.

Keywords: Oriented strand board (OSB); solid-wall element; recycling; joining; mechanical testing

MCYR 2025 SCIENTIFIC SESSIONS

PLANTS & AGRICULTURE

Genomic-Phenotypic Comparative Study on Antifungal, Plant Growth Promoting, Bioremediating Aspects of *Bacillus subtilis* NSS, a Gut Isolated of *Hemidactylus Flaviviridis*

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Abstract: Gut system of insectivorous reptile *Hemidactylus flaviviridis* was purposefully targeted to find unexplored microbial resources based on the rationale of their usual food habits. A phytobeneficial gut bacterial strain *Bacillus subtilis* NSS was successfully isolated and characterized upto genomic approaches. Deeper investigation into the whole genome sequence analysis of *B. subtilis* NSS corroborated the findings revealed from several phenotypic and biochemical observations in *in vitro* and *in vivo* studies. The gut isolate *B. subtilis* NSS exhibited 2.86±0.21, 89.68±2.46, and 4.62±0.23 U/ml chitinase, protease, and β-1,3-glucanase production, respectively. Further *in vitro* and *in vivo* studies also decipher the effective utilization of such gut bacterial attributes against as many as nine plant pathogenic fungi, in plant growth-promoting (PGP) activities with *Cicer arietinum* and *Oryza sativa* IR36, and heavy metal(oid)s (HMs) resistant, removal, and bioaccumulation potentialities. Genomic and phenotypic investigations also ascertained PGP attributes like indole-3-acetic acid (IAA) and siderophore production, phosphate solubilization, nitrogen fixation, biofilm formation, and root colonization. The current study revealed the potential of the gut symbiont NSS to respond against both the biotic and abiotic stresses with integrated PGP attributes for sustainable agriculture.

Keywords: biocontrol; chitinase; β-glucanase; protease; gut symbiont; heavy metal; plant-microbe interaction; root colonization

Valorization of Agricultural Residues Materials for Extraction of Nanocellulose.

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Abstract: Nanocellulose derived from renewable sources like agricultural residues offers a sustainable alternative to non-biodegradable materials due to its exceptional properties. Agricultural residues represent an immense potential for sustainable nanocellulose production, contributing to a circular economy and addressing environmental challenges. This study aims to assess the potential of a wide range of agricultural residues for sustainable nanocellulose production. Compositional analysis of eight agricultural and wood residues (poppy, flax, rapeseed, barley, hemp, wheat, corn, and wood residues) was carried out to determine content of extractives, cellulose, hemicelluloses and lignin. Monosaccharides composition (glucose, xylose, arabinose, galactose and mannose) was analyzed using High-Performance Liquid Chromatography (HPLC), providing key information for nanocellulose production. Extractives content varied, from 1.82% in flax to 9.5% in corn, which could influence initial processing steps. Hemp was identified as an exceptionally promising material with remarkably low lignin (5.15%), the highest cellulose content (65.03%), and the highest glucose concentration (72.42 mg/g). Other materials had higher lignin content (17.39-27.78%) and lower cellulose (30.46-43.18%). Agricultural residues represent a viable and sustainable source for nanocellulose production. Due to its chemical properties, particularly high cellulose content and low lignin content, hemp is most suitable for efficient nanocellulose extraction. Materials with higher lignin and hemicelluloses content will require more intensive pre-treatment. Future research should focus on developing low-cost and eco-friendly methods for the suitable commercialization of nanocellulose.

Keywords: cellulose; nanocellulose; lignin; chromatography; extraction

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The Impact of Military Equipment Movement on Soil Hardness

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Abstract: The relevance of the study is due to the growing anthropogenic load on agricultural landscapes, in particular in areas of active movement of military equipment. Changes in soil hardness can lead to degradation of soil structure, deterioration of the water-air regime, and increased erosion risks. The aim of the research was to determine the type and level of changes in soil hardness caused by the movement of military equipment on agricultural landscapes with different types of land use. The study of hardness was conducted using the LAN-M soil density meter, an electronic device for measuring the degree of soil compaction in fields in accordance with ASAE S313.3. The highest hardness is observed in the areas where military equipment passes through and where it is parked, where values reach 60-62 kg/cm^2 already in the upper layers (2.5-5 cm) and remain at 55-60 kg/cm^2 throughout the soil profile up to 60 cm depth. In the parking areas of machinery, hardnesses at depths of 15-25 cm also exceed 55 kg/cm^2, creating localized compaction. Road plowing partially alleviates the situation, reducing the hardness in the surface layer to 30-35 kg/cm^2, but in the deeper layers (10-25 cm), compaction with hard zones of up to 50-57 kg/cm^2 remains. The best condition is in the fallow and partially in its burnt area, where the hardness values do not exceed 20-28 kg/cm^2 throughout the studied profile. This indicates the absence of mechanical pressure and effective natural regeneration of the soil structure. Analyzing these processes is critical to developing strategies for restoring and preserving soil resources in the post-crisis land use environment.

Keywords: soil hardness; military equipment; post-war land use

Assessment of Water Quality for Irrigation by Electrical Conductivity and Ionic Content

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Abstract: The total content of water-soluble salts, or salinity, indicates the toxicity of irrigation water for agricultural plants and the risk of soil salinization. Prolonged irrigation with water of high salinity contributes to the accumulation of salts in the upper layers of the soil, which disrupts the stability of agroecosystems, reduces the yield and quality of crop production. Excessive salt content in irrigation water reduces the osmotic activity of plants and prevents normal soil aeration. Electrical conductivity, total mineralization, salinity of water was determined using an EZODO 8200M salinity conductometer; the content of water-soluble salts of calcium, sodium and potassium cations in irrigation water was determined using HORIBA LAQUAtwin Na-11 (Na^+); K-11 (K^+); Ca-11 (Ca^{2+}) ionometers. During the electrophysical analysis of the water, it was found that the electrical conductivity is 1047 μs/cm, the total amount of all dissolved salts in the water is 708 mg/l (ppm), and its salinity reaches 540 mg/l (ppm). Therefore, according to the level of dissolved salts, the water can be classified as medium saline (electrical conductivity in the range of 650-1300 μs/cm). The water used for irrigation has a small amount of water-soluble potassium salts - 6 mg/l (ppm); much more water-soluble calcium salts - 93 mg/l (ppm); most of all water-soluble sodium salts - 190 mg/l (ppm). An increased content of water-soluble sodium salts in irrigation water leads to soil salinization and an increase in their amount in the soil. Excessive content of monovalent sodium and potassium cations compared to divalent calcium and magnesium cations indicates a risk of disruption of soil permeability, soil structure, development of peptidization processes, transition of soil colloids to an unnatural ash state, etc.

Keywords: mineralization; soil salinity; irrigation water; electrical conductivity; cation content

Thermal Responses of Wild Red Deer (*Cervus elaphus*) Meat to Sous-Vide Treatment: A Comparative Study Across Age Groups

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Abstract: This study evaluates the impact of sous-vide cooking at varying temperatures on the quality attributes of wild red deer (*Cervus elaphus*) meat from animals of different ages. Semimembranosus muscles from 7-, 18-, and 48-month-old deer, hunted in western Hungary, were cut into uniform steaks, vacuum-packed, and cooked sous-vide at 60 °C, 65 °C, and 70 °C for 3 hours. Quality parameters including drip loss, pH, surface color, texture, SDS-PAGE protein profiling, differential scanning calorimetry (DSC), and scanning electron microscopy (SEM) were assessed to determine age-related thermal responses. Results indicated that both pH and drip loss increased with age and cooking temperature. Color measurements revealed higher lightness (L*) and yellowness (b*), alongside reduced redness (a*), particularly at higher temperatures. SDS-PAGE analysis showed progressive degradation of sarcoplasmic and myofibrillar proteins, notably actin and myoglobin, under elevated heat. DSC thermograms revealed incomplete protein denaturation in 7-month-old samples at 60 °C, while older samples exhibited fully denatured profiles. SEM imaging confirmed structural deterioration post-cooking, with older samples displaying pronounced fiber disruption at 65 °C. These findings highlight the interplay between age and thermal treatment in shaping the physicochemical and structural properties of wild game meat.

Keywords: game meat; red deer; sous-vide; protein denaturation

Chemical Composition, Extraction Conditions, and Biological Properties of *Allium Sativum* Bulb Essential Oil from Son La Province, Vietnam

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Abstract: Garlic (*Allium sativum* L.) is a valuable medicinal plant and spice, widely recognized for its potent antimicrobial, antioxidant, and anti-inflammatory properties stemming from its essential oil (EO). However, the impact of extraction conditions and regional factors, such as in Son La, Vietnam, on EO yield and composition has not been fully explored. This study comprehensively examines EO from garlic bulbs collected in Son La province, Vietnam. The effect of extraction conditions (material pretreatment, material-to-solvent ratio, and extraction time) on the amount of extracted EO, as well as the chemical composition and biological activity of EO, was also evaluated. Hydro-distillation under appropriate extraction conditions (ultrasonic treatment of the mixed components, material-to-water ratio of 1:3, and extraction time of 3 h) resulted in a high EO yield (0.422% ± 0.007%). The analysis of garlic EO using gas chromatography-mass spectrometry (GC/MS) found 22 different compounds, with disulfide and trisulfide compounds being the most common, making up 78.62% of what was identified. The EO exhibited higher antioxidant activity than ascorbic acid, based on the 2,2-diphenyl-1-picrylhydrazyl radical assay. The EO has also been shown to have antibacterial activity against Escherichia coli and Staphylococcus aureus. These results have highlighted the potential applications and usefulness of garlic EO as a natural antioxidant and antibacterial agent.

Keywords: *Allium sativum*; essential oil; garlic

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Use of qRT-PCR and ddPCR Methods to Detect the Expression of Major Allergens in Horticultural Crops

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Abstract: The number of people suffering from food allergies has significantly increased in recent decades. In many cases, these allergies are triggered by fruit and vegetable allergens, which not only exhibit high stability against heat and enzymatic degradation, making them difficult to eliminate through processing, but they also cross-react with other major allergens. The allergenicity of individual plant species is determined by the level of expression of genes encoding the synthesis of their allergenic proteins. This expression can be accurately detected at the molecular level using PCR methods. In this research, new specific primer pairs were designed and successfully used to amplify the apple isoallergens Mal d 1.01 and Mal d 1.02. For the first time, a ddPCR method was optimized for detecting the expression of apple allergens, proving to be highly precise. Gene expression of Mal d 1.01 and Mal d 1.02 was relativized to the reference gene Actin 7 and normalized to the calibration variety 'Golden Delicious'. Among the two isoforms, Mal d 1.01 showed overall higher expression level. The highest expression of Mal d 1.01 was observed in the 'Gala' variety, previously described as hyperallergenic. In contrast, Mal d 1.02 exhibited the strongest expression in the 'Red Prince' cultivar. Both isoforms were least expressed in the 'Granny Smith', 'Kanzi', and 'Zingy' varieties, confirming their lower allergenicity. This study supports the potential use of molecular methods in high-throughput identification of low-allergenic genotypes, enabling the selection and breeding of hypoallergenic fruit and vegetable cultivars.

Keywords: plant allergens; panallergens; qRT-PCR; ddPCR; Mal d 1

Vertical Gardens and Invisible Guests: Health Implications of Mycobacteria in Indoor Green Walls

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Abstract: Indoor vertical green walls are increasingly implemented in public and semi-public environments such as offices, shopping centers, and universities, recognized for improving indoor microclimates and mental well-being. However, their potential health risks, particularly regarding microbial contamination, remain insufficiently studied. This research evaluates the presence of opportunistic pathogens, specifically non-tuberculous mycobacteria (NTM), in green wall systems and their possible health implications. A total of 103 samples (73 substrate/root samples and 30 irrigation water samples) were collected from 18 indoor green walls across the Czech Republic (n = 88) and Poland (n = 15). Mycobacteria were isolated using accredited culture methods; DNA was detected via qPCR. Identifications were performed using molecular hybridization probe assays (Genotype Mycobacteria CM/AS/NTM-DR). Mycobacterial DNA was found in 96.1% of all samples (Czech: 98.9%, Poland: 80.8%). Culture positivity was observed in 37.9% of samples (Czech: 23.9%, Poland: 40.0%). A total of 52 isolates were obtained (14 samples contained multiple species). The dominant isolate was *Mycobacterium avium* subsp. hominissuis (MAH) (53.9%), followed by *M. gordonae* (21.2%), M. chimaera (19.2%), M. malmoense (3.9%), and M. sp. (1.9%). Although vertical gardens harbor potentially pathogenic mycobacteria MAH—including emerging species such as *M. chimaera* and *M. malmoense*—the biofilm-associated nature of these organisms limits direct human exposure. Thus, they pose minimal risk to the general population. Caution is advised, however, for immunocompromised or respiratory-compromised individuals due to possible airborne NTM exposure in inadequately maintained systems.

Keywords: indoor green walls; mycobacterial ecology; environmental saprophytic mycobacteria; biofilm; public health

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Combined Soil Application of Phosphogypsum & Vermicompost Leachate and its Effects on the Growth of Mustard (*Brassica Juncea*) Plant

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Abstract: Phosphogypsum (PG) and Vermicompost Leachate (VCL) are considered as one of the most beneficial soil treatments to enhance inorganic as well as organic components of the soil and boost plant growth. They can fulfil the deficiencies of some essential elements in soil, such as Ca, S, Al, P, Fe, Cu, Ni, Zn, K, ammonium & oxides of nitrogen - based on their composition and sampling location. Since VCL has beneficial microbes which help in co-composting of food waste in bioponics, and PG has essential elements for enhancing the enzymatic activity for certain soil microbes, this study is focused on the combined action of both. Seeds of *Brassica juncea* were sown in filtered soil and allowed to germinate for 3 days. Soil treatments were prepared in different dilutions vis-a-vis 10% VCL in each treatment and 1%, 5% & 10% PG in different treatments and were added on the third day. It was observed that samples with 10% VCL + 5% PG treatment showed 25.82% & 16.07% increase in root length & shoot length respectively during preliminary analysis, whereas samples with 10% VCL + 10% PG treatment showed 113.57% & 96.15% increase in fresh and dry shoot biomass respectively compared to samples with no treatment. The results indicate higher nutrient availability to plants upon increasing PG concentration. The proposed treatment can be a supportive technique in soil remediation technologies and PG waste management.

Keywords: soil treatments; phosphogypsum; vermicompost leachate; *Brassica juncea*

Economic Losses from Ukraine's Crop Sector: Implications for Food Security and Sustainable Recovery

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Abstract: The war in Ukraine has disrupted agricultural production at an unprecedented scale, directly affecting crop yields, land accessibility, and global food supply chains. Beyond immediate food losses, these impacts threaten progress toward Sustainable Development Goals (SDGs) 2 (Zero Hunger) and 12 (Responsible Consumption and Production), posing long-term sustainability challenges. This study applies an area-based loss valuation method, combining official statistics from the State Statistics Service of Ukraine for 2021–2022 with structured economic models. Reductions in harvested area were multiplied by pre-war yields, adjusted for perennials, and valued at regional and national prices. Losses were disaggregated by crop groups and regions, with attention to conflict exposure and farmland accessibility. Total crop production losses in 2022 exceeded €6 billion, dominated by cereals (corn, wheat, barley) and oilseeds (sunflower), which together accounted for more than 80% of the total. Over 70% of losses occurred in frontline regions—Kherson, Zaporizhzhia, Donetsk, Luhansk, and Kharkiv—where farmland inaccessibility reached up to 100%. Nationally, 27.8% of agricultural land was inaccessible in 2022, improving to 15.7% in 2024 due to de-occupation, though mine contamination and land degradation remain critical obstacles. The findings demonstrate both the vulnerability and resilience potential of Ukraine's agriculture. Sustainable recovery requires urgent demining, land restoration, and investment in logistics, alongside diversification and climate-smart technologies. Integrating these measures into policy is essential to rebuild food security and enhance agricultural resilience under prolonged conflict.

Keywords: Ukraine war; crop production losses; land accessibility; food security; sustainable recovery

Enhancing the Efficacy of *Beaveria Bassiana* through Passaging and Assessment of Intra-Specific Differences among the Passages

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Abstract: The study aims to determine whether adaptation through host passage can improve the strain's pathogenicity and production characteristics for potential application in biological pest control. The study involved serial passaging of the *Beauveria bassiana* strain CCM8382 through different substrates—PDA and oat flakes—and developmental stages of *Tenebrio molitor* (larva, pupa, and adult) for five and ten consecutive passages. At the 5th and 10th passage, fungal strains were evaluated for growth characteristics, spore production, and virulence against *T. molitor* larvae. A bioassay was conducted to assess mortality caused by each passage variant. This method allowed researchers to compare the effects of passaging through insect hosts versus artificial media on the fungus's performance and pathogenicity. After five passages, the strain CCM8382 maintained similar growth when passaged through PDA and larvae. At the 10th passage, the strain passaged through PDA formed larger colonies than at the 5th passage, but spore production decreased. Spore production significantly increased after five passages across all treatments. The highest mortality of Tenebrio molitor larvae was caused by strains passaged through larvae and PDA. The fungus adapted to the developmental stage of the host, showing enhanced virulence when passaged through insect hosts, particularly larvae, compared to artificial media. Passaging *B. bassiana* strain CCM8382 through *T. molitor* larvae improves its virulence and spore production, suggesting that host-based passaging can enhance the strain's effectiveness as a biocontrol agent.

Keywords: *Beauveria bassiana*; sustainable agriculture; passages

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Local Markets – Importance for Regional Food Systems and State Security

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Abstract: In an age of global crises such as climate change, supply chain disruptions and growing socio-economic inequality, the issue of food security is becoming increasingly important for national security. In this context, this study focuses on analyzing the role of local markets in ensuring regional food security within Poland. The purpose of the study was to understand and demonstrate how local food distribution mechanisms affect the availability and stability of food supply at the regional level, thereby supporting national security. To achieve the objective indicated above, the method of literature analysis was applied, and primary research obtained through field observations was used to identify key aspects of local markets in different social and economic contexts. Particular emphasis was placed on the relationship between producers and consumers, the structure of local supply chains, the environmental impact of these markets, and food security at the regional level. The results indicate that local markets play a key role in ensuring regional food security, influencing increased food availability and quality, food system stability, as well as the protection of local economies and the environment, which positively impacts the country's national security by ensuring regional self-sufficiency. Supporting these markets is therefore not only an ad hoc solution, but also a long-term strategy for building the resilience of regional food systems, which translates into increased national security in terms of food self-sufficiency.

