



UNIVERSITY OF AGRONOMIC SCIENCES
AND VETERINARY MEDICINE OF BUCHAREST
FACULTY OF LAND RECLAMATION
AND ENVIRONMENTAL ENGINEERING



International Conference
"Agriculture for Life, Life for Agriculture"

BOOK OF ABSTRACTS

SECTION 5

LAND RECLAMATION, EARTH OBSERVATION &
SURVEYING, ENVIRONMENTAL ENGINEERING



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**ENVIRONMENTAL
SCIENCE AND
ENGINEERING**

EVALUATION OF THE PERFORMANCE OF WHEAT VARIETIES UNDER MINIMUM TILLAGE SYSTEM IN THE PEDOCLIMATIC CONDITIONS OF SĂCELE AREA, CONSTANȚA COUNTY (2021-2024)

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Abstract

*This study aimed to evaluate the performance of several winter wheat (*Triticum aestivum* L.) varieties cultivated under the minimum tillage system in the semi-arid pedoclimatic conditions of Săcele, Constanța County (Romania) during the 2021–2024 agricultural years (October–July cropping cycles). The experimental design included four varieties: Avenue, Katarina, Rubisko, and Sorrial, monitored under variable rainfall regimes (330 mm in 2021-2022, 380 mm in 2022-2023, and <290 mm in 2023-2024). Morpho-productive parameters such as tillering capacity, plant height, grain number per spike, grain mass per spike, thousand kernel weight (TKW), and test weight (TW) were analyzed. The results represent the mean values of three consecutive agricultural years, highlighting varietal stability and adaptability under drought stress.*

Among the tested varieties, Rubisko showed the highest productivity (5.9 t/ha), followed by Avenue (5.5 t/ha), Sorrial (5.0 t/ha), and Katarina (4.3 t/ha). Strong positive correlations were recorded between yield and TKW ($r = 0.94$), yield and TW ($r = 0.91$), and yield and NDVI ($r = 0.97$). The linear regression analysis confirmed a significant relationship ($R^2 = 0.93$, $p < 0.05$) between NDVI and yield, demonstrating that vegetation indices derived from multispectral UAV imagery and Sentinel-2 satellite data provide reliable and complementary information for predicting wheat yield under the studied conditions.

The study demonstrates that combining minimum tillage with precision agriculture technologies ensures sustainable and resilient wheat production in arid regions. The results support the integration of digital monitoring, biofertilization, and site-specific management as key components of climate-smart agriculture for southern Romania and similar environments.

Key words: drought, minimum tillage, NDVI, precision agriculture, *Triticum aestivum*.

***DAPHNIA MAGNA* INDICATOR OF WATER POLLUTION WITH ZINC**

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Abstract

*Heavy metal contamination represents a persistent threat to aquatic ecosystems due to its toxicity and long-term environmental persistence. Among these metals, zinc plays a dual role as an essential micronutrient at low concentrations but becomes toxic when present in excess. The present study evaluates the acute toxicity of zinc on the freshwater crustacean *Daphnia magna*, a widely used bioindicator species in ecotoxicological assessments. Toxicity experiments were conducted using standardized Daphtoxkit bioassays in which neonates of *D. magna* were exposed to zinc concentrations ranging from 1.0 to 6.0 mg/L under controlled laboratory conditions. Mortality rates were recorded at four-hour intervals over an exposure period of 36 hours. The results revealed a strong concentration- and time-dependent increase in mortality. At the lowest concentration tested (1.0 mg/L), mortality reached 20% after 16 hours and increased to 60% after 36 hours. In contrast, the highest concentration (6.0 mg/L) induced rapid toxicity, producing 80% mortality within four hours and complete mortality after twelve hours of exposure. These findings highlight the high sensitivity of *D. magna* to elevated zinc concentrations and confirm its suitability as an effective biological indicator for monitoring heavy metal contamination in freshwater ecosystems. The results contribute to a better understanding of zinc-induced toxicity mechanisms in aquatic invertebrates and provide valuable information for environmental monitoring and risk assessment of metal pollution.*

Key words: *Daphnia magna*, toxicity, zinc, mortality rate.

**EFFECT OF SOIL TYPE AND MANAGEMENT
ON POTENTIALLY TOXIC ELEMENTS (As, Cu, Zn)
IN SOILS OF OLIVE GROVES IN DALMATIA, CROATIA**

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Abstract

The objectives of the study were to (i) establish and compare As, Cu, and Zn concentrations in two contrasting soil types under different management and (ii) assess soil pollution of the study area by the mentioned potentially toxic elements. A 40 composite topsoil samples were collected in Middle Dalmatia, Croatia, out of which 20 were from Terra rossa and 20 from Regosols. On each soil type, 10 samples were taken from intensive olive groves (IOG) and 10 from traditional low-input olive groves (TOG). The total concentrations of As, Cu, and Zn were obtained using the pXRF method. The mean As, Cu, and Zn concentrations in Terra rossa were 21.9, 112.7, and 124.5 mg/kg, respectively. In Regosols, mean As, Cu, and Zn concentrations were 6.3, 55.0, and 63.6 mg/kg, respectively. Significantly higher ($P < 0.05$) As, Cu, and Zn concentrations were determined in Terra rossa compared to Regosols. Significantly higher ($P < 0.05$) Cu concentrations were found in IOG compared to TOG (124.5 and 43.2 mg/kg, respectively). Terra rossa under IOG was polluted with Cu, while the other soils were not. The studied soils were not polluted with As and Zn.

Key words: Terra rossa, Regosol, soil pollution.

HYDROCARBON TOLERANCE AND BIODEGRADATION IN ENVIRONMENTAL *PSEUDOMONAS* STRAINS

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Abstract

Hydrocarbons are widely recognized as the most important class of persistent and toxic environmental pollutants. Moreover, bacteria from the genus Pseudomonas play a key role in the biodegradation of these compounds, and their remarkable metabolic versatility enables them to adapt to a wide range of contaminated environments, enhancing their effectiveness in pollutant removal. Although many species in this genus have already been identified, new Pseudomonas strains with significant relevance for environmental bioremediation continue to be reported each year. This study investigated hydrocarbon-tolerant and hydrocarbon-degrading bacteria in sediment samples from the Danube Delta collected during summer and autumn. Additionally, the ability of four Pseudomonas strains, individually and as a consortium, to tolerate and degrade paraffin (a mixture of saturated petroleum hydrocarbons) was evaluated. The tested strains demonstrated promising potential for paraffin biodegradation, particularly when applied as a consortium, likely due to functional complementarity and enhanced metabolic interactions. These findings provide valuable insights for environmental applications, including land reclamation and ecological engineering, and contribute to the development of effective strategies to mitigate petroleum hydrocarbon pollution and restore contaminated ecosystems.

Key words: *paraffin, Pseudomonas, tolerance, biodegradation.*

FOREWARNING ON SOME POLLUTANTS AND THEIR EFFECTS ON WATERFOWL

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Abstract

Anthropogenic pollution is becoming increasingly widespread in ecosystems worldwide. In recent years, we have observed negative consequences for many species, particularly birds. This review focuses on the impacts of common anthropogenic pollutants on aquatic birds, detailing a range of effects from direct mortality to sublethal impacts, including reduced fitness. There are interactions between these pollutants that can amplify their effects beyond those of each pollutant individually. Despite this, research on these interactions is still limited and requires more targeted investigation. As threats to avian species and anthropogenic pollution continue to rise, implementing mitigation measures is crucial for the preservation of these birds. This paper aims to evaluate specialized scientific articles, highlight, and understand the threats that bird species face.

Key words: *pollutants interactions, wild bird, toxic effects, environmental contamination.*

PHYSICOCHEMICAL STABILITY AND EMULSIFYING ACTIVITY OF A BIOSURFACTANT OF SALINE ORIGIN

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Abstract

Biosurfactants produced by microorganisms from saline environments have attracted increasing interest due to their potential to remain functional under conditions that limit the efficiency of chemical surfactants. The aim of the present study was to evaluate the physicochemical stability and emulsifying activity of a crude biosurfactant produced by a bacterial isolate from the Techirghiol saline lake. The experimental design included testing the biosurfactant at different pH values, NaCl concentrations, and temperatures, by determining the emulsification index at 24 h. Emulsifying performance was further evaluated in a simplified diesel-contaminated saline-water microcosm at different salinities. This study examines how the biosurfactant performs under high-salinity conditions and indicates potential value for hydrocarbon dispersion and microbial activity in saline environments.