Keywords: local markets; food security; regional economy; food availability

Development of Adaptive Technologies for Growing Niche Crops in the Conditions of the Southern Steppe of Ukraine under Climate Change

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Abstract: In the context of climate change, the development of adaptive cultivation technologies for niche bioenergy, essential oil, and spice crops has become increasingly relevant. These crops combine the potential of renewable energy with the opportunity to enhance the added value of agricultural products. The aim of the research was to develop adaptive cultivation measures for niche crops under the conditions of the Southern Steppe of Ukraine. To achieve this goal, field and laboratory experiments, phenological observations, and statistical analysis methods were used. Among the bioenergy crops, the most productive under the arid climate conditions of the Southern Steppe of Ukraine were *Sorghum saccharatum* (L.) Moench., *Sorghum bicolor* L., *Helianthus tuberosus* L., *Helianthus tuberosus* × *Helianthus annuus* L., and *Silphium perfoliatum* L. Essential oil crops demonstrated a high adaptive potential. In the third year of vegetation, the yield of plant raw materials was as follows: *Lavandula angustifolia* Mill. – 5.7 t/ha, Lavandula hybrida Rev. – 7.9 t/ha, *Hyssopus officinalis* L. – 6.7 t/ha. Saffron (*Crocus sativus* L.) is one of the most expensive spices in the world, which generates considerable interest in its cultivation. We initiated research into the development of saffron cultivation technologies, considering its advantages: high profitability, potential access to international markets, relative unpretentiousness regarding soil conditions, and increasing demand for organic and niche products. The obtained results demonstrate the high adaptive capacity of niche crops and support their recommendation for cultivation in the Southern Steppe of Ukraine.

Keywords: niche crops; variety; adaptation; productivity; climate change; yield

Factors Affecting Member Loyalty Towards Farmer Cooperatives. Case of Ugandan Districts: Iganga, Bugiri, and Namutumba

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Abstract: Farmer cooperatives are vital to rural development in sub-Saharan Africa, providing collective solutions for agricultural production, market access, and financial inclusion. However, sustaining member loyalty poses a persistent challenge that often undermines their long-term impact. This study examines the drivers of member loyalty to cooperatives in Uganda's Iganga, Bugiri, and Namutumba districts, where smallholder farming prevails. A structured survey targeted 288 members from 28 cooperatives, selected through simple random sampling. Data were collected via online questionnaires and direct interviews. Statistical analysis using SPSS employed descriptive statistics, T-Tests, multivariate probit modeling, and multiple linear regression to explore loyalty determinants and their relationship to household welfare. Findings indicate that gender, marital status, education level, crop type, and sales channels significantly influenced loyalty behaviors such as shareholding, leadership, and meeting attendance. Maize farmers and those selling exclusively via cooperatives exhibited stronger loyalty. The multivariate probit model identified farming experience, household size, cooperative satisfaction, and personal objectives as positive predictors of loyalty, while primary education showed a negative association. Regression analysis results revealed that loyal members benefit from improved access to credit, higher income, increased production, and expanded cultivated land. Thus, strengthening inclusive and responsive cooperative environments can boost member engagement, reinforce institutional resilience, and yield substantial welfare gains. These findings position farmer cooperatives as strategic engines for sustainable rural development.

Keywords: member loyalty; farmer cooperatives; agricultural welfare; rural development; Eastern Uganda

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Formulation and Evaluation of Standard and Low-Sugar Beetroot Jams Enriched with Strawberry.

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Abstract: This study investigates whether beetroot (*Beta vulgaris* L.), known for its vibrant pigmentation and antioxidant potential, can serve as both a natural red colorant and a functional ingredient in jam production. This study focuses on methods for developing beetroot-based jams with both standard and reduced sugar levels, incorporating strawberry at five blend ratios (10-50%). Physicochemical parameters, including pH, Brix, Titratable acidity, L*a*b colour, antioxidant activity, and total phenolic content, were evaluated, alongside sensory evaluation of colour, texture, taste, sweetness, intensity of fruity flavour, and overall acceptability. Results showed that higher beetroot content maintains vibrant red hues while enhancing antioxidant potential. Compositions and blends containing 70-80% beetroot and 20-30% strawberry demonstrated a favorable balance of sensory and functional attributes, even in reduced-sugar variants. The results confirmed that higher beetroot content enhanced antioxidant properties and color stability. Blends with 70–80% beetroot showed the best sensory and functional quality, supporting beetroot's potential in sustainable, additive-free jam production.

Keywords: Beetroot, jam, antioxidant activity, total phenolic content, sensory evaluation.

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Effect of Burial Depth and Propagule Type on the Regeneration Capacity of *Cyperus rotundus* L. on Degraded Grey Soils in Ho Chi Minh City, Vietnam

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Abstract: Purple nutsedge (*Cyperus rotundus* L.) is a persistent global weed, particularly problematic in degraded soils. This study assessed how burial depth and type of reproductive material affect their regeneration and potential competition with mung bean (*Vigna radiata* L.) on grey degraded soils in Ho Chi Minh City, Vietnam. A factorial experiment with 15 treatments and three replications was arranged in a completely randomized design. Treatments combined five propagule types (whole tuber, ½ tuber, ¼ tuber, rhizome with one bud, and rhizome with two buds) and three burial depths (3–5 cm, 13–15 cm, and 23–25 cm). Deeper burial delayed emergence, with the 23–25 cm depth averaging 13.9 days after sowing (DAS), compared to 10.7 and 11.6 DAS at shallower depths. Regeneration varied significantly among propagule types; rhizomes with one and two buds showed the lowest emergence and tuber formation (7.1 and 17.6 shoots; 7.0 and 20.1 new tubers by 30 DAS). Rhizomes consistently had poorer regeneration than tubers. Notably, no significant negative impact on mung bean growth and yield was recorded within the study period. The findings improve understanding of *C. rotundus* regeneration and suggest that control strategies based on burial depth and propagule type manipulation may reduce its spread.

Keywords: purple nutsedge; burial depth; propagule type

How do Microcredit Interventions Impact Agricultural Risk Management Strategies Among Smallholder Farmers? Evidence from Kenya.

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Abstract: Microcredit has become a key financial tool for enhancing agricultural risk management among smallholder farmers, though its specific role in mitigating risks for maize growers in Uasin Gishu County, Kenya, remains underexplored. This systematic literature review evaluates empirical evidence on how microcredit influences risk management strategies, including input access, crop diversification, and climate adaptation, to inform policies that strengthen smallholder resilience in Kenya's maize sector. Through employing a systematic review methodology, this study synthesizes empirical data on microcredit's impact on agricultural risk management. The analysis focuses on group-based lending models, credit-enabled technology adoption, and financial mechanisms influencing farmers' liquidity and risk mitigation strategies, while identifying critical constraints such as high interest rates and inadequate financial literacy. The findings demonstrate that microcredit significantly improves liquidity, enabling investments in climate-resilient practices and insurance products. Group-lending models enhance credit accessibility and repayment rates, with empirical studies associating microcredit with a 40.52% income increase and elevated agricultural productivity. However, adoption rates remain suboptimal (36.8% traditional credit: 33% risk-contingent models), reflecting systematic and behavioral barriers. The study underscores the need for tailored financial products and comprehensive advisory services to maximize microcredit's risk-reduction potential. Synthesizing existing evidence provides actionable insights for policymakers and development practitioners seeking to enhance smallholder resilience in Kenya's maize production systems.

Keywords: microcredit; agricultural risk management; smallholder farmers; climate adaptation; systematic literature review

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Growing Tomatoes in a Hydroponic System

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Abstract: The study aimed to evaluate the efficiency of a hydroponic greenhouse system for tomato cultivation compared to traditional soil-based methods. The focus was on proving that hydroponics can ensure high productivity and superior fruit quality while optimizing resource use. Five tomato hybrids (Mirely F1, Nargiza Rz, Bellfort F1, Ciuciu F1, Manusa) were cultivated in a greenhouse equipped with automated climate control, reverse osmosis water filtration, and a drip irrigation system ("spaghetti" type). Plants were grown in a perlite–vermiculite substrate, with daily monitoring of pH and EC levels. Nutrient solutions were adjusted according to plant growth stages. All hybrids demonstrated high adaptability to hydroponic conditions. Nargiza Rz achieved the highest total yield per plant (16.8 kg), while Mirely F1 produced the highest number of fruits per plant (90). The quality of fruits remained consistently high, with uniform size, good density, and excellent taste characteristics across all hybrids. Hydroponic tomato cultivation proved to be an effective alternative to soil farming, offering higher control over plant nutrition, stable yields, and superior product quality. The study confirmed that hydroponics can be implemented on a larger scale for sustainable agricultural production.

Keywords: hydroponics; tomato cultivation; greenhouse technology; yield quality; sustainable agriculture

Acknowledgement: The research was conducted at the Technical University of Moldova's experimental greenhouse, with technical support from Croponix FARM.

In Vitro Micropropagation of *Olea europaea* L. Using Nanoparticles: A Preliminary Study on Cultivars 'Galega vulgar' and 'Frantoio'

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Abstract: In vitro micropropagation of olive trees (*Olea europaea* L.) is limited by low multiplication rates, genotype-dependent responses, and high costs of cytokinins, especially zeatin. This study tested the hypothesis that adding silicon dioxide (SiO_2NPs) and copper oxide nanoparticles (CuONPs) could maintain or improve shoot multiplication while reducing zeatin concentration in cultivars 'Galega vulgar' and 'Frantoio'. Single nodal segments were cultured on Rugini olive medium with cultivar-specific zeatin (1.5, 1.0, 0.5 mg/L for 'Galega'; 3.0, 2.0, 1.0 mg/L for 'Frantoio') and nanoparticles (SiO_2NPs at 0, 25, 50 mg/L; CuONPs at 0, 10, 20 mg/L) through three multiplication cycles. For 'Galega', the highest multiplication coefficient (MC) occurred with 50 mg/L SiO_2NPs combined with 1.5 or 1.0 mg/L zeatin; 10 mg/L CuONPs at 1.5 mg/L zeatin also moderately increased MC. Control treatments showed better shoot growth at higher zeatin, but some nanoparticle treatments matched MC at reduced hormone levels. For 'Frantoio', MC ranged 1.90–3.64. Treatments with 20 mg/L CuONPs + 3.0 mg/L zeatin and 25 mg/L SiO_2NPs + 3.0 mg/L zeatin reached MC of 3.33, close to the control MC of 3.64 (3.0 mg/L zeatin without nanoparticles). Lower zeatin (1.0–2.0 mg/L) with 10 mg/L CuONPs also showed MC of 2.50–2.86. These preliminary results suggest nanoparticles can enhance micropropagation efficiency and reduce costly cytokinin use, benefiting commercial applications.

Keywords: olive; tissue culture; multiplication; zeatin; nanoparticles

Acknowledgement: Financial support was provided via IGA-ZF/2025-SI1-004.

Protoplast-Based Platforms for Metabolic Engineering of Oil-Producing Crops: A Tool for Sustainable Agricultural Innovation

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Abstract: The increasing global demand for plant-derived oils in food, biofuel, and industrial applications necessitates the development of efficient strategies for improving oil yield and quality in crops. Traditional breeding approaches often fall short due to genetic constraints and long generation times. Protoplast technology offers a versatile and rapid system for genome manipulation, functional genomics, and metabolic engineering in oil-producing species. This study focused on the isolation, transient transformation, and metabolic evaluation of mesophyll protoplasts from Ricinus communis and Camelina sativa. Viable protoplasts were obtained using enzymatic digestion with cellulase and pectinase, followed by PEG-mediated transfection with lipid biosynthesis regulators (DGAT1 and WRI1). Transformation efficiency was quantified through fluorescence microscopy, while lipid accumulation was analyzed via gas chromatography–mass spectrometry (GC-MS). Optimized protocols yielded high-viability protoplasts with transformation efficiencies above 60%. Transient overexpression of DGAT1 and WRI1 resulted in upregulation of lipid biosynthetic genes and a significant increase in triacylglycerol accumulation compared to non-transformed controls. Protoplast systems represent a powerful tool for the metabolic engineering of oil-producing crops. They enable rapid assessment of gene function and metabolic output, facilitating the development of high-oil cultivars through precision biotechnology approaches.

Keywords: protoplast technology; oil biosynthesis; metabolic engineering; plant biotechnology; DGAT1

Acknowledgement: This research was supported by EAFIT university.

Comparison of Different Near-Infrared Spectroscopic Devices for Detecting the Enrichment of Plum Juice with Plant Extracts

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Abstract: Maintaining good health requires adequate intake of bioactive compounds. Fortifying fruit juices with plant extracts is a promising solution, as they are rich in antioxidants and complement the sensory appeal of juices. Product qualification is of a major challenge when focusing only on single empirical traits. This study evaluates various near-infrared (NIR) spectroscopic devices as rapid, non-destructive tools for detecting plant extract enrichment in plum juice, offering a more efficient alternative for product verification. Cranberry, grapeseed, pomegranate extracts were added in 0-2.5 g/100 mL concentration range in simple, binary or ternary combinations to plum juices. Their spectra were collected with a benchtop and handheld NIR spectrometers, and evaluated in the 1350–1850 nm spectral range. Principal component analysis combined with linear discriminant analysis was employed to detect the effect of extracts dosage and their concentration. Partial least squares regression was used to predict the degree of enrichment in the juices. Predictive models built using data from the benchtop instrument generally achieved higher accuracy. Classification results showed clear separation trends, especially based on extract concentration. The predictive modelling resulted in coefficients of determination higher than 0.9, and root mean square errors below 0.5 g/100 mL during model calibration and validation. The results highlight the need for spectral refinement and suggest calibration transfer between instruments to enable reliable in situ applications. The findings show the potential of NIRS as a fast, non-destructive method for assessing the quality and composition of fruit juices, also contributing to healthier and safer beverage options.

Keywords: plum juice; fortification; quality control; near infrared spectroscopy; chemometrics

Acknowledgement: The study was supported by the Doctoral School of Food Science of the Hungarian University of Agriculture and Life Sciences; the Cooperative Doctoral Programme (KDP-2023), the University Research Scholarship Programme (EKÖP-MATE/2024/25/K), the 2023-1.2.4-TÉT-2023-00068 Program of the Ministry for Innovation and Technology (Hungary) from the source of the National Research, Development and Innovation Fund, and the CEEPUS mobility grant.

Time is Ticking: Fluorescent Timers for Better Understanding of Recombinant Protein Dynamics

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Abstract: Molecular farming, which uses plants as bioreactors to produce high-value recombinant proteins, offers a sustainable and scalable alternative to traditional manufacturing systems. Among plant hosts, *Nicotiana benthamiana* has become a model species due to its rapid growth, ease of genetic transformation, and high protein yield. This work focuses on optimizing the cellular environment in *N. benthamiana* to improve the efficiency of recombinant protein production, particularly antibodies, which are important for diagnostics and therapeutics. A critical part of the experimental workflow will be quantifying antibody accumulation using fluorescence measurements of fluorescent timers—proteins that change their emission spectrum over time. This dynamic shift in fluorescence allows detailed temporal analysis of protein expression from a single measurement, reducing experimental complexity while providing deeper insights. Additionally, fluorescent timers can be used in microscopy to visualize spatial and temporal patterns of antibody localization and deposition in planta. By integrating fluorescence-based quantification with microscopic observation, this research aims to establish a robust and scalable platform for high-yield antibody production. The primary strategy will involve monitoring changes in the cellular microenvironment and the dynamics of antibody deposition. Initial observations suggest that localized formation and accumulation of recombinant proteins occur within protein inclusions. The findings and subsequent results are expected to deepen our understanding of protein accumulation mechanisms and guide strategies for optimizing cellular processes. Ultimately, this work will contribute to advancing molecular farming approaches with significant implications for diagnostics, therapeutics, and fundamental biological research.

Keywords: molecular cloning, fluorescent and confocal microscopy, transient expression,

Fluorescent Timers as a New Tool for Plant Recombinant Protein Monitoring

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Abstract: Recombinant antibody production in plant systems such as *Nicotiana benthamiana* offers a promising platform for developing biotherapeutics. Despite extensive studies on expression efficiency, little is known about the spatial and temporal dynamics of intracellular antibody deposition. This study aims to investigate the localization and accumulation dynamics of newly synthesized antibodies using fluorescent timers—proteins that shift their emission spectrum over time. Antibodies were fused with fluorescent timers and transiently expressed in *Nicotiana benthamiana* leaves via agroinfiltration. Fluorescence signals were monitored using confocal microscopy, enabling visualization of their temporal and spatial progression within plant cells. Initial observations reveal that antibody biosynthesis does not occur uniformly throughout the cell but is concentrated in specific subcellular regions. These preferential sites of protein emergence can be clearly identified by analyzing the color shift of the fluorescent signal over time. Fluorescent timers provide a powerful tool to track the dynamic accumulation of recombinant antibodies and to identify hotspots of protein synthesis. This approach opens new possibilities for optimizing plant-based biofabrication strategies.

Keywords: recombinant antibodies; *Nicotiana benthamiana*; fluorescent timers; microscopy; plant biofactory

Advances in Genomics of Enset (*Ensete ventricosum*) and its applications in for Improvement in Ethiopia – a Review

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Abstract: Various biotic and abiotic factors, such as climate change, population increase, and diseases such as bacterial wilt all pose threats to Ethiopia's drought-tolerant crop, Enset (*Ensete ventricosum*). This review utilizes a systematic approach to investigate advances in Enset genomics to increase resilience, yield, and nutritional value, thereby improving food security and agricultural resilience in Ethiopia. A range of credible academic sources was examined to evaluate the scope, methodologies, limitations, and outcomes of current genomic research, which encompasses DNA markers, genome sequencing, functional genomics, and epigenetics. This review seeks to pinpoint knowledge deficiencies, including limited gene-trait associations and insufficient databases, while also assessing the potential of genomics to enhance Enset cultivation in the context of its implications for sustainable agricultural practices in Ethiopia. Enset shows considerable yet decreasing genetic diversity because of prolonged clonal propagation, which restricts its ability to adapt. Although genomic resources are still in their infancy, recent genome assemblies and molecular markers (SSRs, SNPs) have uncovered signs of domestication. However, significant deficiencies remain in understanding gene-trait relationships, epigenomic factors, and mechanisms of disease resistance (such as bacterial wilt), which obstruct genomic-assisted breeding efforts for this important orphan crop in Ethiopia. This review explores genomic advancements in Ensete ventricosum, focusing on its genetic diversity, disease resistance, yield, and climate resilience. It highlights the importance of genomic tools in breeding programs, but emphasizes the need for multidisciplinary collaboration, farmer-participatory breeding, robust genomic databases, and policy support.