Key words: *bacteria, biosurfactants, physicochemical stability, saline environments, diesel.*

**OCCURRENCE AND LEVELS
OF HAZARDOUS ORGANIC COMPOUNDS
IN SOILS FROM INDUSTRIAL AREAS**

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Abstract

Hazardous organic compounds are organic chemicals that pose risks due to their toxicity, persistence, bioaccumulation potential, or ability to contaminate environmental compartments such as soil, water, and air. This study aims to determine the occurrence and concentration levels of three major categories of hazardous organic compounds - organochlorine pesticides (OCPs), polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs) - in soils from industrial areas. For this purpose, 40 soil samples were collected from industrial sites in the southern region of the country, extracted using hexane-like solvents, and analysed by gas chromatography (GC) and high-performance liquid chromatography (HPLC). The results indicate that soil concentrations of PCBs ranged between 0.002 mg/kg and 0.326 mg/kg, whereas PAH concentrations ranged from 0.044 mg/kg to 12.022 mg/kg. Among OCPs, lindane and DDE - the main metabolite of DDT - were the most frequently detected OCPs in soil.

Key words: contamination, OCPs, PAHs, PCBs, soil.

MOBILITY AND TOXICOLOGICAL RELEVANCE IN THE EVALUATION OF HEAVY METAL TRANSFER FROM SOIL TO PLANTS

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Abstract

The classic transfer factor formula, widely used in studies dedicated to heavy metal mobility in the soil-plant system, represents a direct ratio between the metal concentration in the plant and that in the soil. Although valuable for general comparisons and for describing their behavior in the environment, this formula does not allow for an adequate separation between the actual forms of mobility, the toxicological characteristics of each metal, and strict reporting to the limits regulated by the Codex Alimentarius. In this context, the paper proposes the Assimilated Mobility Transfer Factor (AMTF), an extended, integrative formula that includes the toxicity coefficient, the mobile fraction in the soil, the actual level of accumulation in fruit, and the food regulations in force. Applying the AMTF to data sets from historically polluted areas, such as the Baia Mare Mining Basin, highlights consistent differences between the mobility of heavy metals and their actual accumulation in fruit, discrepancies that the classic ratio cannot capture. The new formula proposed for the AMTF provides an adequate, modern tool for current food safety and ecotoxicological risk studies.

Key words: food safety, heavy metals, mobile fraction, soil-plant transfer, toxicity coefficient.

INACTIVATION OF GRAM-POSITIVE AND GRAM-NEGATIVE BACTERIA BY USING ARGON COLD ATMOSPHERIC PRESSURE PLASMA

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Abstract

Cold atmospheric pressure plasma (CAPP) is a residue-free alternative for decontaminating surfaces and reusable equipment when chemical disinfectants are inconvenient, such as during field work in environmental engineering and land reclamation. Here, we tested an argon CAPP plume (atmospheric pressure, low-current DC discharge) against Staphylococcus aureus, Escherichia coli, and Pseudomonas aeruginosa after 5–120 s exposures. Antimicrobial activity increased with treatment time: inhibition-zone areas grew from 2.83 cm² (5 s) to 31.40 cm² (120 s). P. aeruginosa was the most sensitive (31.40 cm² at 120 s), whereas S. aureus and E. coli reached 11.30 cm². Viable counts for E. coli and P. aeruginosa dropped from >10⁶ to 10³ CFU mL⁻¹ after 120 s, while S. aureus showed no significant reduction at 120 s; for P. aeruginosa, counts decreased from >10⁶ to 10⁵ CFU mL⁻¹ after 15 s. Overall, these findings support CAPP as a practical, non-chemical option for rapid decontamination of hard surfaces (e.g., tools and sampling devices) in remediation and environmental monitoring workflows.

Key words: cold atmospheric pressure plasma, bacteria, susceptibility, surface sterilization.

CARBON STORAGE IN FOREST STANDS ON DEGRADED LANDS

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Abstract

In the context of expanding environmental degradation processes, degraded lands represent potential areas for forest plantations that help reduce soil erosion, increase carbon storage and biodiversity. Research conducted in 2025 aimed to determine the carbon stock (in soil, litter, forest biomass and deadwood) and the annual carbon sequestration capacity in forest stands established on degraded lands in the Curvature Subcarpathians region. The results indicate that soil and living biomass are essential components for storing organic carbon. Soil carbon stock is relatively stable (between 70 and 120 t/ha), while carbon in living biomass shows greater variation (between 45.78 and 258.24 t/ha). The distribution of carbon in soil, litter, forest biomass and deadwood reflects the influence of environmental conditions and stand structure on carbon storage dynamics. The results demonstrate that forest plantations on degraded lands represent an effective tool for carbon storage and for mitigating the effects of climate change, capable of providing significant ecosystem and socio-economic services.

Key words: carbon storage, degraded lands, forest biomass, stands.

ANTHROPOGENIC AIR POLLUTION IN URBAN AREAS

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Abstract

A study of the state of atmospheric air in a typical urban region - the city of Plovdiv and its surroundings, Bulgaria and the anthropogenic impact was conducted. Two specific incidents were discussed - a fire at the municipal solid waste landfill in the city of Plovdiv and the movement of heavy vehicles on a road with poor road surface in the region. The values of the main pollutants of the atmospheric air above the settlements were recorded (PM_{10} , SO_2 , NO_2 , O_3 , CO , lead and benzene). A chemical and ecological assessment of the state of the atmospheric air was carried out. The air quality index was analyzed. Deviations from the permissible values are observed only for dust (PM_{10}) - irregular higher hourly values above the standard, which is for 24 hours. The risk to human health, the impact of pollution on living organisms, on protected species, habitats and territories were assessed. Measures to improve the ecological state of the air were determined.

Key words: air pollution, chemical state, ecological assessment, air quality index, anthropogenic impact.

NATURA 2000 SITE DEALURILE STREHAIA- BÂTLANELE - UPDATED INFORMATION ON SPECIES AND HABITATS OF COMMUNITY INTEREST

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Abstract

*Situated in south-west Romania (Mehedinți County), with a temperate-continental with sub-Mediterranean influences climate, the protected area Dealurile Strehaia-Bâtlanele (Natura 2000 code ROSCI0405 and ROSAC0405) is a small area (803.9 ha) designated on the basis of the presence of Hermann's tortoise (*Testudo hermanni*) and two forest habitats (91M0 Pannonian-Balkan turkey oak-sessile oak forests and 91Y0 Dacian oak & hornbeam forests). There is very little information about this site (standard forms and national & international websites). Following field trips (summers 2018-2019), our assessment of plant, herpetofauna and invertebrate species and habitats highlighted the existence of species listed in the Habitats Directive, some of them having here a new distribution locality in Romania. The human impact (trash, habitat fragmentation, agricultural field development, forest clearcutting, distribution of invasive species, etc.) is increasing in recent years, and thus this protected area is threatened as a whole. This study highlights the high biological value of the site. The increasing intensity of human pressures poses a major threat to ecosystem integrity, emphasising the need for appropriate conservation and management measures.*

Key words: Natura 2000 site, community interest species and habitats, high biological value.

**PHYSICAL AND MECHANICAL CHARACTERISTIC
ASPECTS FOR CLADDING PRODUCTS
BASED ON RICE HUSKS AND HEMP STALKS**

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Abstract

Natural agro-industrial by-products and the circular economy concept are closely interconnected, both being essential for promoting sustainability in various representative fields of the economy, such as agriculture, the food industry, the construction industry, etc. The establishment of circular practices in the agro-industrial and construction sectors leads to the minimization of deposits of such materials/natural waste, optimizes their use by increasing their value, and simultaneously creates economic, environmental and social benefits. The paper presents aspects of the experimental research carried out with the aim of the superior valorization of two local agro-industrial by-products, namely rice husks and hemp stalks, by obtaining cladding products usable in construction. It is recognized that due to their compositional and structural particularities, the two natural materials, integrated in different types of construction materials, give them mechanical resistance, thermal insulation properties and acoustic performance. The products resulting from this research were studied from physical and mechanical point of view, considering that additional, multi-criteria tests are necessary, to gain a complete evaluation regarding the field of use in constructions of this type of innovative products.

Key words: *agro-industrial by-products, waste, circular economy, construction, sustainability.*

CULTIVABLE MICROALGAE FROM PEATLAND WATERS: MORPHOLOGICAL FEATURES AND PIGMENT PROFILES

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Abstract

Peatlands represent globally significant carbon reservoirs, and the microalgae inhabiting these sensitive ecosystems play an essential role in climate change mitigation. Peatland microalgae occur not only in surface waters but also within peat layers, contributing to carbon fixation through photosynthesis. This study investigates the diversity of cultivable microalgae from peatland waters and provides a preliminary characterisation based on pigment composition. Water samples were collected from two restored Romanian peatland sites, Avrig Peatbog and Mlaca Tătarilor Peatbog, selected due to their similar characteristics. Microalgal strains were isolated and cultivated under laboratory conditions in BG-11 medium. Identification was performed at the genus level using the microphotography method, an approach suitable for baseline diversity assessment studies. Photosynthetic pigments were extracted from the isolates and analysed using UV-Vis spectrophotometry. Ten cultivable microalgal strains were obtained, with higher diversity in Avrig Peatbog compared to Mlaca Tătarilor Peatbog. The combined morphological and pigment-based analysis revealed microalgal genera adapted to acidic, humic-rich peatland waters and differences in pigment profiles among isolates. These findings provide baseline data and support future molecular, ecological, and biotechnological investigations.

Key words: *peatlands, cultivable microalgae, pigments spectrophotometry.*

BIOMATERIALS - BASED COATINGS WITH INDOOR EMISSION CONTROL PROPERTIES

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Abstract

At the international level, current concerns of scientists have been observed, through which concerted actions are being taken, both in the spirit of developing the circular economy, and to reduce carbon dioxide emissions. To harness synergistically the potential of the two global challenges, our work has focused on developing innovative construction products by integrating rice husks and hemp stalks, two natural agro-industrial by-products. Biomaterials - based coatings with responsive potential have been obtained, characteristics that have been confirmed by verifying the innovative coatings through their indoor emission control properties by means of TVOC emission, CO₂ and/or CO absorption capacity. From the comparative analysis of the way in which the three responsive characteristics are correlated for each tested product, it is highlighted the importance that the distribution of the nature and size of the pores in the structure of the respective materials has on the mechanisms underlying the mentioned characteristics of the obtained products. Further research is necessary to specify and capitalize on the specific mechanisms of this type of innovative coatings.

Key words: *circular economy, climate change, indoor air quality, natural agro-industrial by-products.*

**ON THE IMPORTANCE OF ENVIRONMENTAL
FACTOR PROTECTION IN KEY AREAS OF THE
BORDER ZONE. CASE STUDY ROMANIA-UCRAINA,
MARAMUREȘ MOUNTAINS**

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Abstract

Key areas located in the northernmost part of Romania, within the Maramureș Mountains along the northern border with Ukraine, represent agro-mountain ecosystems of high value for environmental stability and regional ecological security. This cross-border area is exposed to increased anthropogenic pressures in the context of the armed conflict in Ukraine, which amplifies the vulnerability of environmental components, biodiversity, and ecosystem functionality. The study addresses the assessment of environmental impacts on soil, water resources, biodiversity, and habitat fragmentation through an integrated approach specific to environmental science and engineering. The methodology is based on environmental quality indicators, pedological and hydrological analyses, ecosystem condition assessment, multi-criteria evaluation methods, and GIS tools for the spatial analysis of pressures and impacts. The results highlight the need to implement preventive-oriented environmental protection measures aimed at biodiversity conservation and the reduction of ecological degradation risks in border regions. Romania-Ukraine cooperation is essential for the sustainable management of environmental impacts in transboundary areas affected by conflict-induced regional instability.

Key words: key-areas, transboundary area, environmental impact.

THE INFLUENCE OF INOCULATION WITH SYNTHETIC MICROBIOMES ON THE EVOLUTION OF SOIL CARBON SEQUESTRATION UNDER THERMAL STRESS

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Abstract

Synthetic microbial communities form networks of diverse microorganisms interconnected through a variety of interspecific interactions. Considering that positive interactions are favored in more stressful environments, assessments of the influence of complex synthetic microbial communities required a more precise identification, analysis of the evolution and amplitude of interactions. The effect of inoculation and the involvement of synthetic microbiomes in carbon sequestration/release was determined after evaluations of glycoproteins, exopolysaccharides (EPS) and dissolved organic carbon (DOC) content, under thermal stress conditions (35°C and 45°C). The Mollic Gleysol inoculated with microbiomes M5 and M7 had a DOC content in the rhizosphere at both temperatures below the level of the uninoculated control. Also, M7 induced the highest changes in glycoprotein content, which, after 14 days at 45°C, reached 1.79 mg·g⁻¹. Under similar experimental conditions, M5 was highlighted by inducing the highest changes in exopolysaccharide content (587 μg·ml⁻¹). Synthetic microbiomes (M1, M4, M5, M7) promoted beneficial interactions in soil after inoculation, strengthened beneficial microbial cooperation and improved organic carbon decomposition/cycling in the rhizosphere.

Key words: thermal stress; microbiome; glycoproteins; exopolysaccharides; dissolved organic carbon.

FROM WASTE TO RESOURCE: IMPLEMENTING SPENT GARNET (SG) AS A PARTIAL FINE AGGREGATE IN CEMENT-BASED MATERIALS - TECHNICAL, LEGAL AND COMMERCIAL PERSPECTIVES

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Abstract

The growing demand for natural aggregates and stricter environmental regulations are driving the construction sector toward the valorisation of industrial by-products. This study investigates the technological transfer potential of Garnet sand waste (SG) as a partial substitute for natural fine aggregates in cement-based building materials, including mortars and concrete. Experimental results at laboratory and preliminary pilot scale demonstrate that controlled replacement levels of SG can achieve comparable or improved fresh and hardened properties relative to reference mixes, while meeting durability and performance requirements. Beyond technical validation, the paper examines the legislative framework governing waste reuse in construction, with particular attention to aggregate standards, waste-to-product transition, and conformity assessment procedures. Finally, commercial and market aspects are addressed, identifying barriers and drivers for industrial uptake, stakeholder acceptance, and potential business models within a circular economy context. The results provide an integrated pathway proposal for transforming Spent Garnet (SG) sand waste from an industrial residue into a viable construction resource, supporting sustainable material innovation and market implementation.

Key words: Spent garnet (SG), fine aggregate substitution, cement-based materials, technology transfer, waste regulation, circular economy, market adoption, sustainable construction.

DETERMINATION OF CONCRETE PERMEABILITY WITH CERAMIC WASTE CONTENT

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Abstract

The paper presents an experimental analysis of the influence of partially replacing natural aggregates with ceramic waste on the permeability of concrete. The use of recycled materials in concrete aims to reduce environmental impact and promote the reuse of waste from the construction industry. In this study, concrete samples were prepared with different substitution levels of aggregates (0%, 50% of 0-4 mm aggregates, 50% of 4-8 mm aggregates, and 50% of 8-16 mm aggregates), and permeability characteristics were determined using standardized methods. The chemical composition of the ceramic waste aggregates was determined by X-ray fluorescence (XRF) analysis to characterize their oxide content and potential influence on concrete behaviour. The results indicate that the addition of ceramic waste affects the pore structure of concrete, having an impact on the permeability coefficient and the material's durability. Water permeability tests according to EN 12390-8 showed an increase in water penetration depth from 700 mm in the control concrete to 850-1300 mm in concretes with ceramic aggregates, depending on the replaced fraction. The conclusions highlight the potential of using ceramic waste in concrete as a sustainable solution with positive effects on the circular economy and technical performance.