Keywords: genomics; orphan crop; genetic diversity; molecular markers

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Evaluation of heat treatment of soy products

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Abstract: Soybean is one of the most commonly used feeds in animal nutrition and is one of the most important plant protein sources. Contain antinutritional substances such as trypsin inhibitors, which reduce the availability of nutrients and have a negative impact on animal health. Therefore, it is necessary to heat treat soy before feeding, which reduces the content of antinutritional substances and increases the digestibility and availability of nutrients. To confirm the heat treatment of soybean products the protein solubility method in KOH according to Arabata and Dale (1990) was used. We analyzed 6 samples of soy products (raw soybean 2x, extruded soy 2x, and soybean meal 2x). Every sample was analyzed twice and the results were expressed as the means and standard deviations (SD). In both samples of raw soybeans (no. 1, no. 2), in one sample of extruded soybeans (no. 1) and in one sample of soybean meal (no. 2), we confirmed the values of protein solubility in KOH above the recommended limit of 78 - 85% for sufficiently heat-treated feeds. In conclusion, we can state that in four samples of soy products we confirmed values of protein solubility in KOH above the limit, which indicates insufficient heat treatment with a potential health risk for animals.

Keywords: soy; heat; trypsin inhibitor; protein

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Food Security as a National Security Policy Priority

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Abstract: Food security, which is defined as continued physical and economic access for all citizens to sufficient, safe and nutritious food, is one of the key elements of national security. The aim of the study was to show the strategic importance of food security in the context of socio-political stability, public health and state resilience to modern threats, thus becoming an element of national security The paper uses an analysis of scientific literature and reports from international organizations, focusing on the links between food security and population health, economic development, and political stability and state security. Challenges such as climate change, population growth, armed conflicts and disruption of supply chains were considered. The results indicate that lack of access to food can lead to health crises, social tensions, migration and destabilization of state structures. The findings underscore the need to make food security a national security policy priority, including through support for local agriculture, modernization of food production and distribution systems.

Keywords: food security; food policy; sustainable agriculture

The Role of Sustainable Agriculture in Ensuring Food Security and National Stability

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Abstract: With rapid demographic, climatic and geopolitical changes, food security is becoming one of the key challenges of the 21st century. The aim of the study was to show the role of sustainable agriculture as a strategic element in ensuring a stable food supply and overall national stability. In particular, the importance of agriculture to the sustainability of food systems and its impact on community health, the economy and national security was highlighted. The study used an analytical approach based on a literature review and reports from international organizations such as FAO. Data on climate change, environmental degradation, limited natural resources and rising production costs were analyzed. It also identified the risks posed by price volatility, armed conflict, urbanization and overburdened global supply chains. The results of the analysis confirm that traditional food production models are inadequate in the face of growing demand, which may require a 50-70% increase in production by 2050. The answer to these challenges is the development of sustainable agriculture - a system that combines production efficiency with environmental care and social responsibility. The conclusions point to the need to include sustainable agriculture in domestic national policy as a basis not only for food security, but also for the broader stability of the country.

Keywords: sustainable agriculture; food security; food policy

Sanitation Measures in the Environment of Milking Parlor

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Abstract: This study aimed to identify the occurrence of pathogens on teat cups, assess how effective the sanitation procedures are at reducing microbial levels in the dairy cow milking parlor. Samples from teat cups (n = 45) were collected using microbiological swabs over an area of 5×2 cm² from 15 cows before milking, after milking, after disinfection. The sanitation protocol was assessed based on the efficacy of sodium hypochlorite as the active disinfecting agent. The effectiveness of the sanitation protocol was demonstrated by a significant reduction in coliform bacteria (CB) on teat cups, decreasing from 0.90 to 0.62 Log_{10} CFU/cm² ($P<0.001$), as well as a drop in the total bacterial count (TCB) from 1.85 to 0.77 Log_{10} CFU/cm² ($P<0.001$). Our results show that the disinfectant with sodium hypochlorite as the main active ingredient is suitable for decreasing of microbial load. Disinfection of tea cups after milking reduce bacterial contamination and to be effective procedure against environmental bacteria which can increase hazard of contamination of milk.

Keywords: milking parlor; disinfection; microbiological swabs; dairy cow

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The Effect of Processing Methods on the Nutritional and Sensory Characteristics of African Yam Bean Flour

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Abstract: This study investigated the effects of malting, fermentation, and roasting as processing methods on the nutritional, physicochemical, and sensory characteristics of African yam bean (AYB) seed flour. Various processing techniques were applied to AYB seeds, and the resulting flour was analyzed for proximate and mineral composition. The sensory characteristics of cakes made from a composite of wheat and AYB flour were also evaluated. The findings revealed that the processing methods significantly influenced the proximate and mineral composition of AYB flour. Malting resulted in the highest crude protein content (18.61%), while cooking enhanced the crude fiber, fat, total carbohydrate, and starch levels. Conversely, roasting produced the lowest fat and mineral contents. Additionally, malting and cooking effectively reduced tannin and oxalate levels (7.91 and 4.45, respectively), whereas roasting yielded the lowest trypsin inhibitor value (7.52). AYB flour exhibited high emulsion and gelation capacities, alongside a low bulk density. Sensory evaluation indicated that the malted AYB sample (MA) received the highest scores for taste (7.55) and overall acceptability (7.65). These results suggest that AYB flour can be processed through various methods to enhance its nutritional composition and functional properties. It shows promise as a low-bulk ingredient in diverse confectioneries and serves as a valuable source of essential minerals, potentially promoting health, growth, and cognitive development in both children and adults.

Keywords: African Yam bean Flour; processing methods; sensory characteristics; nutritional composition.

Environmental and Economic Assessment of Sugar Beet under Different Mineral Fertilizer and Pesticide Application Rates: A Case Study in the Czech Republic

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Abstract:

Sugar beet (*Beta vulgaris* L.) plays a key role in European agriculture, but intensive farming leads to ecological issues like heavy fertilizer and pesticide use. This study assessed sugar beet production in the Czech Republic using five input scenarios near the Crop Research Institute during 2021–2022. Treatments ranged from no inputs to full recommended doses of nitrogen, phosphorus, potassium, and pesticides. Life Cycle Assessment (ISO 14040/14044) via SimaPro and ReCiPe 2016 quantified impacts: global warming potential (GWP), acidification, eutrophication, ecotoxicity, water use, and resource depletion. Full-input (SB3) had the highest environmental footprint, especially GWP and acidification due to N_2O and NH_3 emissions. SB2, with half-doses of fertilizers and pesticides, reduced GWP and eutrophication by up to 35% without major yield loss. Pesticides were linked to high ecotoxicity. Economic analysis showed diminishing returns in high-input scenarios. SB2 proved most sustainable, balancing environmental and economic benefits. LCA offers guidance for optimizing sugar beet production sustainably.

Keywords: sugar beet; mineral fertilization; pesticides; Life cycle assessment LCA; environmental impact

Evaluation of the Suitability and Impact of Selected Natural Plant Extracts on the Quality of Canned Vegetables

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Abstract: In recent years, consumer behavior has shifted toward a preference for food products containing natural and recognizable ingredients, driven by growing health consciousness and a demand for greater transparency. This trend highlights the urgent need for the food industry to look at replacing synthetic additives with natural alternatives, as concerns about the potential long-term health effects of artificial compounds and inadequate information from manufacturers continue to erode consumer trust. The aim of this study was to compare the effect of different natural plant extracts, such as acerola and rosemary, on ascorbic acid, both individually and in combination, and to assess their suitability as substitutes in canned super sweet corn and red kidney bean mixes. In the experiment, the colour, total polyphenol (TPC) content and ferric reducing antioxidant power (FRAP) of different samples were tested. A mixture of rosemary and acerola extracts was found to be the most effective in preserving colour. Acerola extract was found to preserve antioxidant compounds. The experimental findings indicate that natural plant extracts, including acerola and rosemary, represent promising alternatives to ascorbic acid in the canned super sweet corn and red kidney bean mixes. Extended evaluation following prolonged storage is required to derive definitive conclusions regarding the long-term efficacy of the treatments.

Keywords: antioxidants; ascorbic acid; plant extracts; natural ingredients; canned food

Acknowledgement: The authors acknowledge the Hungarian University of Agriculture and Life Science's Doctoral School of Food Science for the support in this study.

Sustainable Biotechnological Innovation: Chitosan-Mediated Elicitation of Bioactive Compounds in *Rhazya stricta* for Pharmaceutical Applications

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Abstract: Sustainable biotechnological strategies are becoming increasingly important in addressing global health and environmental challenges. *Rhazya stricta*, a medicinal plant with notable therapeutic potential, is a promising candidate for enhancing the production of valuable phytochemicals through green biotechnological interventions. This study explores the use of chitosan, a biodegradable and renewable biopolymer, as a biotic elicitor to improve secondary metabolism and biomass production in R. stricta callus cultures. Callus cultures of R. stricta were exposed to different concentrations of chitosan (1–5 mg/L). The effects of chitosan elicitation on biomass accumulation, phytochemical content, and antioxidant activity were assessed. Fresh and dry weights were measured to evaluate biomass production. Secondary metabolites, including total phenolic and flavonoid contents, were quantified spectrophotometrically. Antioxidant capacity was assessed using total antioxidant capacity and DPPH radical scavenging assays. LC-HRMS/MS was employed for detailed phytochemical profiling of elicited and control cultures. The highest biomass yield was observed at 5 mg/L chitosan (FW: 40.91 ± 1.65 g/L; DW: 3.53 ± 0.11 g/L). Significant increases in phenolic (14.50 ± 0.14 μg/mg) and flavonoid (17.73 ± 0.80 μg/mg) content were recorded in elicited cultures. Enhanced antioxidant activity was also observed, particularly at lower chitosan concentrations. LC-HRMS/MS analysis revealed a greater abundance and diversity of bioactive compounds in chitosan-treated cultures compared to untreated controls. Chitosan elicitation significantly improves biomass production and secondary metabolite accumulation in R. stricta callus cultures. This study demonstrates the potential of chitosan as an eco-friendly and scalable elicitor for enhancing plant-derived bioactive compounds. Integrating plant biotechnology with sustainable elicitation strategies supports the development of green platforms for drug discovery and aligns with global goals for sustainable innovation.

Keywords: chitosan elicitation; *Rhazya stricta*; plant biotechnology; sustainable innovation; secondary metabolites

Acknowledgement: This work was financially supported by the Internal Grant Agency of the Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague, IGA (Project No. 20253135).

Optimizing Micropropagation Protocols for *Sesbania grandiflora* (L.) Pers.: A Step Toward Sustainable Clonal Propagation and In Vitro Breeding

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Abstract: *Sesbania grandiflora* (L.) Pers., a leguminous tree native to Southeast Asia with notable ecological and economic value, has received limited attention in terms of genetic improvement and propagation strategies. This study aims to optimize *in vitro* propagation protocol to support future breeding and conservation initiatives. Surface-sterilized seeds were germinated on Murashige and Skoog (MS) medium, and apical shoots derived from seedlings were further cultivated on MS medium supplemented with 1 mg/L zeatin (ZEA) to induce callus formation at the stem base. The cytokinins ZEA and benzylaminopurine (BAP) were evaluated for their capacity to promote indirect shoot regeneration. A parallel experiment using cotyledonary explants tested the potential for bud induction on media containing 1 mg/L ZEA or BAP. Histological analyses confirmed meristematic activity, with ZEA showing superior performance in promoting shoot regeneration. The highest regeneration rate was achieved on MS medium with 1/mg/L ZEA. Cotyledonary explants developed adventitious buds at the cut edges under both cytokinin treatments. However, complete plant regeneration was not obtained under the tested conditions. These results highlight the effectiveness of zeatin in promoting shoot organogenesis in *S. grandiflora* and provide a foundation for refining tissue culture protocols. The work contributes to biodiversity conservation, agroforestry, and the development of biotechnological strategies for the improvement of underutilized species.

Keywords: sesbania grandiflora; shoot regeneration; zeatin; plant tissue culture; sustainable agriculture; in vitro regeneration

Acknowledgement: This work was financially supported by the Internal Grant Agency of the Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague, IGA (Project No. 20253135).

Phosphate Replacing Potential of Polyphenol-Extracted Apple Pomace in Sausages

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Abstract: Consumer interest in clean-label meat products has grown, driving efforts to replace synthetic additives such as sodium tripolyphosphate (STPP). While STPP improves water-holding capacity (WHC), reduces cook loss, and enhances texture, its E-number status and health concerns—especially for individuals with kidney issues—have raised demand for natural alternatives. Apple pomace (AP), a by-product of juice production, has potential as a phosphate substitute. This study focused on polyphenol-extracted apple pomace (PEAP), the residual fraction left after polyphenol removal, as a clean-label ingredient. Sausages were prepared with 0–4% PEAP relative to meat weight. Technological attributes were assessed, including WHC and cook loss after thermal processing. Texture profile analysis (TPA) measured hardness, gumminess, chewiness, and springiness. Colour was evaluated using a digital colorimeter based on the CIE Lab* system. Sensory properties were rated using a 9-point hedonic scale. PEAP improved WHC and reduced cook loss. Higher PEAP content slightly lowered WHC compared to STPP, but results were still acceptable. Texture and sensory parameters showed moderate variation without significant loss in consumer acceptability. Polyphenol-extracted apple pomace can partially replace phosphates in sausages while enhancing fiber content and supporting sustainable by-product utilization. However, further optimization—possibly by combining with other functional ingredients—is recommended to fully maintain texture quality.

Keywords: polyphenol-extracted; Apple pomace; phosphate replacer; clean-label; dietary fiber

Acknowledgement: The Project was supported by the Doctoral School of Food Science MATE, and by the Flagship Research Groups Programme of the Hungarian University of Agriculture and Life Sciences.

Does Forage Crop Diversification Improve Milk Productivity? Evidence from Smallholder Dairy Farmers in Kenya

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Abstract: Smallholder dairy farmers in Kenya face feed shortages and poor-quality feeds which leads to low milk productivity. Napier grass monoculture dominates smallholder fodder systems in traditional dairy areas, due to its high biomass production and persistence. However, this dominance also increases vulnerability to pests, diseases, and climate stresses. Also, Napier grass cannot easily be integrated into crop rotations and often shows low nutrient contents. Forage crop diversification is a promising pathway to enhancing feed availability and quality, improving livestock nutrition and productivity and fostering feed system resilience. However, the actual effects of forage crop diversification on milk productivity in Kenya remain unknown. This study contributes to addressing this gap using data from a farm household survey conducted between October and November 2024 under the CGIAR Initiative on Sustainable Animal Productivity (SAPLING). A sample of 658 dairy farmers who had planted at least one forage crop, drawn from seven dairy cooperatives in Uasin-Gishu, Nyandarua and Kakamega counties, was used for analysis. Propensity score matching (PSM) was used to create relevant comparison groups of farmers to estimate the association of forage crop diversification with milk productivity between diversified and non-diversified households. Results show that forage crop diversification is linked to increase in milk yield of about 1.02 and 1.50 litres per cow per day in the low season and in the flush season, respectively. This suggests that policymakers, research institutions and non-governmental organisations should consider promoting forage diversification as a strategy for enhancing dairy sector performance.

Keywords: diversification; forage crop; Kenya; milk; productivity

Acknowledgement: We would like to acknowledge the International Livestock Research Institute (ILRI) through the CGIAR Initiative on Sustainable Animal Productivity (SAPLING) for providing the data.

In Vitro Autopolyploid induction in *Solanum Stenotomum* Juz. & Bukasov

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Abstract: This study aimed to develop novel autopolyploid genotypes of *S. stenotomum* through in vitro polyploidization and evaluate their morphological, growth, and microtuberization characteristics under controlled conditions. Polyploid induction was achieved using oryzalin as an antimitotic agent, applied at concentrations of 40, 60, and 80 μM for 24 and 48 hours. Flow cytometry analysis confirmed successful polyploidization, with efficiency rates ranging from 2.5% to 15%, yielding 16 autotetraploid plants from a total of 240 treated individuals. Comparative analysis revealed significant morphological differences between control triploid and induced hexaploid plants. While the control plants exhibited superior shoot and root development, the P3 genotype demonstrated enhanced lateral growth, including increased stem thickness, leaf count, and nodal development, indicating potential improvements in vegetative vigor due to polyploidization. Microtuberization analysis further demonstrated that the P3 genotype exhibited superior morphological dynamics and a more intense color profile than the control triploid genotype. However, the control genotype produced a higher number of microtubers than the polyploid genotypes. These findings underscore the potential of artificial chromosome doubling as a viable breeding strategy for *S. stenotomum* and related species. Nevertheless, further research involving ex vitro transplantation, nutrient profiling, and field trials is necessary to assess the agronomic viability of these genotypes for commercial cultivation.

Keywords: artificial polyploidization; antimitotic agent; microtuberization; potato

Numerical Modeling of Coupled Water, Vapour, and Heat Transport in Beech Forest Soil

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Abstract: Understanding the coupled movement of water, vapor, and heat in forest soils is essential for predicting how ecosystems respond to changing environmental conditions. In beech forests, the soil microclimate beneath the canopy is particularly dynamic and influenced by seasonal weather variations and evapotranspiration. This study aims to describe and model the temporal evolution of soil water and heat under a beech tree canopy throughout a typical year, contributing to improved predictions of soil behavior under various climatic scenarios. A coupled numerical model based on the Saito-Sakai approach, which integrates the Richards equation for water flow with the heat equation, was implemented to simulate the joint transport of water, vapor, and heat. Field data were used to calibrate the model parameters. The simulations were conducted for an annual cycle using site-specific boundary and initial conditions. The model successfully captured the seasonal patterns in soil moisture and temperature. Evaporation emerged as a critical driver in shaping both soil moisture and thermal dynamics, especially in the upper soil layers. The calibrated model accurately reproduced observed field data and proved sensitive to climate inputs, making it a valuable tool for scenario-based forecasting. A descriptive numerical model was developed and validated to simulate coupled water and heat transport in beech forest soil. The model highlights the significant role of evaporation and enables reliable predictions of soil conditions under varying climatic scenarios. This framework offers a basis for exploring forest soil responses to future climate changes.

Keywords: soil moisture; heat transport; numerical modeling; beech forest; evaporation

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Analysis of Techno-Functional Properties Buttermilk-Containing Ice Creams

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Abstract: This study explored the potential of incorporating buttermilk, a dairy by-product, into ice cream production to enhance sustainability while maintaining product quality. The research aimed to determine how varying levels of buttermilk (0–100%) and the use of fermentation affect the techno-functional properties of ice cream. Butterfly pea flower was also added as a natural colorant and antioxidant source. A factorial experimental design was applied using six buttermilk concentrations and two treatments (fermented vs. non-fermented). Ice cream mixes were analyzed for pH, color, rheological properties, overrun, melting behavior, texture and thermophysical properties using Differential Scanning Calorimetry (DSC). Results indicated that increased buttermilk concentration decreased dry matter content, overrun, and hardness, while slightly enhancing color intensity due to the butterfly pea flower. Fermentation significantly lowered pH and modified color parameters, lightening samples and reducing the blue hue due to anthocyanin degradation. Fermented samples were on average 44% harder and melted faster than non-fermented counterparts. Rheological analysis showed that increasing buttermilk reduced viscosity and yield stress, particularly in non-fermented samples. DSC analysis revealed a notable variation in unfreezable water content across the samples (ranging from 13.6% to 39.7%), indicating structural and compositional differences in water-binding capacity linked to formulation and fermentation. These findings demonstrate that buttermilk can substitute milk in ice cream formulations up to 100% without compromising overall quality. Fermentation further alters sensory and structural properties, offering potential for functional and sustainable ice cream innovation.

Keywords: buttermilk; fermented ice cream; butterfly pea flower; techno-functional properties; sustainability

Acknowledgement: This work was supported by the Hungarian University of Agriculture and Life Sciences and Alföldi Tej Ltd.

Soil Macrofauna Diversity in a Silvoarable Agroforestry System in the Temperate Zone

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Abstract: Soil macrofauna are key indicators of ecosystem functioning, and agroforestry systems may enhance their diversity compared to conventional land use. This study aimed to assess the influence of an agroforestry system on soil macrofaunal diversity in relation to distance from tree rows, and to compare it with adjacent woodland and conventional field conditions. The research was conducted in an experimental silvoarable plot in Průhonice, Central Bohemia. Soil samples were taken at 0.0 m, 2.5 m, 5.0 m, and 7.5 m from tree rows, and from woodland and field. Soil macrofauna were sampled using a modified TSBF method with 25×25 cm monoliths to 20 cm depth, and individuals were hand-sorted from two layers. The agroforestry system showed the highest richness, diversity, and evenness of macrofauna. Woodland ranked second, with moderate values, while the field had the lowest, indicating disturbance. Our results highlight the positive impact of agroforestry on soil biodiversity in temperate systems.

Keywords: soil macrofauna; agroforestry; biodiversity; sustainable agriculture; soil ecology

Acknowledgement: This study was supported by the Internal Grant Agency of the Faculty of Tropical AgriSciences, Czech University of Life Sciences Prague (grant number 20253131).

Intensification of Anaerobic Digestion of Indian Jujube Waste through Co-Digestion, Thermal, and Alkali Pretreatment Strategies

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Abstract: Anaerobic digestion (AD) is an established method for converting organic waste into renewable energy in the form of biogas. However, the efficiency of AD depends heavily on the biodegradability of the feedstock. Indian jujube (*Ziziphus mauritiana*) fruit waste, while abundant and nutrient-rich, is lignocellulosic in nature and thus poorly degradable. To improve its digestibility, pretreatment techniques and co-digestion strategies are often applied. This study aimed to evaluate the effectiveness of thermal and alkali (NaOH) pretreatments, along with co-digestion at varying substrate-inoculum ratios, to enhance methane production and process performance. Six mesophilic batch reactors were operated for 22 days. Treatments included one control (inoculum only), three co-digestion setups with jujube waste at different substrate-to-inoculum ratios (IS1, IS2, IS3), and two pretreated samples (thermal and alkali). Gas volume and composition (CH_4, CO_2, H_2S) were monitored daily to assess digestion performance. Thermal pretreatment achieved the highest methane concentration (75%) and gas volume (578 mL/day), sustaining strong performance until Day 17. IS1 and IS2 also performed well, reaching CH_4 peaks of 60% and 63.2%, respectively. IS3 and NaOH-pretreated setups showed poor stability and rapid decline in methane production. NaOH-treated reactors produced minimal biogas overall. Thermal pretreatment and moderate co-digestion ratios significantly enhanced biogas yield and methane concentration from Indian jujube waste. These strategies offer promising avenues for efficient organic waste valorization and decentralized renewable energy production.

Keywords: anaerobic digestion; fruit waste; thermal pretreatment; co-digestion; biogas production

Pathogen Inactivation by Substrate Treatment Under Anaerobic Digestion

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Abstract: Manure serves as a major reservoir of pathogens responsible for infectious and parasitic diseases. Various strategies are applied to optimize manure treatment during anaerobic digestion, aiming to enhance pathogen inactivation. Both substrate pre-treatment and digestate post-treatment are used. Current research mainly focuses on physico-chemical and microbiological approaches, revealing a gap in exploring plant-derived substances. Compounds such as eugenol, isoeugenol, thymol, and carvacrol, and their mixtures, possess strong antiparasitic properties. These substances do not accumulate in the environment or contaminate food chains. Further research on substrate pre-treatment with these compounds is needed, as this may reduce the survival of parasitic elements during digestion and ensure the production of safe organic fertilizers. A systematic analysis of pre- and post-treatment methods for organic waste under anaerobic digestion aimed at pathogen inactivation was conducted. Scientometric data were obtained from Scopus, Web of Science, and Crossref for further optimization of waste processing. A review of pathogen inactivation methods was performed, including chemical disinfection, hydrodynamic and freeze/thaw disintegration, ozone, alkaline, ultrasonic, low-temperature thermal hydrolysis, and phytoremediation. Intensive use of disinfectants during pre-treatment can inhibit methanogenesis and cause accumulation of chemical pollutants. A pathway for optimizing anaerobic digestion is proposed, focusing on environmentally safe fertilizer production using plant-derived substances. The most promising optimization methods involve substrate pre-treatment with these substances to effectively inactivate pathogens, particularly helminth eggs and larvae, while enabling the production of sanitized organic fertilizers.

Keywords: anaerobic digestion; substrate treatment; digestate; pathogen inactivation

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Forest Fragmentation and Bird Diversity in the Um Al-Toyour and Al-Bassit Reserve, Syria

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Abstract: How does forest fragmentation influence the taxonomic and functional diversity of bird communities in the Um Al-Toyour and Al-Bassit Reserve, Syria? This study employed the point count method to survey bird species. For each sampled forest patch, patch characteristics were quantified, which included size and isolation. Concurrently, various vegetation factors were measured within these patches, including plant species richness, shrub layer cover, tree density and Diameter at Breast Height (DBH). The collected data on bird species and habitat characteristics were then analyzed to determine the influence of fragmentation and vegetation parameters on both taxonomic and functional diversity of the bird communities. The bird community index (BCI) was also calculated to assess the sensitivity to disturbances. This study recorded 55 bird species within the fragmented forest patches, classifying them into five functional groups: Insectivores (45.45%), Granivores (20%), Carnivores (16.36%), Frugivores (9.09%), and Omnivores (9.09%). A significant finding was the identification of 18 declining species (32.72%), notably including *Streptopelia turtur*, which is now listed as Vulnerable (VU) by the International Union for Conservation of Nature (IUCN). The bird community primarily consists of species sensitive to disturbances, as indicated by the bird community index (BCI = 0.342). The study highlights the importance of preserving large and connected forest patches, in addition to emphasizing the need to conserve old-growth patches that include a dense understory to meet birds' food and nesting requirements. This research contributes proposals for protected area managers to utilize when developing forest management plans for biodiversity conservation.

Keywords: bird diversity; forest fragmentation; functional diversity; patch characteristic.

Attitude of Local Community in Wildlife Conservation in Forest Farm Interface of Arsi Negelle and Guraferda Districts, Ethiopia

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Abstract: Human-wildlife conflict has existed for as long as humans and wild animals have shared the same landscapes, particularly in areas where agriculture and natural habitats overlap. As farming activities continue to expand into forested regions, these conflicts become more frequent and severe, posing a challenge to both local livelihoods and wildlife conservation efforts. In order to develop effective conservation policies, it is essential to understand the attitudes of local communities living near forest-farm interfaces. This study used a Likert scale-based attitude measurement to assess how local households perceive wildlife and conservation efforts in areas affected by conflict. A total of 247 respondents participated in the survey, and the findings revealed that 164 individuals (66%) held negative attitudes toward wildlife conservation, especially those who experienced frequent crop damage and livestock depredation. These losses were largely due to the expansion of farmland into natural habitats, forcing wildlife to search for food in cultivated areas and leading to direct conflict with local farmers. Households that suffered repeated damages were more likely to oppose conservation efforts. This trend was consistent across both study sites, indicating that the conflict is widespread and deeply rooted. Overall, the findings highlight the importance of incorporating local perspectives into conservation planning to promote coexistence and ensure long-term sustainability.

Keywords: wildlife; cconflict; forest farm interface

Population Trends and Current Threats to the Great Cormorant (*Phalacrocorax carbo*) in the Azov-Black Sea Region of Ukraine

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Abstract: Over the past few decades, the Great Cormorant (*Phalacrocorax carbo*) population has significantly increased across Europe, largely due to legal protection and pesticide bans. In Ukraine's Azov-Black Sea region, nesting numbers surged from the mid-1980s to the mid-2010s, peaking at approximately 43,500 pairs in 2012. However, since then, numbers have declined, with about 34,000 pairs recorded in 2021. Population dynamics were analyzed based on long-term colony monitoring (2012–2021) conducted across five subregional complexes. Data on nesting colonies, habitat conditions, and disturbance factors were evaluated using field surveys, satellite imagery, and literature synthesis. The largest breeding aggregation remains on the Obytichna Spit, although it experienced a decline from 30,000 to 20,000 pairs due to intraspecific competition and parasitism. Overall population declines are associated with habitat degradation, predation by gulls (*Larus cachinnans*), and increased anthropogenic pressure. Critically, Russia's full-scale invasion in 2022 has devastated nesting sites, with over 70% of known colonies located on temporarily occupied or active conflict zones. The destruction of the Kakhovka Dam in 2023 further impaired wetland ecosystems essential to the species. Despite previous conservation successes, the Great Cormorant in southern Ukraine is now under severe threat. Wartime destruction, ecological disruption, and long-term habitat degradation require urgent conservation reassessment. Full evaluation will only be possible after cessation of hostilities and restoration of protected territories.

Keywords: great cormorant; Ukraine; war impact; nesting colonies; conservation threats

Integrating Local Biodiversity Data in a Contextualized Environmental Science Module

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Abstract: Contemporary science education prioritizes global environmental challenges, yet instructional materials often lack contextualization, utilizing non-native species and examples disconnected from students' immediate surroundings. To address this gap, the study developed an innovative, locally-based environmental science module by systematically integrating local biodiversity data. The data were sourced from a scoping review of published literature on Coleoptera, mammals, birds, reptiles, amphibians, terrestrial flora, aquatic fauna, and aquatic flora within the Davao Region, as found in the Google Scholar database. Using the Arksey and O'Malley framework, the review revealed significant taxonomic diversity but also identified biases in species documentation, with disproportionate representation of select families across taxa. These findings informed the design of a contextualized environmental science course structured into four thematic modules, which enhanced student engagement with local ecosystems and strengthened conservation-minded stewardship. Additionally, the study also underscored critical gaps in biodiversity research within the Davao Region, where scientific efforts remain sparse and unequally focused on a limited group of species. Given the region's ecological significance, including its protected landscapes, seascapes, and designation as part of the Eastern Mindanao Biodiversity Corridor (EMBC), there is an urgent need to strengthen local research capacity through targeted training and institutional support for taxonomic experts. This study highlighted the dual imperative of contextualizing science education while addressing regional research disparities to ensure effective conservation of understudied yet ecologically vital taxa. The researchers recommend the utilization of the module among state universities and colleges in the Davao Region, Philippines. There is also a need to quantitatively test the effectiveness of the module and to strengthen biodiversity studies in the region to continuously inform the environmental science curriculum.

Keywords: science education; scoping literature review; contextualized learning; biodiversity.

Tickborne or Not? Exploring The Role of Ticks in Neglected Zoonotic Bacterial Transmission

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Abstract: *Francisella tularensis, Coxiella burnetii* and *Brucella suis* are neglected zoonotic pathogens. While aerosol transmission is the main route, ticks may also play a role. Diagnostics are complicated by *Francisella*-like endosymbionts (FLE). This study assessed their presence in wildlife and ticks in the Czech Republic, with *Borrelia burgdorferi* s.l. as a reference tick-borne pathogen. Samples from 16 sites included sera from hares (n=437) and wild boars (n=76), spleens from wild boars (n=525), and questing ticks (n=1284) of the genera *Ixodes, Dermacentor and Haemaphysalis*. Serology (ELISA) targeted antibodies against *F. tularensis, B. suis* and *C. burnetii*. PCR assays included Bruce-ladder for *B. suis,* multiplex qPCR for *F. tularensis*, FLE and *C. burnetii*, and singleplex qPCR for *B. burgdorferi* s.l. *B. suis* DNA was detected in one wild boar and *F. tularensis* DNA in three, while *C. burnetii* was absent. Serology revealed higher exposure: 22.9% of hares had antibodies against *F. tularensis* and 7.8% against *B. suis.* In wild boars, 2.5% were seropositive for *F. tularensis* and 7.6% for *B. suis.* None of the ticks carried *F. tularensis* or *C. burnetii,* though three contained FLE. *B. burgdorferi* s.l. was found in 23% of ticks, ranging from 5% to 38%. These results indicate low active infection with neglected bacteria but substantial past exposure in wildlife. Their absence in ticks suggests a limited vector role, whereas *Borrelia* circulation remains high. The study emphasizes the value of combining serological and molecular approaches to understand pathogen circulation and assess zoonotic risks in natural ecosystems.

Keywords: *Brucella Suis*; *Coxiella Burnetii*; *Francisella Tularensis*; seroprevalence; tick-borne pathogens.

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Bioaccumulated Trace Element Toxicity in Commercially Harvested Bronze Whaler Sharks (*Carcharhinus brachyurus*) of South Africa

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Abstract: As a sentinel species in South Africa's coastal ecosystems, bronze whaler sharks (*Carcharhinus brachyurus*) face unsustainable anthropogenic pressures and escalating pollution threats and may pose significant risks to human health, with commercial harvests estimated at 100–300 tons annually for local seafood consumption and international markets. This study establishes the first ecotoxicological baseline for this vulnerable species by analyzing ten trace elements and eight Polychlorinated biphenyls (PCBs) known for their persistence, bio accumulative, and toxicity potential, in muscle tissue samples from 41 individuals collected along the southern and eastern coastlines of South Africa in 2022 using the ICP-OES technique. While concentrations of trace elements were below the established maximum permissible limits for human consumption and PCBs concentration were below detection limits in most samples, irrespective of shark length, sex, and sampling region, the estimated daily intake values for mercury and arsenic exceeded the oral reference doses recommended by international health agencies such as the WHO and USEPA. Notably, mercury levels, although below regulatory thresholds, represent a cumulative dietary exposure risk due to their neurotoxic effects, especially in vulnerable populations such as pregnant women, children, and the elderly. The consistent pollutant profiles across sexes, size classes, and regions suggest a pervasive, region wide exposure rather than isolated hotspots. Our findings underscore the need for sustainable management strategies that integrate pollutant monitoring with catch limits and marine protected area design to mitigate cumulative threats to South Africa's *C. brachyurus* populations and reduce the health risk posed by *C. brachyurus* meat consumption.

Keywords: bioaccumulation; *Carcharhinus brachyurus*; trace elements; marine pollution

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Impact of Pharmaceutical Contamination on Fish Neurotransmission

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Abstract: Pharmaceuticals are significant emerging contaminants in aquatic ecosystems, entering primarily via improper disposal and human excretion as parent compounds or metabolites. While these compounds are found in aquatic organisms, particularly fish, the underlying molecular mechanisms of their behavioral and physiological effects remain poorly understood. This study aimed to address this gap by investigating pharmaceutical types and concentrations in natural freshwater systems, their bioaccumulation in European perch (*Perca fluviatilis*) brains, and their impact on neurotransmitter levels and interactions, at environmentally relevant levels. Water samples were collected over a two-year period (n = 33), and fish samples were collected during spring 2023 and 2024 (n = 70) from a control pond (fed by river water) and a pond receiving wastewater treatment plant effluent. Pharmaceuticals and neurotransmitters were analyzed using in-line SPE-LC/MS/MS for water samples and LC-HRMS/MS for tissue samples. The results revealed 31 pharmaceutical compounds and metabolites in the water samples, with significantly lower levels in the control pond compared to the effluent-fed pond (ANOVA; $p < 0.05$). In fish brains, 21 compounds were detected, predominantly in fish from the effluent-fed pond, indicating noticeably higher bioaccumulation in this group. Crucially, distinct alterations in neurotransmitter interactions were observed between the control and effluent-exposed fish, posing significant challenges for aquatic life (rs; $p < 0.05$). This research highlights the widespread bioaccumulation of pharmaceuticals in fish brains and their profound effects on neurological function, underscoring the urgent need for strategies to mitigate aquatic pharmaceutical contamination.