Key words: ceramic waste, concrete permeability, recycled aggregates, sustainable construction, durability, circular economy.

DETERMINATION OF SPLITTING TENSILE STRENGTH OF PAVING BLOCKS CONTAINING CERAMIC WASTE

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Abstract

This study investigates the influence of incorporating ceramic waste into paving block mixtures on their splitting tensile strength. The use of recycled ceramic materials aims to reduce environmental impact and promote sustainable construction practices. The aggregates were characterized in terms of particle size, shape, bulk density, porosity, water absorption, hardness, and chemical composition, with X-ray fluorescence (XRF) analysis used to determine the main oxides present in the ceramic waste. Experimental tests were conducted on paving blocks with varying percentages of ceramic waste replacing natural aggregates, including partial (50%) and full (100%) replacement. Splitting tensile strength was determined according to standardized procedures. The results indicate that ceramic waste affects the mechanical performance of paving blocks, with partial replacement slightly reducing tensile strength, while full replacement improves performance beyond the control mix. These findings highlight the importance of aggregate characterization for understanding mechanical behavior and support the potential of ceramic waste as an alternative aggregate in paving block production, contributing to circular economy objectives, particularly in low- to moderate-traffic applications.

Key words: *splitting tensile strength, paving blocks, ceramic waste, recycled aggregates, sustainable construction, durability.*

EXPERIMENTAL STUDY ON BRICKS MADE WITH BRICK WASTE AND SAWDUST

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Abstract

The paper presents an experimental study on the production and testing of bricks that incorporate brick waste and sawdust as a sustainable solution for the construction industry. The aim of the research is to reduce environmental impact by reusing recycled materials and wood processing residues. Samples were manufactured using brick waste fractions (0–4 mm, 4–8 mm, 8–16 mm) and sawdust of different particle sizes, with cement as a binder, and tests focused on physical and mechanical properties (compressive strength), density, water absorption, and drying behavior. Brick waste was analyzed using X-ray fluorescence (XRF) spectroscopy in order to determine its chemical composition and elemental distribution. The results indicate that the addition of sawdust influences density and porosity, while ceramic waste helps maintain structural strength. Data show a reduction in dry density by 5.8%, saturated density by 7.2%, water absorption by 13.8%, and compressive strength by 55.6%, indicating that the incorporation of brick waste and sawdust produces lighter, less porous bricks with significantly reduced mechanical strength. The conclusions highlight the potential of these materials for producing eco-friendly masonry elements.

Key words: brick waste, sawdust, experimental bricks, recycled materials, compressive strength, sustainable construction.

POTENTIAL OF SELECTED AROMATIC ASTERACEAE SPECIES FOR PHYTOREMEDIATION OF HEAVY METAL-CONTAMINATED SOILS

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Abstract

Aromatic plants of the Asteraceae family have significant potential for phytoremediation due to their rapid growth, high biomass production, and resilience in contaminated soils. This study evaluated the capacity of Artemisia absinthium, Achillea millefolium, Tanacetum balsamita, Tanacetum vulgare, and Artemisia dracunculus to accumulate heavy metals in soils contaminated by industrial activities in Bulgaria. Field experiments were conducted at contaminated sites, where soil and plant tissues (roots, stems, leaves, and flowers) were analysed for Pb, Cd, and Zn using ICP-OES. Bioconcentration (BCF) and translocation (TF) factors were calculated to assess metal uptake and distribution from roots to aboveground biomass. The results demonstrate considerable accumulation of Pb and Zn, with A. absinthium and A. millefolium exhibiting the highest BCF and TF values, indicating their suitability as the most effective species for phytoextraction. T. balsamita and T. vulgare displayed moderate accumulation with limited translocation, suggesting their potential for phytostabilisation, whereas A. dracunculus showed minimal uptake. These findings provide important insights into metal accumulation and translocation in Asteraceae species and identify the most promising species for the sustainable management of industrially contaminated soils.

Key words: Asteraceae, aromatic plants, heavy metals, phytoremediation, bioaccumulation, soil contamination.

NICKEL SPECIATION AND BIOAVAILABILITY IN SERPENTINE SOILS OF THE EASTERN AND SOUTHERN RHODOPE, BULGARIA

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Abstract

Serpentine soils in the Eastern and Southern Rhodopes, Bulgaria, exhibit elevated nickel (Ni) concentrations and distinct mineralogical characteristics, dominated by serpentine minerals (antigorite, lizardite) and the Ni-rich willemseite. This study assesses Ni speciation, mobility, and potential bioavailability by analysing soil physicochemical properties, iron oxide mineralogy, and selective chemical extractions targeting exchangeable, DTPA-extractable, and iron oxide-associated Ni fractions. Results indicate that Ni distribution depends on pedogenetic development: in moderately developed soils, Ni preferentially associates with amorphous and poorly crystalline iron oxides, while in more advanced soils, well-crystallised oxides stabilise Ni and limit its mobility. The Fe₀/Fe_d ratio reflects oxide crystallinity and pedogenic stage, serving as a key control on Ni behaviour. Multivariate analyses, including PCA and cluster analysis, reveal a pedogenetic continuum linking mineralogical inheritance, iron oxide transformation, and Ni fractionation. This framework enables the prediction of potential Ni bioavailability and highlights the importance of pedogenesis and secondary mineral phases in regulating Ni dynamics. The findings improve understanding of Ni behaviour in temperate ultramafic soils and provide a basis for ecological risk assessment and sustainable management of serpentine ecosystems.

Key words: bioavailability, nickel (Ni), Rhodopes Mountains, serpentine soils, soil geochemistry.

PRELIMINARY ASSESSMENT OF PHOTOCATALYTIC PERFORMANCE POTENTIAL IN TiO₂-MODIFIED BI-LAYER GEOPOLYMER PAVING BLOCKS

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Abstract

This study presents a preliminary assessment of the potential photocatalytic performance of bi-layer geopolymer paving blocks modified with titanium dioxide (TiO₂) in the surface layer. The research aims to explore the feasibility of integrating photocatalytic functionality into geopolymer-based paving elements as a step toward developing sustainable, self-cleaning, and pollution-mitigating building materials. Bi-layer paving blocks prototypes were produced using a geopolymer base layer and a TiO₂-enhanced top layer designed to interact with environmental light. Initial investigations focused on physical and mechanical characterization, including density, water absorption, compressive strength, and visual/microstructural observations of the interface between layers. These preliminary findings establish a foundation for upcoming studies focused on quantifying photocatalytic efficiency, assessing durability under environmental exposure, and optimizing the formulation and processing parameters to enhance performance.

Key words: *geopolymer paving blocks, photocatalytic materials, bi-layer composites.*

VALORIZATION OF STEEL FURNACE SLAG FOR CONSTRUCTION APPLICATIONS: TECHNICAL CHALLENGES AND OPPORTUNITIES

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Abstract

Steel furnace slags is a strategically important secondary resource for sustainable building materials, but its efficient utilization requires a clear understanding of its highly variable behaviour. Previous studies indicate that slag-derived composites often exhibit reduced workability due to particle size and shape, high water demand, and the slow reactivity of certain silicate phases. Dimensional stability remains a critical issue, as several types of steel slag from furnaces contain phases predisposed to delayed expansion, mainly related to the mineralogical composition of the particles. Furthermore, the presence of heavy metals requires detailed characterization, representing a critical factor in assessing the safety of using steel furnace slag in construction composites. In addition to these generalized mechanisms, an important regional challenge is the utilization of the large quantities of steel furnace slag accumulated in Romania from decades of steel production. These materials remain in landfills without being given a new cycle of use, despite their potential for integration into cement-based composites and civil infrastructure. This article examines the main technical limitations associated with the use of steel furnace slag, while highlighting possible characterization strategies and processing methods that can enable the safe and efficient use of existing steel furnace slag resources in Romania.

Key words: secondary raw materials, circular economy, steel furnace slag valorization.

**CORRELATION BETWEEN THE PHYSICAL
PROPERTIES AND NPK NUTRIENT CONTENT
OF ORCHARD SOILS FOR THE SELECTION OF
APPROPRIATE SOIL DECONTAMINATION
TECHNOLOGIES**

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Abstract

The network of underground pipelines used to transport petroleum products may crack and lead to soil contamination. As these pipelines can be located near orchards, this study investigated soils from quince, plum, and pear orchards. The physical properties of the soils were analyzed comparatively, including density, texture and granulometry, capillarity and permeability. Capillarity, permeability and retention capacity were determined for both water and a petroleum product considered a potential soil pollutant. The analysis of physical properties, together with the NPK nutrient content of each soil type, was used to facilitate the selection of appropriate decontamination technologies. Two pollutant removal methods applicable to all three soil types were evaluated: thermal desorption desorption 752 °F and successive extraction using two solvents, petroleum ether and benzene. Nutrient content was determined before and after each decontamination process.

Key words: orchard soil, nutrients, pollutant, decontamination.

DYNAMICS OF AIRBORNE MICROORGANISMS ACCORDING TO ENVIRONMENTAL CONDITIONS

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Abstract

The present study aims to track the dynamics of airborne microorganisms in the territory of Sofia, Bulgaria in relation to the dynamics of fine particulate matter (FPM). Sampling points were 20, which cover territories with different dynamics - parks, intersections, central and peripheral parts, etc. Spin Air sampler was used. Sampling was carried out at a height of 1.5 m, for optimal consideration of the potential impact on human health. Specific microbiological characteristics were recorded - total microbial number in 1m³, the main microbiological groups and their ratio and the percentage of pigment forms in relation to the change in the UV index. Specific environmental parameters related to airborne microorganisms were also recorded - amount of FPM, air temperature, humidity, pressure, wind direction and speed, UV index. The data show a specific distribution of microbial groups, as well as a certain microbial load in points with intensive car traffic. There is a direct correlation between the amount of pigment forms and environmental factors. The present pilot study shows a correlation between PM and microorganisms in ground air.

Key words: *airborne microorganisms, air quality, fine particulate matter.*

A LOW-COST, OPEN-SOURCE APPROACH FOR SENSOR-BASED LIGHT MANAGEMENT IN PROTECTED CULTIVATION SYSTEMS

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Abstract

*Efficient light management represents a key challenge in protected cultivation systems, particularly when cost constraints limit the use of advanced dimmable lighting technologies. This study presents a low-cost, open-source, sensor-based approach for practical light management in protected horticultural environments. A custom-built multi-stage lighting system was combined with a multispectral light sensor used as a control variable, while a reference PAR sensor was employed for calibration under real operating conditions. Light intensity was regulated through automated multi-stage switching with integrated energy monitoring, enabling feedback between illumination targets and electrical power consumption. The control logic was implemented using an open-source automation platform, allowing data acquisition, logging, and system adaptability. The experimental setup was evaluated under greenhouse conditions using *Capsicum spp.* as experimental plant support. Rather than replacing professional photometric instruments, the proposed approach demonstrates the functional integration of low-cost sensors and open-source tools for scalable and energy-efficient light management applications.*

Key words: artificial lighting; DLI control; Home Assistant; open-source automation; PPFD estimation.

**IMPACT OF ANTIBIOTIC-CONTAMINATED
WASTEWATER IRRIGATION ON PHOTOSYNTHETIC
PERFORMANCE AND STRESS RESPONSES
IN *BRASSICA OLERACEA***

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Abstract

*This study investigates the effects of expired antibiotics introduced via irrigation on two Brassica oleracea crops, cabbage (*B. oleracea* var. *capitata*) and cauliflower (*B. oleracea* var. *botrytis*), focusing on photosynthetic performance and biochemical responses. Improper disposal of expired pharmaceuticals can contaminate wastewater with antibiotic residues, creating a realistic pathway for soil and crop exposure. Plants were irrigated with wastewater-like solutions containing antibiotics at 1 g/L, representing four major classes: macrolides (azithromycin, clarithromycin), penicillins (amoxicillin), cephalosporins (cefalexin, cefixime), and lincosamides (clindamycin). Antibiotic exposure significantly reduced net CO₂ assimilation and stomatal conductance, indicating impaired photosynthetic capacity. Chlorophyll a and b concentrations declined markedly, suggesting pigment degradation and/or inhibition of biosynthesis. In contrast, increased zeaxanthin levels indicate activation of photoprotective mechanisms under oxidative stress. While total phenolic content showed limited variation, flavonoid concentrations decreased significantly, reflecting disruption of secondary metabolism. Antioxidant activity was also altered, indicating changes in redox balance. These findings highlight the potential risks of antibiotic-contaminated wastewater irrigation for crop physiology and agroecosystem sustainability.*

Key words: antibiotic-contaminated wastewater, irrigation, *Brassica oleracea*, photosynthesis.

THE DUAL CHALLENGE OF CO₂ AND OZONE: INSIGHTS INTO PHOTOSYNTHESIS, VOC EMISSION AND BIOCHEMICAL RESPONSES

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Abstract

*Human activities release various pollutants into the atmosphere, many of which directly affect plants. Among these pollutants are carbon dioxide (CO₂), which serves as the essential substrate for photosynthesis, and ozone (O₃), which acts as a harmful oxidant. With a particular emphasis on photosynthetic parameters, pigment content, volatile organic compound emissions, and biochemical features, this research investigates the responses of *Raphanus sativus* plants to increased exposure to carbon dioxide and ozone, focusing on three different varieties: Johanna, Helga, and Rozaria. To create conditions similar to those in the real world, the plants were grown under varying CO₂ concentrations (400, 800, and 1200 ppmv) and subjected to high ozone levels (100 ppb). Photosynthetic parameters were assessed through a gas exchange system, while volatile organic compound (VOC) emissions were analyzed using gas chromatography-mass spectrometry (GC-MS). Additionally, photosynthetic pigments were identified and quantified using the UHPLC-DAD system. Higher CO₂ levels initially enhanced net photosynthesis, but ozone severely reduced photosynthesis, leading to partial recovery after 24 hours. Ozone degraded chlorophyll a and b at all CO₂ concentrations, whereas zeaxanthin protected the photosynthetic system.*

Key words: *climate changes, abiotic stress, secondary metabolites, ozone fumigation.*

LABORATORY STUDIES AND MEASUREMENTS FOR THE IDENTIFICATION OF THE ACOUSTIC FOOTPRINT AND THE IMPACT NOISE PRODUCED BY WALKING OF PERSONS WEARING DIFFERENT TYPES OF FOOTWEAR

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Abstract

Considering specific types of noise sources that can act in civil buildings with different destinations, produced from usual human activities that are common in rooms, a series of laboratory researches and studies were carried out in Romania, in project PN 18-35.03.03, about human acoustic footprint and the impact noise produced by walking of persons wearing different types of footwear, on the floor. Under certain conditions of repeatability, these noise sources may affect human health. Experimental acoustic measurements were made in the impact noise isolation stand, where several human subjects walked on foot with various types of footwear on an experimental floor. The noise produced by the steps, recorded in the emission and in the reception room, and the results of the acoustic characteristics (spectra, noise levels) obtained, for many cases, were studied considered the psychoacoustic perception of the people. The results of the acoustic measurements show that the psychoacoustic discomfort for humans is due to the existence of a significant difference, of 8...10...30 dB, between the minimum and maximum values of the received noise level.

Key words: building acoustics, impact noise, impact sound insulation, human acoustic footprint, footwear on the floor.

HYBRID RENEWABLE ENERGY SUPPLY SYSTEM- STORAGE REQUIREMENTS CONSIDERING SEASONAL VARIATION OF PV OUTPUT

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Abstract

The transition toward sustainable, decentralized energy systems has accelerated the deployment of hybrid renewable energy supply systems (HRESS) in remote and off-grid areas worldwide. Hybrid systems that combine photovoltaic (PV) and wind energy technologies have emerged as particularly attractive solutions due to their ability to harness complementary renewable resources, reduce dependence on fossil fuels, and improve energy security for isolated users. Although the literature contains numerous technical studies and hundreds of specialized articles on hybrid renewable energy supply systems, detailed analyses addressing yearly storage requirements that explicitly account for seasonal variations in renewable generation remain comparatively limited. The main objective of this paper is to address this gap by proposing an analytical method to determine the required annual energy storage capacity necessary to ensure continuous supply to an isolated consumer, considering the seasonal variation of PV output. The proposed method will be illustrated with a concrete application for a vineyard of 2-3 ha with a small guesthouse in a mountainous area in Romania

Key words: Hybrid Renewable Energy System, seasonal photovoltaic (PV) energy storage, sizing method of storage.