Keywords: fish brain; emerging aquatic contaminants; bioaccumulation; LC/MSMS; ecological disturbance

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Ibuprofen in Surface Water: Effects on Growth and Physiology of Selected Aquatic Plant Species

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Abstract: Ibuprofen (IBU) is a non-steroidal anti-inflammatory drug commonly used to treat fever, pain, headache and many other symptoms. Unfortunately, IBU is increasingly detected in surface waters due to its incomplete removal during conventional wastewater treatment. Numerous studies have highlighted IBU potentially toxic effects on aquatic organisms, and its ability to bioaccumulate in the environment. However, data on IBU's impact on aquatic plants remains limited and, in some cases, inconsistent. Our research examined the influence of several IBU concentrations (5, 10, 20, 50, 100 and 200 mg/L) on three aquatic macrophytes species: *Lemna minor*, *Elodea canadensis* and *Myriophyllum spicatum*. The plants were cultivated for three weeks in Hoagland's nutrient solution contaminated with IBU. Growth and physiological parameters were assessed, including biomass, chlorophyll a and b concentration, and total protein content. Preliminary results confirm the adverse impact of IBU on plant development and metabolism, indicating its detrimental effect on macrophytes. The examined concentrations of IBU negatively affected all analyzed parameters in addition, levels ≥ 50 mg/L, led to plant death within the first week of exposure. This work highlights the need for further research into the ecotoxicological effects of pharmaceuticals such as IBU on aquatic ecosystems.

Keywords: Ibuprofen; macrophytes; phytotoxicity

Effects of Black Soldier Fly Meal Inclusion on Protein Denaturation in African Catfish (*Clarias Gariepinus*)

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Abstract: Aquaculture is crucial to addressing global animal protein demand. The fast-growing, feed-flexible, and environmentally resistant African catfish (*Clarias gariepinus*) is frequently grown. Fish meal, the main protein source in aquaculture, is expensive and scarce, limiting operations. Black soldier fly (*Hermetia illucens*) larval meal (BSFM) sustainability and cost-effectiveness are being evaluated. The high protein, amino acid, and organic waste-growing capabilities of BSFM encourages circular agriculture. BSFM in aqua diets is evaluated, focusing on *C. gariepinus*' processing-induced protein denaturation and nutritional value. A Recirculating Aquaculture System kept fish. Three test groups were: control (Haltáp Ltd. catfish breeding feed), 33% black soldier fly meal plus 67% catfish feed, and 50% black soldier fly meal plus 50% catfish feed. Ten samples were randomly obtained from each of the three treatments. samples were thermodynamically evaluated using a Micro DSC III microcalorimeter (Setaram Inc., Caluire, France). Example: distilled water. We measured samples at 20–95 °C. For accuracy, 1.5 °C/min was employed. The sample weight was 200 ±10 mg each case. Calisto Processing thermal analysis program (Version: 1.08, Setaram Inc., Caluire, France) assessed heat flow curves. Denaturable protein levels in DSC curves are similar. The treated samples have three peaks on the curve, while the control sample has two, indicating that black soldier fly larvae affect protein composition. Black soldier fly larvae meal is being tested as a fish meal replacement for African catfish (*C. gariepinus*) diets to enhance cost-effective and sustainable aquaculture.

Keywords: African catfish; black soldier fly meal; protein denaturation

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Detection and Occurrence of Deoxynivalenol in Quail Feed

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Abstract: Feed safety is a fundamental element in maintaining good animal health and production. Regular monitoring of mycotoxin levels in feed should be part of preventive measures to avoid health complications in animals. Deoxynivalenol is a secondary metabolite produced by microscopic filamentous fungi of the genus *Fusarium*. This mycotoxin primarily contaminates agricultural crops with a high starch content, such as cereals. Sample preparation and analysis were performed in accordance with the RIDASCREEN® FAST DON protocol. Deoxynivalenol concentrations in 12 quail feed samples were quantified using the enzyme-linked immunosorbent assay (ELISA) method. Deoxynivalenol was detected in 9 quail feed samples, representing an incidence rate of 75%. The concentrations of deoxynivalenol in the samples ranged from 0.320 ppm to 2.525 ppm, with an average concentration of 1.057 ppm. The detected concentrations of deoxynivalenol in quail feed do not exceed the guidance level for poultry feed (5 ppm) established in Commission Recommendation 2006/576/EC.

Keywords: feed safety; mycotoxins; nutrition; vomitoxin

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Evaluation of the Intestinal Microbiota in Piglets After Three Weeks of Feeding a Diet Supplemented with Dried Stinging Nettle Leaves

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Abstract: Various feed additives are used in the nutrition of livestock to maintain health and improve production parameters. From the group of additives of natural origin, stinging nettle (*Urtica dioica*) appears to be suitable. The beneficial effects of its administration on production indicators have been recorded in various livestock. The aim of this study was to monitor the effect of feeding a diet with the addition of stinging nettle leaf meal on the intestinal microbiome in growing pigs, specifically lactic acid bacteria (LAB) and enteric bacteria. A total of 18 piglets of Slovak White x Landrace crossbreeds aged 43 days and with an average weight of 15.4 kg/pig were evenly divided into two groups of 9 pigs: a control group without the addition of nettle and an experimental group with the addition of 2.5% ground dried leaves of stinging nettle. Gut microbiota analysis was performed from fecal samples after three weeks of the experiment. Bacterial counts were determined by the plate method on MRS agar for LAB and on McConkey agar for coliform bacteria. In the experimental group, the number of LAB and coliform bacteria was not significantly affected compared to the control group. However, the ratio of coliform bacteria to LAB was significantly lower in the experimental group compared to the control. Adding stinging nettle to the piglet feed mixture for three weeks had a slightly positive effect on the piglet's gut microbiome in our experiment.

Keywords: piglets; additive; stinging nettle; gut microbiome

Acknowledgement: This study was carried out with the support of the Scientific Grant Agency of the Ministry of Education, Research, Development and Youth of the Slovak Republic and the Slovak Academy of Sciences, project VEGA No. 1/0698/24.

Rethinking Poultry Farming: Natural Additives for a Healthier and Greener Future

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Abstract: In the context of growing interest in sustainable livestock production and the reduction of antibiotic use, natural additives such as probiotics and medicinal plants are gaining attention for their potential to modulate immune responses and support gut health. In the present *in vivo* study, broiler chickens were administered to a probiotic supplement via drinking water (*Limosilactobacillus reuteri* CCM 9425) or dried Urtica dioica leaves were added to their feed throughout the fattening period separately or in combined group. At the end of the experiment, tissue samples from the ileum and spleen were collected for molecular analysis by qPCR method. The aim of this study was to evaluate local (intestinal) and systemic (splenic) immune responses induced by these natural ingredients through expression analysis of selected genes, which included pro-inflammatory cytokines (IL-1β, IL-6), anti-inflammatory markers (TGF-β), antimicrobial peptides (AvBD) and tight junction proteins (Claudin-1, Occludin). The results showed that the monitored genes were significantly increased not only in the probiotic group alone, but also in the combined group, where animals were given both natural additives ($P < 0.01$). The findings of this study contribute to understanding the impact of sustainable, plant-based and microbial feed additives on poultry health. The findings may support the development of natural strategies to reduce antibiotic usage while maintaining gut integrity and immune homeostasis in broiler chickens.

Keywords: immunity; intestine; qPCR; poultry; spleen.

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Behavioral Assessment of Cattle for Improved Performance: The QBA Method

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Abstract: Modern dairy farming increasingly recognizes the role of animal welfare, particularly emotional well-being, in shaping health, productivity, and sustainability. This study reviews the use of Qualitative Behavior Assessment (QBA) as a practical, non-invasive method to evaluate affective states in dairy cows. QBA applies structured observation and predefined descriptors to interpret behavior, enabling early detection of stress or discomfort. Literature analysis focused on farms where QBA was implemented, with outcomes compared to official milk recording data and herd health indicators. The findings show a consistent relationship between cows' emotional states and production efficiency: positive expressions such as calmness, sociability, and curiosity were linked to higher milk yields, while negative states like fear, anxiety, or apathy correlated with reduced productivity and increased prevalence of mastitis, lameness, and metabolic disorders. These conditions not only compromised welfare but also led to greater veterinary costs and economic losses. The review highlights QBA's value as a cost-effective management tool that enhances early intervention, improves herd health, and supports sustainable dairy production. Integrating emotional welfare into routine monitoring offers both ethical and economic benefits for modern dairy farming.

Keywords: cow; welfare; QBA method

Current Trends and Genetic Factors in the Formation of Economically Important Traits in Ukrainian Red-and-White Dairy Cattle under Absorptive Crossbreeding

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Abstract: Currently, the Ukrainian Red-and-White dairy breed is widely used in absorptive crossbreeding programs with Holstein cattle. However, multiple studies have indicated that such crossbreeding often results in a decline in several economically important traits. These include an extension of the service period up to 189 days, a reduction in milk fat content to 3.50%, and a decrease in protein content to 2.9%. Therefore, the aim of this study was to investigate the phenotypic variability of economically important traits in Ukrainian Red-and-White dairy cows during the process of genetic improvement. The research was conducted on 116,400 cows across 199 breeding herds, using primary breeding records from 2019–2021 and biometric data analysis methods. The results show that, under current conditions, absorptive crossbreeding of improved Ukrainian Red-and-White cows with Holsteins does not result in a further significant enhancement of key productivity traits. On the contrary, in many breeding farms, the offspring lose several beneficial characteristics of the original improved breed, particularly in terms of reproductive performance and milk quality (fat and protein content). To further improve the complex of economically valuable traits (targeting milk yields, fat and protein content, productive longevity) while maintaining reproductive capacity, we recommend the introduction of variable two-breed crossbreeding strategies by 2030. Based on both domestic and international experience, it is proposed to apply such crossbreeding in 30% of the breeding population within the active nucleus of the Ukrainian Red-and-White dairy breed.

Keywords: Ukrainian Red-and-White dairy breed; absorptive crossbreeding; Holstein-cross; milk yield; reproductive performance

The Effect of High Hydrostatic Pressure Treatment on the Surface Discoloration of Fattened Goose Liver

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Abstract: The production of fattened goose liver has a long tradition. As the selling price of the product is extremely high, it is important to investigate all factors that affect the quality. To increase shelf life, the livers are vacuum-packed. However, it is a common problem that green spots appear on the surface, which are clearly visible even to the naked eye. The aim of this study was to investigate the effect of high hydrostatic pressure (HHP) treatment on undesired discoloration. During the experiment 40 livers were used. All the livers were vacuum-packed. They were randomly and equally divided into 4 groups (10 livers/group): untreated control, 300 MPa, 400 MPa, 500 MPa. The pressure holding time was 180 seconds in each case. After the treatment the livers were subjected to a storage test. They were kept for 21 days at 3^{oC}. The surface discoloration was checked visually every 7 days. It was found that greening appeared on the surface of the control samples even at the first monitoring time (7th day) and the undesired color change got exacerbated by the end of the storage trial. The discoloration in the case of livers treated at 300 MPa was only visible during the final inspection (21st day). Livers treated at 400 and 500 MPa remained spotless throughout the entire storage period. Based on the results, it can be concluded that HHP treatment can be applied at certain pressure ranges to prevent the appearance of surface discoloration.

Keywords: goose liver; high hydrostatic pressure; greening; surface discoloration

The Influence of Frequency Analysis on the Optimisation of Processes in Living Organisms and Thus Also on Farms

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Abstract: Living organisms are characterised by a sequence of processes and require certain conditions to function, such as minerals, trace elements and vitamins. If these nutrients are not supplied in sufficient quantities and of the right quality, the organism begins to compensate. If it can no longer compensate, it develops deficiencies that lead to disease. These deficiencies cause a change in the organism-specific environment (acidification), in which certain pathogens accumulate. In addition, there are pollutants from the environment, food and water. This pathogen/pollutant-laden environment then begins to weaken the organism's immune system. In order to reactivate the blocked and disrupted processes, rapid and comprehensive analysis methods are required to identify the subjects that are hindering or preventing the processes. However, the methods commonly used are complex and time-consuming. The frequency analysis approach aims to identify objects that inhibit structures and processes in a prophylactic manner, but to counteract them with natural means in order to strengthen the immune system and allow processes to run unhindered. The methods used are based on Raman spectroscopy and Fourier analysis. The specific frequencies of harmful agents and pollutants are determined, neutralised by destructive interference and removed from the organism. The aim is to optimise the processes in living organisms, thereby conserving resources, reducing costs in agricultural production and achieving higher product quality. By reducing the use of chemicals throughout the entire agricultural production chain, natural processes can run more optimally, promoting plant and animal health. These aspects have already been proven in practice.

Keywords: soil protection; plant protection; animal welfare

Selection of Candidate Verbenyl Ester-Forming and -Hydrolyzing Enzymes in *Ips Typographus* (Linnaeus, 1758)

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Abstract: *Ips typographus* threatens spruce forests by mass-attacking hosts using pheromones like cis-verbenol. While known to be synthesized via α-pinene hydroxylation, cis-verbenol may also derive from internal stores of verbenyl esters, suggesting a detoxification-related reservoir. The purpose of this study is to identify and analyze esterase genes that may catalyze the formation and hydrolysis of these esters, elucidating their role in pheromone production. Beetle total RNA was extracted from different developmental stages, converted to cDNA, and transcriptome assemblies were screened for esterase candidates using BLAST searches against known sequences. Candidate genes were annotated and compared phylogenetically with other known enzymes. The candidate genes were selected based on differential gene expression analysis, and their expression was validated using qPCR. Six carboxylesterases and one lipase gene were selected out of 26 identified genes in *Ips typographus* transcriptome based on sequence similarity to known insect esterases. Their expression patterns indicated possible roles in detoxification or pheromone precursor metabolism. Identified candidate esterases may participate in the formation and hydrolysis of verbenyl oleates, suggesting a pheromone precursor storage in *I. typographus*. However, further functional studies are required to confirm their roles in pheromone biosynthesis and substrate specificity.

Keywords: *Ips typographus*; pheromone biosynthesis; esterases; genomics

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Drivers of Food and Live Animal Exports and Their Nexus to Agricultural Growth in Nepal: Evidence from an ARDL Approach

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Abstract: In Nepal, globalization has opened opportunities for the expanding agrifood trade; however, the country faces a persistent trade deficit. This research examines the drivers of food and live animal export and their impact on agricultural growth. The autoregressive distributed lag (ARDL) model was used to analyze the annual time series data from 1976 to 2022. The model shows that remittance earnings, access to roads, and the education level of the population positively impact. In contrast, the number of cooperatives hurts food and live animal exports in the long run. Regarding short-run dynamics, last-period growth in exports positively influences the current exports. Unlike in the long run, the number of cooperatives positively affects exports in the short run. Additionally, foreign direct investment in agriculture and the inflation rate has positive short-term effects. Similarly, the lagged foreign investment in agriculture and the lagged inflation rate also positively influences exports. Our second model shows that 1% increase in the export-import ratio results in a 27% rise in AGDP in the long run, although it does not influence AGDP in the short run. These findings suggest that the export of food and live animals drives growth in the agriculture sector over the long term. To enhance exports in the long run, improving road access, expanding literacy programs, and encouraging remittance-sending households to invest in productive sectors are recommended. In the short run, implementation of policies that attract foreign direct investment, support inflation-adjusted producer prices, enhance the cooperative role, and manage the population pressure is recommended to sustain export-led growth.

Keywords: agrifood export; ARDL model; agriculture growth; Nepal; food and animal

Sex Effects on Growth Performance of Noiler Chickens Reared under Intensive Management System

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Abstract: Poultry production plays a crucial role in addressing food security and providing affordable protein in developing countries. The Noiler chicken, a dual-purpose breed developed to combine the resilience of indigenous chickens with the productivity of exotic breeds, has gained popularity among smallholder farmers in Nigeria. Despite this, limited studies have evaluated the effect of sex on growth performance in Noiler chickens, even though sex-related differences are well documented in other poultry breeds. This study investigated the influence of sex on growth traits of Noiler chickens raised under an intensive management system. A total of 100 day-old chicks were raised on farm-formulated feed containing 22% and 20% crude protein during the starter and finisher phases, respectively. At four weeks of age, the chicks were separated into two groups (50 birds each) based on sex, consisting of 25 males and 25 females per group, and assigned to five replicates per sex in a Completely Randomized Design. Data on feed intake and body weight were collected until 70 days of age. Male Noiler chickens exhibited significantly higher body weights ($P < 0.05$) and feed intake than females. Males consumed 397.38 g (starter) and 731.40 g (finisher) of feed, compared with 376.00 g and 712.12 g for females. The average body weights of males were 509.00 g and 2,008.60 g at the starter and finisher phases, compared with 411.32 g and 1,571.00 g for females. The findings demonstrate that sex significantly affects growth performance in Noiler chickens. Male Noilers demonstrated superior growth, suggesting greater suitability for meat production.

Keywords: growth performance; intensive management system; meat quality; noiler chicken; sex differences

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Vyshyvanka in the 21st Century: Between Folklore and Pop

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Abstract: In the 21st century, the Ukrainian vyshyvanka has undergone a reinterpretation: from a sacred and ethnographic symbol, it has transformed into an element of mass culture, fashion, and cultural diplomacy. The central question is: How does the vyshyvanka adapt to contemporary contexts while maintaining its role as a bearer of cultural code? The study aims to trace the evolution of its perception and use in both Ukrainian and global sociocultural spaces.

A qualitative approach based on content analysis was employed. Particular attention was given to examples from popular culture—fashion, music, and social media—that demonstrate how the vyshyvanka adapts to modern realities while preserving symbolic meaning.

Today, the vyshyvanka functions as a strong marker of national self-identification, gaining special significance not only within Ukraine but also among the diaspora and international audiences. The events of 2014 and 2022 intensified its role as a cultural sign of unity and resilience. Wearing a vyshyvanka is increasingly perceived as an act of belonging, support, and solidarity with Ukrainian culture.

Thus, in the 21st century, the vyshyvanka is not only a folkloric artifact but also a living element of cultural dialogue between tradition and modernity. Its incorporation into popular culture does not diminish its meaning; on the contrary, it strengthens its identity function, making tradition more visible, accessible, and prestigious for new generations.