***IRIS PSEUDACORUS*: A PROMISING NATURE-BASED SOLUTION FOR AQUATIC PHYTOREMEDIATION**

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Abstract

Iris pseudacorus L., an aquatic species native to Europe, represents a promising nature-based solution (NbS) for the phytoremediation of waters contaminated with metals, nutrients, emerging organic pollutants, pharmaceutical residues and microplastics. Recent studies indicate that this species can absorb and accumulate metals and metalloids, reduce the concentrations of organic compounds such as PFAS and bisphenols and remove microplastics from the water column, without significant negative effects on plant growth. In the case of pharmaceutical residues, including psychoactive compounds, antibiotics and hormones, Iris pseudacorus has demonstrated high removal performances, without bioaccumulation in leaves or roots. Association with arbuscular mycorrhizal fungi can reduce PFAS-induced oxidative stress and improve purification efficiency, while enzymatic detoxification mechanisms allow the biotransformation of bisphenols into less toxic metabolites. The plant also contributes to the restoration of ecological balance and provides habitat for aquatic fauna. Therefore, this review aims to present the potential of water phytoremediation by Iris pseudacorus as NbS, evaluating its capacity to remove emerging inorganic and organic pollutants, as well as microplastics.

Key words: *Iris pseudacorus, phytoremediation, water contamination.*

**BACTERIAL MICROBIOTA IN AQUATIC
ENVIRONMENTS AND THE BIODEGRADATION
POTENTIAL OF SUSTAINABLE MATERIALS:
INSIGHTS INTO ENVIRONMENTAL FATE. A REVIEW**

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Abstract

The balance of ecosystem is maintained by microorganisms that regulate the composition of organic matter; however, the risk of pathogenic contamination represents a significant challenge for aquaculture. In recent years, a global strategy to replace petroleum-based polymers has been the development of durable, innovative and sustainable alternatives, namely biodegradable materials. The bacterial colonization of biodegradable materials is more extensive than of conventional materials, promoting microbial diversity and facilitating the transformation of biodegradable polymers into final metabolic products. Environmental condition influences the biodegradation and the relationships of biodegradable alternatives with the microbiome of the aquatic environments remain insufficiently explored. This study aims to contribute new directions to biomaterials research by filling current knowledge gaps, specifically by deepening the understanding of material biodegradability under the influence of bacterial factors in natural aquatic environments. The proactive nature of the study lies in evaluating long-term effects of biodegradable solutions in natural ecosystems, developed to reduce the use of conventional materials and in opening new research directions for investigating the environmental fate of biodegradable materials as their production and use continue to increase.

Key words: *biodegradable materials, aquatic ecosystem, bacterial microbiota, environmental risk, biodegradation.*

MOISTURE-LIPID RELATIONSHIPS IN MUSCLE TISSUE OF FRESHWATER FISH SPECIES AS INDICATORS OF ECOLOGICAL STATUS IN THE LOWER DANUBE RIVER

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Abstract

The composition of fish muscle is influenced by environmental factors and can be used to assess the status of the aquatic ecosystems. This study explores the relationship between moisture and lipid content in the muscle tissue of selected freshwater fish species from the Lower Danube River, aiming to evaluate their potential as ecological indicators. Eight edible fish species, asp, vimba bream, perch, wels catfish, zander, pontic shad, common roach, and common carp, were included in the analysis. Moisture content was determined by freeze-drying and total lipid content was assessed on the dry fish using the Soxhlet extraction method. Lipid content was expressed both as dry and wet weight to allow an extensive interpretation in a biologic and environmental context. The results for moisture content ranged from 59.0% to 82.0%, while lipid content (expressed as wet weight) showed high variability among species. There was observed a strong inverse correlation between moisture and lipid content ($r \approx -0.91$), which suggests that fish muscle composition is reflecting differences in energy storage and environmental conditions. The findings of this study support the use of biochemical parameters as complementary indicators in aquatic environmental assessment, particularly in freshwater systems subject to environmental variability.

Key words: freshwater fish, Danube river, lipids, soxhlet extraction, freeze-drying.

TRACING PESTICIDES AND PHARMACEUTICALS IN WATER AND SEDIMENTS OF THE DANUBE DELTA

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Abstract

The Danube Delta is listed on UNESCO's World Heritage List for its exceptional value, attributed to the numerous natural ecosystems with remarkable characteristics and high biodiversity that have been preserved in an almost original state. Despite the significant environmental initiatives implemented in recent years, this place remains at risk from both natural and human-made stresses that could alter its ecosystems. This study focuses on determining the contamination degree with emerging and persistent pollutants in the deltaic and pre-deltaic Danube zone. In the present investigation, the pharmaceutical compounds in water samples and pesticides in sediment samples were assessed by considering the physicochemical properties of the targeted contaminants and their interactions with ecosystem matrices. Among the analyzed water samples, the compound caffeine recorded the highest concentration (17.33 ng/L), while the compound carbamazepine registered the lowest value, respectively 0.31 ng/L. The sediment samples were freeze-dried and analyzed in terms of organochlorine and organophosphorus pesticides. The highest pesticide concentrations were identified in the terminal sampling point, including 3.45 ng/g of dichlorodiphenyltrichloroethane (DDT).

Key words: pesticides, pharmaceuticals, danube delta, water, sediment.

**STUDY OF THE DYNAMICS OF SOME
WATER QUALITY PARAMETERS
IN THE PRUT RIVER AREA DURING 2014-2023**

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Abstract

The Prut River area represents an area of maximum importance, considering its international character and RAMSAR-type areas. In this study, we present the statistical analysis of the measurements carried out on the water quality parameters in the Prut River area, covering a period of 10 years. In this way, we were able to establish the trend of evolution of temperature, pH, turbidity, etc. and predictions can be made in this way. The methods used were ANOVA and especially multivariate analysis procedures. The conclusions that emerge are of great importance, especially for the evaluation of the protected area of Lake Beleu and the lower Prut floodplain area.

Key words: *statistical methods, water quality parameters, ANOVA, multivariate methods.*

**SEASONAL AND DIURNAL DYNAMICS
OF SIZE-RESOLVED PARTICULATE MATTER
IN AN URBAN AREA OF GALAȚI, ROMANIA,
BASED ON CONTINUOUS RAPID-E MONITORING**

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Abstract

Fine and ultrafine particulate matter (PM) is a major environmental and public health issue, particularly in densely populated urban areas exposed to significant anthropogenic emissions. This study presents an analysis of PM concentrations based on size in a high-traffic area of Galați, Romania, using the REXDAN Research Center monitoring system and the RAPID-E real-time analyzer. The continuous measurements were carried out between December 31, 2023 (10:00 p.m.) and December 31, 2025 (10:00 p.m.), covering the particle size fractions of 0.3, 0.5, 1 and 5 μm. In addition to an earlier study of daily and weekly variations, this work examines seasonal variability as well as diurnal (day/night) contrasts. Statistical and temporal analyses were used to characterize fluctuations in PM concentrations and to identify trends related to weather conditions and anthropogenic activities. The results improve the understanding of particulate dynamics in urban settings and support the development of effective air quality management strategies.

Key words: *particulate matter (pm), seasonal variability, diurnal variation, urban air quality, RAPID-E monitoring system.*

**INTERRELATIONSHIP BETWEEN SOIL
MICROORGANISMS AND AIRBORNE MICROFLORA
IN URBAN ENVIRONMENT**

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Abstract

The present study aims to establish the potential similarity between airborne microorganisms and soil microorganisms. We analyze the percentage of similarity based on dominant types of soil microorganisms and their frequency of occurrence in ground air, as well as their association with specific fractions of fine dust particles. For the purpose of the study, eight sampling plots were selected, with different anthropogenic pressure. A six-stage cascade impactor was used to collect air samples. Soil samples were taken from a depth of 0-15 cm. The dominant types of microorganisms were determined, both for soils and air samples. DNA identification was performed and the percentage of similarity and occurrence was established. The results show a specific distribution of soil microorganisms in a specific fraction of fine dust particles. The amount of soil microorganisms, as a percentage similarity to the air microflora, increases with increasing anthropogenic pressure. This pilot study shows the need for enhanced measures and compliance with environmental hygiene requirements, in order to optimize the urban environment

Key words: *airborne microorganisms, soil microorganisms, DNA, 16S rRNA, urban environment.*

INVESTIGATION OF HYDROCARBON POLLUTION IN THE OIL TERMINAL CONSTANȚA AREA USING ELECTRICAL RESISTIVITY METHODS AND HYDROSTATIC REGIME ANALYSIS

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Abstract

Soil and groundwater contamination with hydrocarbons represents a major environmental issue in port–industrial areas, with direct impacts on agricultural ecosystems and the quality of life of local populations. This study investigates the degree of pollution in the Oil Terminal Constanța North area, located outside the industrial enclosure, within a residential zone where the persistent smell of hydrocarbons indicates active contamination. Geophysical investigations were carried out using the Vertical Electrical Sounding (VES) method along four electrical profiles (P1, P2, P3, and P4), with a spacing of 10 m between measurement points. The main objective was to determine the geological structure, identify the groundwater table, and highlight its relationship with the hydrocarbon pollution plume. The inverted geoelectrical sections, characterized by low RMS values, reveal low-resistivity anomalies associated with hydrocarbon-saturated materials, predominantly located at the groundwater level. Correlation of the geoelectrical results with the hydrostatic level map indicates a groundwater flow direction oriented toward the Black Sea, facilitating pollutant migration. The results confirm the presence of active hydrocarbon pollution, with potential impacts on agricultural soils and the coastal environment.

Key words: *Hydrocarbon contamination, groundwater migration, electrical resistivity sounding, pollution plume, coastal environment.*

ELECTROCHEMICAL SENSORS FOR DETECTING ENVIRONMENTAL POLLUTANTS - A REVIEW

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Abstract

Electrochemical sensors are an efficient and versatile tools for monitoring environmental pollutants, providing information on target analytes in a rapid, sensitive and cost-effective manner and representing a good alternative to conventional methods such as spectrophotometry and chromatography in real time or on-site analysis. These sensors use electrochemical methods, including amperometry, voltammetry and potentiometry, to detect a wide range of environmental pollutants, including heavy metals, pesticides and other toxic chemicals, making them well-suited for environmental monitoring. Due to their simplicity, accuracy, low cost and their performance (stability, selectivity, LOD in the micro and nanomolar range) and because they can be modified with nanomaterials, enzymes and molecularly imprinted polymers, sensors and biosensors are increasingly used in environmental monitoring and pollution control. Therefore, this work proposes to present a review of the most recent developments in the detection of environmental pollutants using electrochemical sensors.

Key words: *electrochemical sensor, enzyme, nanomaterial, pollutant.*

MONITORING ENVIRONMENTAL QUALITY VIA NITRATE ACCUMULATION IN GREENHOUSE LETTUCE (*LACTUCA SATIVA* L.)

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Abstract

Public health concerns related to nitrate accumulation in vegetables are increasing, as nitrate can be converted into nitrite and contribute to the formation of harmful N-nitroso compounds. Due to its high capacity to accumulate nitrates, lettuce represents a suitable crop for monitoring the effects of fertilization practices on environmental quality in greenhouse systems. This study evaluated nitrate, nitrite, and ammonium levels in greenhouse-grown lettuce from two sources: supermarkets and local producers. Three samples were collected from supermarkets, four from local producers. Samples were separated into leaves, roots, and growing medium (soil), yielding 21 representative samples. Differences were observed in concentrations and distribution patterns. Supermarket lettuce showed higher leaf nitrate levels, consistent with more intensive nitrogen fertilization than local-producer samples. Supermarket samples also exhibited higher nitrite levels, particularly in roots, suggesting active nitrate-reduction processes. Leaves were the primary site for nitrate accumulation, followed by roots and soil, whereas nitrite and ammonium were mainly associated with roots and soil. These findings support closer monitoring of fertilization practices to assess environmental quality in protected agriculture and to limit consumer exposure to nitrogen-related compounds.

Key words: *nitrate residue, greenhouse cultivation, lettuce, environmental quality.*

**MINERAL COMPOSITION
OF *VACCINIUM VITIS-IDAEA* FRUITS
ACROSS DIFFERENT MOUNTAIN HABITATS**

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Abstract

*The present study investigated the mineral composition of *Vaccinium vitis-idaea* fruits collected from five mountain regions of the Romanian Carpathians, characterized by distinct environmental and geological conditions. Fruit samples were analyzed using portable X-ray fluorescence spectrometry (pXRF) to determine the concentrations of macro-, micro- and trace elements, including K, Ca, Fe, Mn, Zn, Cu, Ni, Sr and Rb. Climatic parameters describing the environmental context of the sampling sites were also considered. The results revealed clear differences in elemental profiles among the studied provenances. Potassium was the dominant macronutrient in all samples, whereas Ca, Mn and Rb exhibited noticeable spatial variability. Multivariate analyses (HCA and PCA) indicated that the elemental profile of lingonberry fruits reflects both environmental gradients and site-specific geochemical characteristics. In particular, rubidium showed the strongest differentiation among sites, suggesting a possible relationship between berry elemental composition and the geological characteristics of the habitats. The results highlight spatial variability in the mineral profile of wild *V. vitis-idaea* fruits across mountain environments and provide baseline information on their elemental composition in the Romanian Carpathians.*

Key words: Carpathians, environment, mineral composition, *Vaccinium vitis-idaea*, variability.

SUSTAINABLE UNFIRED CLAY MASONRY INCORPORATING AGRICULTURAL WASTE: PHYSICAL AND MECHANICAL PROPERTIES

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Abstract

Sustainable societal development requires practical solutions that promote the use of traditional and locally available materials, particularly for vulnerable rural communities. In this context, unfired clay represents an environmentally friendly construction material due to its low embodied energy, recyclability, and local availability. Compared to conventional fired materials, it reduces energy consumption and environmental impact, supporting sustainable construction practices. At the same time, the valorization of plant-based waste generated by agricultural and wood-processing activities represents an effective strategy for improving resource efficiency and reducing environmental pollution. According to the National Institute of Statistics, agriculture accounted for approximately 2.5% of Romania's GDP in 2025 and generated over 50% of total municipal waste as vegetal residues. As consumption increases, the management of such waste becomes increasingly challenging, while its decomposition releases greenhouse gases such as methane, contributing to climate change. The incorporation of plant-based waste into clay-based construction materials represents a promising approach for waste valorization and the development of sustainable building materials. This study investigates the effect of hemp fibers and sawdust on the physical and mechanical properties of unfired clay mixtures.

Key words: *hemp fibers, plant-based waste, sawdust, sustainable construction, unfired clay.*

GEOTECHNICAL ENGINEERING AND SOIL MANAGEMENT: LEGAL GAPS AND ENVIRONMENTAL CONSIDERATIONS

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Abstract

This paper analyses the stringent intersection between Romanian construction law (Law No. 50/1991), the status of ground improvements (Law No. 138/2004), and environmental protection (OUG No. 195/2005, OUG No. 92/2021). Land improvements are complex hydraulic and soil (pedo-ameliorative) projects, fundamentally aimed as territorial protection against major geotechnical hazards, such as landslides, erosion, and flooding. Consequently, these activities necessarily include extensive earthworks and are subjected to construction authorization. A primary concern identified is the legislative insufficiency regarding the explicit authorization and regulation of site grading and levelling works - simple changes in ground elevation. This gap is critical, as uncontrolled deposits of excavated material, potentially classified as waste, create ideal conditions for geotechnical instability and subsequent landslides. While backfilling is recognized as a recovery operation for non-hazardous waste, its execution must strictly adhere to quantity limitations and non-waste replacement principles. Legislative clarity is essential to ensure consistent application, prevent environmental damage, and secure geotechnical stability, thus validating the necessity of including all significant earthworks under the permitting regime.