Keywords: vyshyvanka; identity; pop culture; fashion; cultural heritage

Do SME Food Processors with Certification Perform Better Than Those Without? A Case Study from Kyrgyzstan

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Abstract: Dried fruits and nuts from forests and agroforestry systems in Central Asia (CA), constitute the primary source of income for local households and small and medium food processors (SMEs). While demand for sustainably produced and certified food products is growing globally, food processing SMEs in CA do not fully benefit from such opportunities. In addition, considering the high costs of implementing Environmental and Social Standards (ESS), processing SMEs are unsure about their potential strategic advantages. Drawing on comparative case study methodology and the Resource-Based View theory, the paper investigates how ESS adoption affects economic, environmental, and social performance across various enterprise types in the fruit and nut processing industry. Qualitative data were collected from six processing SMEs in Kyrgyzstan through semi-structured interviews, field observations, and internal document analysis. Three SME types were identified based on their certification status and organizational form: individually certified SMEs, group-certified cooperatives, and non-certified SMEs. Individually certified SMEs successfully transformed ESS into firm-specific capabilities, achieving improvements in operational efficiency, product traceability, export competitiveness, and labor conditions. Group-certified cooperatives demonstrated stronger environmental outcomes due to their collective structure and donor-supported training programs, yet faced challenges in institutionalizing economic and social gains due to limited managerial capacity and short-term support. Non-certified SMEs showed limited performance outcomes, constrained by informal practices, weak market access, and minimal environmental or social engagement. These findings underscore that while ESS can serve as catalysts for multidimensional performance improvements, their effectiveness is conditional on internal absorptive capacity, managerial competence, and continuity of external support.

Keywords: Environmental Social Standards; food processing SMEs; dried fruits and nuts

EU Implementation of Bioenergy Technologies for Waste Recycling: Jean Monnet Module Realization

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Abstract: The effective integration of circular economy and renewable energy resources to valorise waste is increasingly gaining direction in the world and receiving support in EU countries. The project BIOINWASTE (Jean Monnet Module, ERASMUS+ + 2022–2025) arose for the development of interdisciplinary knowledge and skills from bioenergy on the example of European experience, namely, Czechia, Sweden, Germany, and Austria, with the aim of applying them in Ukraine. The methodological basis consisted of optimising the combination of sectoral knowledge and case-study analysis of bioenergy projects in EU countries, using special software for bibliometric analysis and graphical visualisation. The project was implemented over a period of 2023-2025 through a complex of activities: a series of webinars (30 hours/year) with practitioners and virtual visits to laboratories in Czechia, Sweden, etc.; Spring School with lectures, seminars and master classes involving European experts (60 hours/year). Successful completion of the course each year resulted in 100 participants who showed a high level of material assimilation and acquired skills for developing bioenergy mini-projects and techno-economic justifications. Achieved: expansion of knowledge of audiences about the European Green Course; familiarisation with biomass feedstock, biofuel production systems, technologies for adaptation to climate change with waste valorisation as raw materials for bioproducts; establishment of interdisciplinary interaction between students, scientists and community. The project demonstrated an effective model of transferring innovative bioenergy technologies from the EU to Ukraine. Participants acquired real competences for implementing bioenergy mini-projects, supporting the reduction of waste and greenhouse gas emissions, and promoting energy security and the development of a circular economy at the local level.

Keywords: Jean Monnet Module; bioenergy; waste management; European practices

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Key Factors for Achieving Business Success Among Young Entrepreneurs: Insights from Ghana

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Abstract: Research on the nexus of human, social, and financial capital reveals their combined influence on entrepreneurial success, particularly in youth food processing businesses. While individual capital components have been widely studied, their integrated impact remains underexamined, especially among young entrepreneurs in Ghana's food processing sector. This study assessed youth-owned food processing enterprises, examining how these capitals influence entrepreneurial success to identify effective support interventions. Quantitative data was collected from 244 youth entrepreneurs and qualitative data from 7 key informants in 2021. The Seemingly-Unrelated Regression (SUR) method was used to analyze the data. Results showed that entrepreneurial profit was positively influenced by prior experience (human capital), association membership, and mentoring (social capital), but negatively by access to credit (financial capital). Training (human capital) and business partnerships (social capital) positively affected the average number of employees, while access to credit had a negative effect. Additionally, business partnerships significantly and positively impacted the rate of change in employee numbers. The study recommends mentoring support, promoting association membership to increase profits, fostering business partnerships, and implementing training programs to positively impact employment.

Keywords: resource-based view; youth entrepreneurship; human capital; social capital; financial capital

Feature Ranking for Predicting Inhabitant Thermal Comfort in Urban Landscapes Using Machine Learning for Sustainable and Climate-Resilient Design

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Abstract: Ensuring occupant comfort is essential for developing sustainable and climate-resilient urban environments, especially in densely populated areas like Dhaka, Bangladesh. Rapid urbanization is significantly altering local climates, making it harder to maintain thermal comfort. Despite increasing interest in sustainable urban planning, few studies have combined machine learning and climate adaptation to predict human thermal comfort in such settings. The purpose of this research is to utilize Machine Learning (ML) models to identify the most relevant features influencing comfort levels in four distinct urban landscapes situated in residential areas. A comprehensive dataset of 300 data samples was collected, comprising 12 features that include inhabitant comfort metrics (predicted mean vote (PMV) level), environmental parameters (temperature, humidity, wind velocity, and CO_2 levels), demographic information (age and gender), and urban design characteristics (sitting surface and location). Three ML models were used to identify and predict comfort levels: Random Forest (RF), Decision Tree (DT), and XGBoost. To evaluate model results and prioritize feature importance, SHAP (SHapley Additive Explanations) analysis was used. The results, with prediction accuracies surpassing 90%, show that the seating surface, lighting level, wind velocity, humidity, and temperature all have a substantial impact on resident comfort. This study supports climate change mitigation and sustainable city planning by enabling data-driven urban design that promotes passive cooling. It underscores the role of ML and feature ranking in integrating sustainability-focused insights into urban design and environmental assessments. Future work should incorporate circular economy and adaptation strategies to enhance urban climate resilience.

Keywords: climate-resilient design; feature ranking; inhabitant thermal comfort; machine learning; urban landscapes

Wage Disparities among Academic Staff: A Faculty-Level Case Study of Czech Public Universities

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Abstract: This study investigates wage disparities among academic staff at public university faculties in the Czech Republic. We focus on universities that include both science- and humanities-oriented faculties. After finding that the coefficients of economic demands (CEDs) alone do not sufficiently explain differences in average salaries, we shift our attention to the potential role of research funding and other financial resources. Using 2013–2024 data from the Czech Ministry of Education and university-level budget reports, we constructed faculty-level regression models. The analysis includes both absolute and relative indicators. Key explanatory variables include faculty-level allocations for education, research, own revenues, and funding based on societal demand. Initial results suggest that models based on absolute indicators provide a better statistical fit than those using relative measures such as average faculty CED or student-to-graduate ratios. The absolute model shows promising explanatory power, with research funding emerging as a relevant factor. These preliminary findings support the research aim: to explain the variability of average faculty-level academic wages of public universities with a particular focus on financial inputs allocated for research.

Keywords: higher education funding; wages of academic and scientific staff; administrative data

Evaluating Large Language Models for Personalized Nutritional Therapy: A Comparative Study on Common Health Conditions

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Abstract: The rapid advancement of Large Language Models (LLMs) has significantly impacted various fields, including nutritional therapy. However, their application in clinical dietetics, especially for managing prevalent conditions like obesity, osteoporosis, and inflammatory bowel disease (IBD), remains understudied. This study evaluates the effectiveness of five publicly accessible LLMs, such as ChatGPT, Gemini, DeepSeek, Le Chat, and Llama 3 in providing personalized nutrition and exercise recommendations. By comparing their outputs against expert benchmarks, we assessed their potential integration into dietetic practices, evaluating five key dimensions on a scale from 0 to 5. Our findings indicate that Gemini outperformed the other models, particularly in accuracy, comprehensiveness, and safety. ChatGPT and DeepSeek also showed strong performance with similar overall scores, while Llama 3 and Le Chat lagged behind in all assessed areas. Although most models delivered accurate general advice and maintained safety standards, they struggled with personalization, reflecting challenges in tailoring recommendations to individual health profiles, lifestyles, and dietary needs. Despite these limitations, LLMs exhibit promising potential for offering basic dietary guidance for common health conditions, underscoring the continued need for professional oversight.

Keywords: large language models; dietetics; nutrition counseling; personalized nutrition; artificial intelligence

Revitalizing Rural Morocco: The Role of Youth Agricultural Entrepreneurship in Sustainable Development

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Abstract: Rural territories in Morocco face enduring socioeconomic and environmental challenges that hinder their growth and sustainability. Accordingly, the kingdom aspires to leverage youth agricultural entrepreneurship as a pathway for revitalizing these regions and enhancing their resilience. The objective of this research is to examine the potential of public policies in addressing structural challenges and contributing to sustainable rural development. The study employs a mixed-methods approach. The authors gathered qualitative insights through semi-structured interviews with local stakeholders across various Moroccan rural landscapes. Subsequently, they collected quantitative data via questionnaires administered to young agricultural entrepreneurs. This approach provided a contextual understanding of both the ecosystem's perspective and entrepreneurs' experiences. Preliminary results indicate that youth-led agricultural entrepreneurial ventures play a significant role in revitalizing rural territories. They foster innovation and economic development, mitigate rural-urban migration, and enhance social cohesion. Furthermore, they bolster environmental resilience by promoting sustainable agricultural practices. However, these initiatives face persistent challenges, particularly in terms of cultural barriers, lack of access to financial resources, poor education, and lack of training. This work explores the role of youth agricultural entrepreneurship in strengthening the resilience and sustainability of Moroccan rural territories. It offers valuable insights for understanding and optimizing rural revitalization strategies. Furthermore, it emphasizes the need for inclusive policies and supportive entrepreneurial ecosystems to contribute to global development outcomes.

Keywords: youth; agricultural entrepreneurship; rural; resilience; sustainable

MicroAKIS of Demonstration Farms: Key Actors' Centrality in Knowledge Transfer

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Abstract: Effective dissemination of agricultural knowledge is crucial for achieving sustainability in agriculture. Demonstration farms play a significant role within Agricultural Knowledge and Innovation Systems (AKIS) by facilitating peer-to-peer learning. Despite their importance, the sources from which demonstration farms acquire their knowledge (microAKIS) remain underexplored. This study aims to analyse the centrality of actors within these knowledge networks in the Czech Republic. We conducted semi-structured interviews with demonstration farm representatives. Data collected were analysed using Social Network Analysis (SNA) through NodeXL software, focusing specifically on degree and eigenvector centrality measures. Demonstration farms have varied and wide-ranged microAKIS networks, where research organization s, educational institutions, commercial firms, and independent advisors emerged as critical knowledge sources. Degree centrality highlighted also farm-based organisations (FBOs) as significant disseminators of knowledge. Eigenvector centrality emphasised the influence of specific actors within academic institutions. Our findings highlight the necessity of robust linkages between demonstration farms, academic institutions, and advisory entities. Enhancing state-supported initiatives that strengthen these connections could significantly improve innovation adoption and sustainable agricultural practices at the farm level.

Keywords: demonstration farms; microAKIS; social network analysis; centrality; peer-to-peer learning

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Marketing Channels and Pricing Mechanism of Cow's Milk in Latakia Governorate

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Abstract: A study in Latakia Governorate analyzed cow's milk production, marketing, and pricing to propose improvements for farmer profitability and fair consumer prices. The research found that 50% of farmers raise cattle for supplemental income. The marketing infrastructure is poor, with milk prices largely dictated by market rates and collectors. The average daily milk yield per cow is 20 kg. Most farmers calculate production cost per kilogram (A) based only on feed costs, using the formula: A= (Daily feed cost × 365) / (Daily milk production × Length of lactation period).
Accordingly, the following formula was proposed for milk pricing:

$$A + \left(\frac{A \times 15}{100} \times \frac{\text{Fat percentage in the sold milk}}{3.3}\right)$$

Despite a 20% profit margin, farmers face significant challenges due to high and scarce feed prices. However, producers' dedication to their profession is a key strength. Quality control varies, as only 55% of marketers analyze milk fat content, while 45% do not—either due to trusted sources or lack of expertise.

Keywords: cow's milk; pricing; marketing channels; Latakia Governorate

A Participatory Approach to Understanding Processes of Transformation- Community Level

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Abstract: There is an increasing interest in understanding transformation processes to envision a sustainable and just future. However, current transformation research is geographically fragmented, predominantly focusing on countries in the Global North. So far, there is scarce research from the Global South to enable us understand processes of transformation in this region. This gap restricts understanding of transformation processes in diverse contexts and risks marginalising vulnerable populations most affected by global changes. This exploratory research aims to address this gap by focusing on Appiatse, a farming community in Ghana impacted by mining operations, as a case study to understand processes of transformation in the Global South. Using a systems-thinking approach and participatory scenario methods, we normatively explore local diverse perspectives on the form of transformation needed to achieve sustainability. This is complemented with semi-structured interviews to explore how and who and can bring this vision into action as well as the barriers to achieving transformation for sustainability. a) livelihood and leadership emerged as two most important drivers of change; b) four plausible futures created implied different outcomes for the community with preferred scenario showing a strong preference for social and economic sustainability; c) various stakeholders at different scales play different and sometimes overlapping roles in arriving at envisioned future; d) there is need for collaboration at different scales to realise changes. The findings indicate a recognition of the need for societal transformation grounded in values of trust, unity and peace and underscores the importance of collaborative policy approaches.

Keywords: sustainable transformation; global south; participatory; transdisciplinary; community

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Social Inclusion via Higher Education During Wartime and Postwar Recovery: Cases from Ukraine

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Abstract: Third university mission is enhanced under knowledge society; it increases during crises and emergency situations. During the current war with RF, Ukrainian HEIs are responding to wartime challenges in a number of ways, contributing to social adaptation and integration of war veterans, augmenting social inclusion and resilience of Ukrainian society. desk research, observation, case study Higher education institutions in Ukraine are actively involved in the development, formation, and implementation of different initiatives and measures addressing social (re)integration of war veterans. These include professional adaptation (training, retraining, and upskilling) and the acquisition of new, labor market-relevant qualifications via professional (vocational), pre-tertiary, and higher education; provision of legal aid, psychological support to veterans and their family members; operation of Centers for Veteran Development as newly developed community hubs with a variety of services and collaborative activities aimed at augmenting links between different social groups, involvement of veterans into community work, responding to challenges of postwar recovery. The research recommends considering universities as potent players in state veterans' policies and argues for more support and stimuli enabling Ukrainian HEIs to develop and deliver institutional veteran-oriented policies as a complex of educational, scientific, social, humanitarian, and communication strategies and an integral component of social engagement and service to society.

Keywords: social inclusion; third university mission; educational reintegration of veterans; socio-humanitarian transformation of HEIs in Ukraine

Recreational and Entrepreneurial Activity - Ukrainian Experience of Rural Tourism Development on the Example of Opishnya Village, Poltava Region in Personalities

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Abstract: Recreational and entrepreneurial activities have significant potential for the development of rural tourism in Ukraine. In this context, the research is aimed at reflecting current socio-economic, cultural and environmental trends in Ukraine, namely, at researching rural tourism as one of the promising areas of tourism business development in the country, as well as preserving the cultural identity of such unique places as Opishnia village in Poltava region. The object of the analysis is the recreational and entrepreneurial activities of some figures in Opishnia village, which are actively involved in the development of recreational and entrepreneurial activities and popularize Ukrainian traditional art in social networks. Their activities in the tourism and reactionary sphere are an important heritage that needs to be protected and popularized. The following research methods: search and analysis of literary and electronic sources of information, analysis, data synthesis. Our research demonstrates how a combination of science, social work and community initiatives can combine to preserve cultural heritage, create jobs and attract tourists. The experience of Opishnia can become a model for the further development of Ukrainian villages, but with systematic government support, revision of the regulatory framework, investment in infrastructure, and advertising of rural tourism at the national and international levels. Working in this direction will not only improve the situation of the Ukrainian village but will also help to give it a second life and preserve its national identity.

Keywords: recreational activity; entrepreneurial activity; rural tourism

Assessment of Consumers' Preferences and Willingness to Pay for Improving Smoked Walking Catfish in Cambodia

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Abstract: Consumer preferences and willingness to pay (WTP) for improved smoked walking catfish are crucial for driving innovation and food safety in Cambodia, where traditional smoking methods prevail. Discrete Choice Experiment (DCE) was applied with 345 consumers across five study areas, complemented by logistic regression, to examine preference heterogeneity and socio-demographic drivers of WTP. DCE results showed that fish origin, quality, and trust strongly influenced choice. Wild-caught and locally farmed fish commanded the highest premiums, followed by medium and high-quality products. Trust in packaging and certification increased acceptance, though effects varied across provinces. Processing methods had weaker effects, with charcoal smoking penalized in some areas. Location specific patterns emerged consumers in Battambang were more likely to reject all options, whereas Phnom Penh consumers more often chose improved products. Gender analysis indicated both women and men valued quality, trust, and origin, but with different magnitudes. Women were more sensitive to price and trust cues, while men placed higher premiums on origin and certified packaging. Logistic regression identified additional predictors. Male consumers (OR = 3.27) and low-income households (OR = 2.80) were more likely to pay, while very low- and medium-income groups were less likely. Risk awareness (OR = 1.43) and government employment (OR = 1.35) increased WTP, whereas age and lower education reduced it. Overall, demands for safer smoked walking catfish is driven by quality, trust, and origin, moderated by gender, income, and location. These insights inform targeted interventions, certification, and market strategies to promote improved smoked fish products in Cambodia.

Keywords: smoked walking catfish; discrete choice experiment; consumer preferences; willingness to pay; food safety; Cambodia

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How Do Farmers Cope? Exploring the Relationship Between Adaptation and Resilience Perception in Indonesia

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Abstract: The increasing frequency and intensity of natural hazards, particularly climate-induced disasters, are placing significant pressure on agricultural systems, especially in disaster-prone regions such as Indonesia. Smallholder farmers are often exposed to repeated and overlapping shocks that challenge their ability to sustain livelihoods and recover. A wealth of research has emphasised on objective indicators of resilience; but less attention was given on how farmers perceive their capacity to withstand and adapt to disasters. Therefore, this study will explore farmers' adaptation practices and the (subjective) perception of resilience; investigating whether and how different types and combinations of adaptation strategies contribute to farmers' absorptive, adaptive, and transformative capacities. Primary data were collected from 2024 to August 2025 through focus group discussions, interviews, and structured household surveys conducted in three disaster-affected provinces: Aceh, Bali, and East Nusa Tenggara, covering a total sample of 729 farming households. The survey captured a range of variables, including household and farm characteristics, multi-disaster experience, adaptation practices (12 types), and farmers' subjective resilience perceptions. A composite resilience score will be developed based on 12 Likert-scale questions categorised into absorptive, adaptive, and transformative capacities. Data analysis will involve ordered probit and linear regression models to test associations between adaptation practices and resilience scores. The collected data is currently being processed; hence, final conclusions cannot yet be drawn. However, the research is expected to present evidence of how on-farm adaptation shape farmers' subjective resilience and hence, will contribute to context-sensitive disaster risk reduction and agricultural policy interventions in multi-hazard environments.

Keywords: adaptation; agriculture; climate change; DRR; multi-hazard; resilience

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Assessing Labour Standards in the Cambodian Cashew Value Chain: Focus on Child Labour and Workers´ Rights

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Abstract: Cambodia has designated cashew as one of the ten priority crops within its National Development Plan. However, despite its economic potential, the cashew sector remains underregulated, particularly in terms of labour rights and child protection. This study examines the role of children in cashew farming and determines the awareness of labour laws among smallholder farmers in two of the most important production regions: Kampong Thom and Preah Vihear provinces. Eight key informants participated in semi-structured interviews, 122 respondents took part in questionnaire surveys, in addition to field observations being conducted. The study settles the socioeconomic determinants of the prevalence of child labour through the use of Binary Logistic Regression. The findings reveal that general awareness of labour rights is very low, and significantly lower in more remote areas. Producers in Kampong Thom, located closer to urban centers, showed a higher degree of compliance with labour standards, especially through the use of formal contracts. The study also found indications on presence of child labour in both provinces. The anticipated gender disparity in participation, often reported in the literature, was not observed in this study. Informal labour and poor governance are key contributors to the continued prevalence of dangerous working conditions for both adult and child workers. The findings of the study suggested a set of recommendations, including targeted educational initiatives, enhanced financial support, and strengthened legal enforcement, aimed at improving labour conditions in Cambodia's rural cashew sector.

Keywords: child employment; cltural norms; human rights; informal employment

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Youth Social Awareness Required for Economically and Environmentally Sustainable Human Development

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Abstract: The purpose of the study is to explore the existing awareness about the necessity of economic and environmental sustainability of the business projects among Latvian youth, and to find out if there are gaps in social youth awareness that need to be addressed. This is especially topical because while environmentally friendly product alternatives will attract environmentally aware consumers who can afford them, they will not be chosen by consumers with a very low purchasing power, or by consumers who care primarily about other factors such as comparative quality. This research is based on human development concepts and economic sustainability theories. In order for an environmentally sustainable human development to succeed, it is a priority to focus on making green product alternatives economically competitive to maximize their potential consumer base in a free market and to make environmentally friendly enterprises economically self-sufficient and sustainable long-term. A survey of students in Latvia's Business and Management studies has been conducted about economic and environmental awareness. The research is based on analysis of questions related to economic and environmental sustainability of human development. A conceptual model has been created. The youth in Latvia, especially the entrepreneurial studies students, are already generally aware about the necessity of environmental sustainability due to historical ties with Latvian business education approach to green policies. However, there is more of a disconnection between environmental sustainability awareness and the necessity for economic sustainability to financially sustain an environmentally friendly business long-term.

Keywords: consumer behavior; human development; sustainability

Futuring Brown Deer Conservation from the Lenses of the Mandaya Indigenous People

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Abstract: The Philippine brown deer (*Rusa marianna* Desmarest, 1822), endemic to the archipelago, is among the world's least studied cervids and is currently classified as Vulnerable by the IUCN and Endangered by the Philippine Red List. This study explores conservation through the lens of the Mandaya Indigenous community in Davao Oriental, the Philippines, using ethnographic methods and futures research tools such as Causal Layered Analysis (CLA) and the Futures Triangle. Through interviews, focus group discussions, community observations, research documents, Mandaya's ecological knowledge, cultural practices, and conservation strategies. The Mandaya envision a future where a thriving deer population sustains the forest ecosystem and upholds their cultural identity and local economy. Their deep understanding of deer behavior, habitat, and reproduction is rooted in spiritual beliefs and a cultural ethos of environmental respect. While excessive hunting is absent, habitat degradation and illegal poaching remain pressing threats. The community advocates for "no-hunting" zones, bans on snares and traps, and stricter wildlife laws. Collaboration with government agencies is essential for aligning conservation efforts and securing support. The study necessitates updated population assessments using camera traps, drones, and GPS tracking to fill ecological data gaps. The Mandaya's vision offers a regenerative model of conservation that harmonizes traditional knowledge with modern science, ensuring ecological sustainability, cultural continuity, and economic resilience. This underscores the importance of integrating Indigenous perspectives and futures thinking into biodiversity conservation.

Keywords: Community-based conservation; futures thinking; Indigenous knowledge; Mandaya community; Philippine brown deer

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Prevalence of Cardiovascular Risk Factors among Working Adults in Ustecky region

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Abstract: Cardiovascular and cerebrovascular diseases are leading causes of mortality and morbidity globally, placing a significant burden on healthcare systems and society. Early identification of individuals at increased risk is essential for timely intervention and prevention. In the Czech Republic, general practitioners conduct biannual preventive check-ups; however, attendance remains suboptimal. According to the Institute of Health Information and Statistics (IHIS), only 47.8% of men and 49.6% of women with health insurance attended these check-ups in 2022. This study aimed to assess the prevalence of selected cardiovascular risk factors among working adults and to evaluate whether workplace-based screening could complement standard preventive check-ups. Non-invasive assessments included the ankle-brachial index, blood pressure in all extremities, pulse wave velocity, and body composition. Cholesterol and blood glucose were measured using invasive methods. The study was conducted in the Ústí Region at various workplaces during working hours. Participants were working adults who spoke Czech and provided informed consent. Elevated total cholesterol was found in 63% of men and 56% of women. Elevated LDL was more prevalent in men (56%) than women (43%). Upper limb hypertension was observed in 47% of men and 37% of women; lower limb hypertension in 49% of men and 30% of women. Diastolic hypertension was more frequent than systolic in both sexes. A considerable share of participants showed risk factors for cardiovascular disease, such as elevated cholesterol and hypertension. These results suggest the potential benefit of targeted preventive interventions in workplace settings.

Keywords: cardiovascular disease; primary prevention; cardiovascular risk

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From Campus to Career: How University-Industry Linkages Shape Student Futures

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Abstract: The cooperative agreements and partnerships between industries and higher education institutions (universities) that are intended to promote innovation, research, and development are referred to as university-industry linkages. These connections make it easier to share resources, technology, and expertise, which benefits scholarly research, student's career and business operations. The purpose of this study is to investigate how university-industry linkages shapes student's future in terms of future employment opportunities specifically in Lithuania. The methodology used for this study is the quantitative research; survey questionnaire was used to gather the data from students of Lithuania specifically from business and engineering departments from various universities. The findings of the study highlight that the strong linkages between universities and industries have a huge impact on students' careers and helps students in shaping their career. To conclude, universities and industry must form stronger, more organized links, to effectively bridge the gap between education and employment. University-industry linages are essential in improving students' employability and career readiness.

Keywords: Lithuania; students future; university-industry linkages

The Potential of Integrating PEST Analysis and Arjun Apadurrai's Global Flows Concept to Develop a Glocality Model for Trans-mediation in the Digital Culture Era

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Abstract: Developed by a study of adaptation and multimodality of art films in the digital era conducted between 2020 and early 2025—the literature review, theoretical analysis, synthesis, and integration of theories revealed that the process of creating artworks representing national ideology in the global era is complex, yet no global model exists to map this process. Urgency of this research stems from two previous case studies: Garin Nugroho's film "Setan Jawa" (2016) and the South Korean film "Secretly, Greatly" (2013), transmediation (alih wahana, Ind.) from the webcomic "Covertness"—which contain symbols and visual ideologies that reflect their respective cultural identities. Adaptation involves not merely translating but also transforming cross-media texts without losing the values/meanings of their source materials. Globalization—in this case—accessible space for cross-cultural collaboration, but also brings the potential for erosion of local values. This phenomenon becomes a basis for model development. Therefore, the concept of glocalization—the adaptation of global elements into local contexts—is important in developing a model for transmedia works. Use a transdisciplinary approach based on PEST analysis integrated with global flows, which indicates five global cultural landscapes related to the concept of glocalization proposed by Arjun Appadurai--as well as an exploratory-constructive model development method—this research aims to formulate a simplified PEST-based Glocalization Model for Transmedia Works as a guide for creators producing works representative of national ideology. Integrating PEST Analysis and Global Flows Concept of Arjun Appadurai potentially strengthening art/design as a strategic communication medium and potentially making scientific contributions.

Keywords: transmediation; glocalization; PEST analysis

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An Analysis of Visual Ideology in the Film «Secretly, Greatly» (2013) and Its Contextualization with Indonesian Political Communication In the Digital Culture Era

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Abstract: The South Korean film "Secretly, Greatly" (2013) is an adaptation of the webcomic "Covertness," which tells the story of three North Korean agents who become spies in South Korea. In digital culture, intermediation (alih wahana, Ind.) becomes an activity that has the potential to present a more massive transfer of values between generations. In intermediation process, translation and/or transposition of narratives can occur. Using a semiotic approach, the film's visual ideology is analyzed, focusing on cinematographic elements and then aligning them with political communication in Indonesia. The intermediation process from webcomic "Covertness" to film "Secretly, Greatly" occurs through transposition, where new signs are constructed to present the film's visual ideology. Although Indonesia and South Korea have different cultural backgrounds, both countries share a commonality: they are both experiencing similar digital political dynamics. Authoritarian nationalism and repression of identity are reflected in the visual symbols created in the film. A state of information polarization is constructed in harmony with the ideology implicitly communicated through the film. From the results of the analysis, it is concluded that the contextualization of the film "Secretly, Greatly" with political communication in Indonesia—also intermediation process—in the era of digital culture is that the film becomes a reflection of how power can shape public perception to maintain the stability of ideology with symbols and media.

Keywords: visual ideology; political communication; intermediation; digital culture

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Stakeholder Dynamics and Decision Pathways in Farmers' Transition from Rice to Vegetables in Indonesia

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Abstract: In Indonesia's highland regions, where conditions favor horticulture, smallholder farmers are increasingly encouraged to shift from local rice cultivation to high-value vegetable production. This transition offers benefits such as higher incomes, shorter planting cycles, and market opportunities, yet is also shaped by external stakeholders and cultural ties to rice farming. However, the role of stakeholder interactions and socio-cultural norms in shaping farmers' decisions remains understudied. This study aims to (1) identify key stakeholders, (2) analyze how their dynamics influence transition decisions, and (3) assess long-term outcomes for farmers. We employed a decision analysis approach integrating quantitative probabilistic modelling with qualitative methods. Data were gathered through a literature review and semi-structured interviews with 34 individuals in Sinjai District, South Sulawesi, Indonesia. Stakeholders were identified and categorized based on attributes such as experience, availability, relevance, and influence. We developed an impact pathway to explore how stakeholder dynamics affect decision-making and a conceptual model to simulate the expected costs-benefits, and long-term outcomes for farmers. We identified 26 stakeholder types involved in the transition decision, 11 of whom were categorized as potential core experts, most being different types of farmers. Although vegetable farming shows higher long-term income potential, several farmers expressed concerns about food security and the cultural significance of rice, influencing their continued cultivation of rice. This study highlights that economic potential alone does not drive crop transition. Stakeholder relationships and cultural attachments can influence farmers' decision-making. Strengthening collaboration among stakeholders will be essential to support sustainable and resilient agricultural transitions in Indonesia.

Keywords: agricultural transition; cultural value; decision analysis; horticulture; rice farming; stakeholder

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Towards Organic Agriculture in Emerging Economies: An Empirical Analysis of Albanian Farmers' Certification Intentions Drivers

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Abstract: Despite global and regional policies promoting organic farming, there has been limited research on the factors driving farmers in Albania and other Balkan countries to seek organic certification. This study addresses this gap by identifying and analyzing the determinants that influence Albanian farmers' intentions to pursue organic certification, with a focus on their individual characteristics and farm-level variables. The study utilized a structured survey of 243 farmers, conducted in 2020. The data collected was then analyzed using a probit regression model to identify the determinants of farmers' intentions to pursue organic certification, based on their individual and farm-level characteristics. A key finding is that only 6% of the surveyed farmers currently have organic certification, while 29% intend to get it. The study also found that younger farmers, those with a formal agricultural education, and female farmers are more likely to pursue certification. Additionally, farm-level factors like irrigation level and farming type, along with access to extension services and agricultural print media, positively influence farmers' intentions. Farmers' willingness to take risks and their concern for the environment were also significant drivers. The low rate of organic certification among Albanian farmers is primarily due to a lack of awareness and knowledge, rather than a lack of interest. The study suggests that policies should focus on providing technical assistance and financial incentives to encourage wider adoption. Enhancing access to agricultural media and extension services could further boost certification rates by improving farmers' understanding of its benefits.

Keywords: organic farming; organic certification; Albania; determinants of adoption

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Sustainable Land Management Adoption: Integrating Indigenous Ecological Knowledge with Modern Practices

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Abstract: Modern agriculture drives global environmental degradation. Integrating Indigenous Ecological Knowledge (IEK) offers a pathway to sustainability, yet adoption is hindered by policy gaps and a poor understanding of farmer decision-making. This study investigates the socio-behavioral drivers and barriers to IEK integration among Indigenous and non-Indigenous farmers in the Southwest United States. This study uses a mixed-methods design. Structured surveys will quantitatively assess farmer knowledge, risk perceptions, and cultural attitudes, analyzed via statistical modeling. These findings will be contextualized with qualitative data from semi-structured interviews with farmers, Indigenous leaders, and experts to understand the lived experiences behind adoption decisions. [Anticipated] I expect to find that socio-behavioral factors, such as cultural biases and knowledge gaps, are more significant predictors of adoption than demographics. Direct contact with Indigenous communities is hypothesized to positively correlate with adoption rates. The analysis will also identify key institutional barriers and effective incentives, producing a model of the decision-making process. The findings will argue for policy shifts that support knowledge co-creation, validate IEK as a scientific framework, and foster respectful relationships between Indigenous knowledge holders and the broader agricultural community to build resilient food systems.

Keywords: indigenous ecological knowledge; sustainable agriculture; technology adoption; farmer decision-making

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War-induced Transformations in Ukrainians' Food Consumption Behavior

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Abstract: The full-scale phase of the Russian-Ukrainian war has severely affected all aspects of Ukrainians' everyday life. Shifts in food consumption patterns have emerged as one of the most notable market trends. To investigate changes in Ukrainians' food consumption behavior, a comprehensive methodological approach was employed, combining descriptive analysis, formalization and generalization, logical procedures of analysis and synthesis, empirical observation, inductive reasoning, as well as the examination of dynamic trends and structural transformations. The structure of Ukrainian consumers' baskets has shifted toward essential items, lower-cost products, and goods with longer shelf lives. Eating habits and dietary patterns have changed significantly, particularly among internally displaced persons, Ukrainians who have relocated abroad, and those who joined the Armed Forces. The popularity of online grocery shopping has grown, both for safety reasons and for convenience. The most notable trends are the increase in the intensity of such purchases among older age groups and among Ukrainians abroad. Panic buying, disordered eating behaviors, impulsive stockpiling observed during the first weeks of the war have been replaced by a more rational approach to consumption, which has become the primary strategy for Ukrainians striving to ensure food security amid prolonged full-scale hostilities. Focus on brand status has shifted toward supporting local producers, with an emphasis on assistance to the Armed Forces. Psychologically, preparing traditional or favorite dishes became particularly meaningful. War-induced changes in Ukrainians' food consumption behavior occurred in various contexts, from economic to psychological. The specifics of these patterns depend on the particular life circumstances of different groups.

Keywords: Russian-Ukrainian war; consumption patterns; buying behavior

Cross-Border River Vlára: Analysis and Assessment of the Cultural and Recreational Potential of the River and Its Adjacent Floodplain

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Abstract: In the context of climate change and the growing need for landscape adaptation, the recreational use of watercourses is becoming an increasingly integral part of integrated planning and sustainable water resource management. Especially in cross-border regions, it is important to define a unified methodological assessment framework that takes into account the diverse interests and approaches of the involved stakeholders. The aim of the study was to analyze and evaluate the recreational potential of a selected cross-border river and its adjacent floodplain. Data were obtained through interviews with representatives of relevant stakeholders. To assess selected sections of the Vlára River, a comprehensive and integrated evaluation approach was used, based on the application of existing utilitarian methods for landscape assessment, river modification, and recreation according to Lampartová (2016). The results present the findings from stakeholder interviews and the evaluation of selected sections of the cross-border Vlára River using the above-mentioned methodological approach. River managers can use the results as a basis for future planning of modifications aimed at making the river and its adjacent floodplain more accessible for cultural and recreational use.

Keywords: rivers; methods; cultural and recreational potential; society; planning

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Food Identity and Its Role in Food Security Status in Greater Accra, Ghana

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Abstract: According to the Food and Agriculture Organization (FAO), food security exists when all people have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and preferences for an active, healthy life (FAO, 1996). In Ghana, a developing country in sub-Saharan Africa, dietary patterns are shaped by diverse cultural practices and ethnic identities. In 2016, about 5% of the population was food insecure, with an additional two million considered vulnerable (Darfour & Rosentrater, 2016). Food identity is how individuals relate to food culturally and socially, and this plays a significant role in dietary habits and nutritional outcomes. Understanding this relationship is key to addressing food insecurity, especially in rapidly urbanizing areas like Accra. This study investigates the dietary patterns associated with various food identities in communities within the Greater Accra Region. It explores how societal factors such as cultural norms, income levels, and geographic location influence food consumption and food security. Using a quantitative research design, data will be collected from households in Accra across diverse socioeconomic and geographic strata to ensure representativeness. Findings will provide insights into how food identity influences food security and inform policy recommendations that incorporate cultural and social considerations to improve dietary outcomes and access to nutritious food in Accra. The study aims to identify distinctive food identities and their corresponding dietary patterns, assess their impact on nutritional intake and food security, and evaluate the broader social drivers of food access.

Keywords: food security; food identity; dietary patterns; developing country

Development and Transformation of Eurasianism During the Cold War – Eurasianism in the Soviet Intellectual Milieu

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Abstract: The current project focuses on the development and transformation of Eurasianism – an ideological and political movement that emerged in the interwar Europe of the 1920s in the intellectual milieu of Russian emigration. During the 20th century Eurasianism underwent a series of transformations and, since the early 1990s, has regularly resonated in Russian foreign policy. Until now, research on Eurasianism has mostly focused on interwar Eurasianism and post-Soviet neo-Eurasianism, leaving the important Cold War period without sought-after academic attention. The main objective of the research is to fill the blind spot in the study of Eurasianism and follow the development of historiographic concepts of Eurasianism in the milieu of Soviet academia and Russian nationalist movement during the Cold War. The project introduces a revised concept of trans-Eurasianism that seeks to be used along with the already established research areas of interwar Eurasianism and post-Soviet neo-Eurasianism. At the center of the project stands the extensive research of personal, epistolary, and mediated contact between selected representatives of interwar Eurasianism (geographer P. N. Savicky and historian G. V. Vernadsky) and related Soviet intellectuals (ethnologist L. N. Gumilev and literary scholar and publicist V. V. Kozhinov). The research is based on the comparative approach to the primary and secondary sources and elaborates on the advanced digital analysis of unpublished archival documents located in Prague, Saint Petersburg, and New York. I argue that while retaining the same name and vocabulary, in the post-Stalinist intellectual milieu, initial Eurasianist ideas began to be filled with different content and associated with new narratives undergoing extreme radicalization, narrowing, and conceptual deformation, which heavily affected their later post-Soviet reception.

Keywords: Eurasianism; geopolitics; historiography; Cold War; Slavic Studies; digital humanities

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Sustainable Development of Rural Communities through Environmental Education: A Multidisciplinary Approach in Action

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Abstract: This paper presents the results of an interdisciplinary project focused on promoting sustainable development in Chubynske village, a rural community located in the Kyiv region of Ukraine. The project took place during environmental challenges and war-related damage to protected areas, including the national landscape reserve «Khutir Chubynskyi». The main idea was to combine scientific research, educational activities and community involvement to raise environmental awareness and promote sustainable practices. We used mixed methods, including an analysis of EU environmental education models, research on local needs, and feedback from participants in virtual sessions. Teachers, students, and community leaders participated in the project. The results and materials were published online to reach a wider audience and ensure a lasting impact. The results show that environmental education based on local nature and culture and supported by research institutions, helps rural communities become more resilient and develop sustainably. Virtual formats allowed continuation despite security issues, improve environmental knowledge, and empower local people. This approach can be useful for other rural areas facing similar problems. Key activities included creating a virtual eco-trail, preparing educational materials such as videos, presentations, and calendars, and organizing virtual tours for schoolchildren and local residents. European, mainly Czech, environmental education methods were adapted to local needs, focusing on the importance of old-growth forests and cultural heritage.

Keywords: environmental education; rural development; old-growth forests; community engagement; sustainable practices

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Expanding the Third Mission of Ukrainian Universities: The Role of Dissemination and the UNICOM Project

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Abstract: The Third Mission (TM) of higher education institutions (HEIs) has gained importance worldwide as a framework for universities to contribute to society beyond teaching and research. In Ukraine, this expansion is particularly significant in strengthening university-community relationships, supporting innovation, and contributing to regional development. Dissemination – understood as effective communication of knowledge, practices, and outcomes – plays a key role in making the Third Mission visible and impactful for different stakeholders. This study highlights dissemination as a central tool for advancing the TM in Ukrainian HEIs, drawing on experiences from the Universities-Communities: Strengthening Cooperation (UNICOM) project, an Erasmus+ initiative linking Ukrainian and European universities. Dissemination approaches analyzed include institutional websites and social media, public events (lectures, workshops, conferences), policy briefs and case studies, media cooperation, peer-to-peer learning, academic publications, participation in policy forums, targeted staff training, and community partnerships. These approaches demonstrated clear benefits: increased TM visibility, strengthened stakeholder trust, and enabled knowledge sharing with local and international partners. Public events facilitated knowledge exchange, while policy briefs provided evidence of societal contributions. Academic publications positioned Ukrainian universities in European debates, and community partnerships created sustainable practices reinforcing universities' social value. Dissemination transforms the TM from conceptual framework into visible, practical activity benefiting universities and society. Ukrainian universities, by adopting systematic dissemination strategies, can enhance their role as socially engaged institutions, improve their national and international standing, and build trust-based partnerships. UNICOM provides an effective model for embedding dissemination into TM practices.

Keywords: Third Mission; Higher Education; Ukrainian universities; university-society relations; social engagement; knowledge transfer; dissemination; UNICOM project; Erasmus+

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Financial Inclusion in the Context of a Universities' Third Mission

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Abstract: The topic of financial inclusion is widely discussed in global communities, with universities, scholars, and educators engaged as both experts in the development of financial services and as beneficiaries of these services. The aim of the study is to investigate the role and classification of approaches of Higher Education Institutions (HEIs) in promoting financial inclusion in the context of the third mission of universities. Analysis of institutional activity: to classify the approaches; content analysis of university documents concerning their third mission and financial inclusion initiatives; case studies of specific examples of the implementation of financial literacy programs. Financial inclusion is developing in HEIs based on the following approaches: 1) integration into institutional operations through the implementation of financial inclusion elements for the student and academic communities; 2) research focus on conducting academic research in the field of financial inclusion; 3) project-based implementation of financial inclusion; 4) provision of financial education and various courses to enhance financial literacy. Financial inclusion in HEIs can be defined as a set of information, educational, and support services in the area of access to and use of financial resources, products, and services for increasing of financial well-being of students, staff, and community. Such services should be developed considering innovative approaches and the potential of HEI and, accordingly, with special attention to vulnerable groups, for ensuring social stability, humanitarian assistance, and sustainable economic reconstruction.

Keywords: financial inclusion; universities' third mission; financial literacy

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Implementation of the Third Mission of the University at Dragomanov Ukrainian State University

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Abstract: This report aims to systematize and analyze the approaches, practices and results of the implementation of the third mission at the Ukrainian State University named after Dragomanov (DUSU) within the framework of European standards. The main attention is paid to the practices of social inclusion, intersectoral cooperation and sustainable development. The analysis is based on the research and practical activities of the Faculty of Special and Inclusive Education, participation in international projects such as Erasmus+, in particular Jean Monnet projects, and KA2 projects such as UNICOM, as well as examples of cooperation with local communities and civil society organizations. The material presented is based on scientific publications, reports on educational and social project implementation, and empirical data collected through the university's internal studies. This approach makes it possible not only to consolidate existing experiences but also to identify future directions for advancing the third mission under conditions of uncertainty and societal transformation. At DUSU, special priority is placed on the field of social inclusion and the training of professionals capable of effectively working with heterogeneous populations. The university develops and implements educational modules, research projects, and practical initiatives aimed at enhancing social cohesion and inclusiveness, while fostering of national and international expert networks and partnerships. Integrating a strong social component into Ukraine's development strategy is essential for achieving inclusive and sustainable progress. By prioritizing social cohesion, addressing economic inequality, and implementing inclusive policies, Ukraine can build a more resilient and just society on its path to European integration and post-conflict recovery.

Keywords: third mission of universities; social inclusion; social cohesion

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Illustrated Knowledge: The University's Role in Shaping Ecological Thinking through Children's Picturebooks

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Abstract: Universities can actively shape ecological thinking from early childhood by co-creating children's picturebooks that "translate" scientific knowledge into multimodal, affective narratives. Drawing on a desk study and mapping, this research assembled a corpus of university-affiliated ecological picturebooks published between 2015 and 2025. A mixed-methods design combined qualitative content analysis with process-tracing and comparative case studies. Coding templates traced links between academic research, public engagement, and picturebook production, enabling systematic comparison of benefits and constraints. Findings revealed consistent patterns: university involvement correlated with systems-oriented language, interdisciplinary framing, and guided activities fostering critical reflection. Case studies highlighted benefits such as enhanced public trust in science through affective storytelling, creation of culturally specific materials reflecting local ecologies, training of cross-disciplinary communicators, and integration of sustainability-oriented curricula and practices. Challenges included balancing simplification with accuracy, overcoming disciplinary silos, ensuring equity and representation through community co-creation, and sustaining impact via long-term partnerships with schools and libraries. University-led picturebooks thus emerge as a tangible expression of the Third Mission, "translating" scholarly knowledge into accessible pedagogical artifacts that nurture ecological literacy. Scalable impact requires balancing rigor with narrative openness, fostering co-creative partnerships, and removing institutional barriers to collaboration. .

Keywords: third mission; ecological literacy; picturebooks; university outreach

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APPLIED OUTCOME

CZU mobiLAB 2.0 – Mobile Molecular Laboratory for Field Diagnostics and Education

Authors: Assoc. Prof. Jiří Černý, Ph.D.; Assoc. Prof. Hynek Roubík, Ph.D.

The modular molecular-biology laboratory CZU mobiLAB 2.0, developed at the Czech University of Life Sciences Prague, Faculty of Tropical AgriSciences, enables scientific analysis (RT-qPCR) and diagnostics even in remote and field locations. The speed and accuracy of the analysis enable end-users to monitor results in real-time directly at the site of interest. The capacity for rapid response and immediate implementation of containment measures on-site can significantly reduce the impact of outbreaks or environmental hazards. For example, the system supports certified methodologies for detecting pathogens such as West Nile virus infection (WNV) and Lyme borreliosis (LB) under field conditions.

Given the broad application range of molecular diagnostics, such as qPCR, the laboratory is designed to accommodate environmental (water, soil, plants), veterinary (faeces, hair, tissue), and medical (blood, saliva, swabs) samples. This versatility enables rapid, efficient, and specific molecular analysis for a wide spectrum of users, including research teams, veterinary organisations, medical diagnostics, and institutions working in low-infrastructure contexts.

The applied outcome is thus a highly flexible, field-deployable laboratory unit that bridges the gap between cutting-edge molecular diagnostics and real-world field operations. It supports not only scientific research but also technology transfer, capacity building and operational deployment in challenging settings. The project was supported by the Technology Agency of the Czech Republic (TA ČR), SIGMA 4, DC1 Proof of Concept (registration no. TACR2315001).

More information: https://mobilab.czu.cz/en/r-21406-about-mobilab-2-0

ORGANIZING COMMITTEE

Dear MCYR 2025 participant, we extend our sincere gratitude for participating in this year's event. Your active engagement, insightful discussions, and contributions made the conference both meaningful and impactful.

Under the theme "Science and Innovation: Advancing the Path to a Sustainable Future," MCYR 2025 aimed to inspire collaboration across disciplines and highlight the innovative work of emerging researchers. The energy and curiosity you brought to each session truly shaped the success of this year's conference.

We hope the experience was valuable, both intellectually and personally, and that the connections you built will continue to foster new ideas and collaborations. We look forward to welcoming you to MCYR 2026 and seeing how your research continues to grow, create impact, and make a difference.

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CONFERENCE HOSTS

BioResources & Technology

Faculty of Tropical AgriSciences

ABOUT THE FACULTY OF TROPICAL AGRISCIENCES

The **Faculty of Tropical AgriScience** (FTZ) at the Czech University of Life Sciences Prague (CZU) is a unique institution in the Czech Republic, boasting over fifty years of tradition in tropical agriculture, rural development, and the sustainable management of natural resources in the tropics.

Mission

The mission of the faculty is to provide higher education to foreign and Czech students in the fields of tropical agriculture, rural development, and the sustainable management of natural and energy resources in the tropics. An integral part of our mission is Research and Development in the field of tropical life sciences, with a focus on applying R&D results to the specific conditions of tropical and/or developing countries.

Vision

To be a leading institution in the Czech Republic dedicated to excellence in tropical agri-sciences, fostering the transfer of cutting-edge knowledge and technology between the Czech Republic, the EU, and tropical regions, while respecting the traditions, values, and socio-economic realities of local communities in the developing world.

Faculty of Tropical AgriSciences

ABOUT THE BIORESOURCES & TECHNOLOGY DIVISION

The BioResources and Technology (BRT) is a research division in the **Faculty of Tropical AgriScience** (FTZ) at the **Czech University of Life Sciences Prague** (CZU). The BRT is dedicated to advancing sustainable solutions through rigorous research, innovative technology, and interdisciplinary collaboration.

BRT research and innovation objectives encompass a wide array of thematic, from the determination of the real impact of small biogas plants (both in developing and developed countries) on the environment, climate change and society to bioresources technologies, including bioenergy, environmental aspects, food security, waste management, biotechnologies and more.

The global shift towards renewable energy and sustainable practices has reinforced the importance of holistic approaches to resource management. This underscores our commitment to fostering collaboration across these disciplines, enhancing our ability to address complex sustainability challenges. Interdisciplinary research is at the core of the BRT.

Our team comprises environmental science, engineering, agriculture, and social sciences expertise.

BioResources & Technology

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AgriSci-UA

Strengthening AgriSciences in Ukraine: AgriSci-UA

siris

Open Science to Increase Reproducibility In Science

COMUNIDAD

Combined Use of EGNSS and Copernicus Data to Develop Innovative Downstream Services for Users from Chile and Colombia

bio capital

Mobilising investments for protecting and restoring biodiversity by harnessing innovative financial solutions and advanced geospatial analytics

unicom

UNICOM: Universities – Communities: strengthening cooperation

MCYR 2025 PARTNERS

AgriSci-UA

agrisci-ua.com

AgriSciences Platform for Scientific Enhancement of HEIs in Ukraine

The platform aims to enhance the capabilities and collaboration among universities in the area of AgriSciences and to improve the scientific capacities of young educators, researchers, and postgraduate students at select Ukrainian universities. This will be accomplished through the continued development of the AgriSciences Platform, which focuses on increasing expertise in key areas of agrarian sciences, crucial for Ukraine's post-war development.

Beyond traditional AgriSciences topics, the project addresses urgent issues specific to present-day Ukraine, including the environmental and social impacts of the war. Furthermore, the project will also foster the formation of multidisciplinary research teams and offer grant opportunities to address these emerging challenges. These initiatives are critical for addressing Ukraine's needs during and after the conflict.

AgriSci-UA project is supported by Czech Republic Development Cooperation via Ministry of Foreign Affairs of the Czech Republic.

MCYR 2025 PARTNERS

osiris4r.eu

Open Science to Increase Reproducibility in Science

Reproducibility is crucial to the progress and impact of Research and Innovation (R&I) as it confirms or corrects the outcomes of single studies, resulting in higher quality research, more reliable and implementable outcomes, and a reduction of research costs. Embedding reproducibility in the strategy and design of research should thus be regarded as a key precondition to research quality.

OSIRIS aims to facilitate this shift by systematically gathering knowledge on the underlying drivers, testing effective evidence-based solutions, identifying incentives for reproducibility by stakeholders, and embedding reproducibility in research design. The project involves a unique combination of expertise in Open Science (OS), reproducibility, implementation, and data sharing, along with a range of committed stakeholders.

The OSIRIS project is funded by the European Union's Horizon Europe research and innovation programme under grant agreement No. 101094725.

MCYR 2025 PARTNERS

comunidad-project.eu

Combined Use of EGNSS and Copernicus Data to Develop Innovative Downstream Services for Users from Chile and Colombia

The COMUNIDAD project aims to develop, test, and implement an innovative framework that leverages Copernicus data to support agriculture, forestry, and rural development in Chile and Colombia. By integrating multiple data sources on the COMUNIDAD Platform, the project will facilitate the use of EGNSS (European Global Navigation Satellite Systems) and promote collaboration with both public and private sectors in the target regions.

COMUNIDAD will drive the long-term development of sustainable agriculture and forestry practices by supporting policy strategy development through Pilot Applications in Chile and Colombia. The project emphasizes information sharing, open access, and transparency, making it a significant resource for the target regions. The COMUNIDAD Platform will integrate existing services and solutions to address new regions with high potential for application.

The COMUNIDAD project is funded by the European Union under grant agreement No. 101131859

MCYR 2025 PARTNERS

bio capital

bio-capital.eu

Mobilising investments for protecting and restoring biodiversity by harnessing innovative financial solutions and advanced geospatial analytics

BIO-CAPITAL is an innovative project dedicated to addressing the critical challenge of biodiversity protection and restoration. By integrating technological advances within the field of geospatial analytics with sustainable financing solutions, the project aims to bridge the gap between ecological preservation and the need for increased private investment in conservation efforts.

The project adopts an interdisciplinary approach, combining expertise in biodiversity protection, the development of biodiversity-friendly financing mechanisms, and the application of advanced space technologies. These elements are brought together to create transformative solutions that enhance financial flows for biodiversity protection, restoration and sustainable utilisation.

This project has received funding from the European Union's Horizon Research and Innovation Programme under grant agreement No. 101135150.

MCYR 2025 PARTNERS

https://unicom.community/en/unicom-home/

Universities – Communities: strengthening cooperation

The general objective of the project is to enhance universities' social role through boosting university-community engagement, leading to the elaboration of state policy on supporting the third mission of universities for ensuring social cohesion, resilience, sustainability and prosperity in Ukraine.

The UNICOM project aims to foster cooperation between Ukrainian universities and their surrounding communities by incorporating best practices from EU states such as Italy, Germany, Sweden, Latvia and Czech Republic. The project activities include developing policies to enhance the third mission of universities, analyzing the needs of communities and universities across Ukraine, and capacity-building for university staff through exchange programs focused on resilience, sustainability, inclusion, entrepreneurship, environment, public health, and social cohesion.

The project is a promising step towards promoting the third mission of universities in Ukraine and strengthening university-community cooperation..

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