Key words: legislation, landslides, waste management, site grading and levelling works, Law 50/1991.

TREE COMMUNITY PATTERNS IN RELATION TO EDGE INFLUENCE IN A PERI-URBAN FOREST NEAR CLUJ-NAPOCA, ROMANIA

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Abstract

*This study investigated the structure and diversity of tree communities in relation to edge influence in a sector of the Hoia-Baciu peri-urban forest located near Cluj-Napoca, Romania. A total of 20 circular sampling plots (500 m²) were systematically distributed along transects covering varying distances from the forest edge. Within each plot, tree species and the number of individuals were recorded to characterize community composition and structural parameters. Species richness, tree density, and diversity indices (Shannon and Simpson) were calculated, and differences in community composition were explored using non-metric multidimensional scaling (NMDS). The results indicate a simplified tree community strongly dominated by *C. betulus*. Species richness ranged between one and four species per plot, while Shannon diversity values varied from 0 to 1.22, reflecting moderate spatial heterogeneity among sampling plots. The NMDS ordination revealed a central cluster of plots characterized by the dominance of *C. betulus*, with a few plots showing greater compositional divergence. These findings highlight the relatively simplified structure but noticeable small-scale variability of tree communities in this peri-urban forest ecosystem.*

Key words: edge influence, peri-urban forest, Romania, species diversity, tree community.

**IN VITRO PROPAGATION FOR THE CONSERVATION
OF SUMMER SNOWFLAKE (*LEUCOJUM AESTIVUM* L.):
PRELIMINARY RESULTS**

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Abstract

In vitro conservation techniques are essential for preserving biodiversity by enabling propagation of endangered species under controlled conditions outside their natural habitats. Anthropogenic pressures such as urbanization, deforestation, soil contamination, and extreme climatic events contribute to ecosystem degradation and loss of native flora. *Leucojum aestivum* L. (summer snowflake) is a bulbous species native to Europe, listed as Least Concern globally but considered Critically Endangered in the Republic of Moldova due to habitat degradation, drainage of floodplain forests, overgrazing, and ruderalization. Alongside *in situ* protection, *ex situ* conservation and propagation are necessary for species recovery and reintroduction. This study examined preliminary *in vitro* propagation using bulb scale explants with basal plate tissue. After sterilization, explants were cultured on media with different mineral formulations supplemented with 6-benzylaminopurine (1 mg/L) and 1-naphthaleneacetic acid (0.1 mg/L) to induce bulbil formation and multiplication. Regenerated bulbils were transferred to sucrose-enriched medium (80 g/L) to support further growth before acclimatization. The results demonstrate the effectiveness of tissue culture techniques for conservation and large-scale propagation of *L. aestivum*, supporting future restoration programs.

Key words: *Amaryllidaceae*, biodiversity loss, endangered species, habitat restoration, *in vitro* conservation.

***IN VITRO* PROPAGATION OF *EUONYMUS FORTUNEI* CULTIVARS FOR SUSTAINABLE URBAN GREENING AND DEGRADED LAND REHABILITATION**

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Abstract

Euonymus fortunei (Fortune's spindle) is an evergreen ornamental species widely used in landscape design due to its adaptability to urban stress conditions such as pollution, drought, high insolation, low temperatures, and degraded soils. Its use in urban greening and land rehabilitation makes it relevant for sustainable environmental engineering applications. This study aimed to develop an efficient *in vitro* propagation protocol for the cultivars 'Emerald 'n Gold' and 'Emerald 'n Gaety' to support large-scale production of uniform planting material. Axillary buds were sterilized and established on Murashige and Skoog (MS) medium supplemented with 6-benzylaminopurine (BAP), indole-3-acetic acid (IAA), gibberellic acid (GA₃), and Plant Preservative Mixture (PPM™) to control microbial contamination. Shoot multiplication was further evaluated on MS media containing either BAP or meta-topolin, alone or in combination with IAA and GA₃. Meta-topolin significantly enhanced shoot proliferation and elongation while reducing callus formation, proving more effective than BAP. The results demonstrate that meta-topolin-based media provide an efficient system for rapid micropropagation of *E. fortunei* cultivars for use in urban landscaping and ecological restoration of degraded environments.

Key words: landscape, meta-topolin, micropropagation, plant growth regulators, shoot proliferation.

**SEASONAL VARIATION OF CO₂ SOIL FLUX
AND VEGETATION RESPONSE AT BODOC
AND BĂILE LĂZĂREȘTI**

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Abstract

Bodoc and Lăzărești were chosen as test sites to assess an environmental monitoring methodology that combines soil CO₂ flux and vegetation surveys. Field campaigns conducted in September 2024 and April 2025 enabled a comparative assessment of spatial and seasonal variability. The two sites display very different patterns. Bodoc exhibits low CO₂ fluxes with limited seasonal change, likely driven by shallow biological processes. In contrast, Lăzărești displays high, naturally sourced CO₂ fluxes with high spatial and seasonal variability, probably also influenced by hydrological conditions and soil biological activity. Vegetation patterns also differ: at Bodoc, elevated CO₂ fluxes are associated with higher cover of healthy plants, whereas at Lăzărești, high fluxes correspond to reduced vegetation cover, changes in community composition and an increased monocot/angiosperm ratio.

Key words: soil CO₂ flux, natural analogue, environmental monitoring, vegetation response, seasonal variability, Bodoc, Lăzărești.

PLANT TISSUE CULTURE STRATEGIES FOR SUSTAINABLE MULTIPLICATION OF BLACK CHOKEBERRY (*ARONIA MELANOCARPA*) GERMPLASM

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Abstract

Plants are essential for ecosystem stability, providing oxygen, food, and valuable bioactive compounds. However, urbanization, industrial expansion, habitat loss, and climate change are accelerating biodiversity decline. Plant tissue culture and micropropagation offer efficient methods for large-scale production of uniform, disease-free planting material independent of seasonal and environmental constraints. Aronia melanocarpa is a valuable berry shrub with high nutraceutical potential. This study aimed to develop an efficient micropropagation protocol by evaluating the effect of different cytokinins on in vitro shoot development. Explants were cultured on MS medium supplemented with meta-topolin, zeatin, kinetin, 2iP, or TDZ, combined with GA₃ and IAA. Meta-topolin resulted in the highest shoot proliferation and biomass production, while kinetin and 2iP enhanced shoot elongation and rooting. TDZ induced hyperhydric and compact tissue formation. Rooting was successfully achieved on half-strength MS medium supplemented with activated charcoal and auxins, leading to effective plant acclimatization. The results demonstrate that meta-topolin is the most efficient cytokinin for rapid micropropagation of A. melanocarpa, providing a reliable system for large-scale propagation and conservation of valuable plant material.

Key words: 2iP, kinetin, meta-topolin, thidiazuron, zeatin.

TECHNICAL FRAMEWORK FOR SUSTAINABLE VALORIZATION OF VINEYARD BY-PRODUCTS THROUGH SMALL-SCALE PROCESSING TECHNOLOGIES

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Abstract

The management of vineyard by-products represents an important environmental challenge in viticultural regions, where large quantities of organic residues are generated annually. From an environmental engineering perspective, the sustainable valorization of these by-products offers significant opportunities for reducing waste streams while improving resource efficiency. This paper proposes a technical framework for the sustainable valorization of vineyard by-products through the implementation of small-scale processing technologies. The framework integrates engineering criteria such as processing efficiency, energy demand, and technological adaptability with environmental considerations including waste reduction, resource recovery, and alignment with circular economy principles. The proposed approach is illustrated through a representative application scenario focusing on grape seed processing for oil production, highlighting the potential of small-scale technologies to convert viticultural residues into value-added products. The results emphasize the role of appropriately selected processing technologies in minimizing environmental pressure associated with vineyard waste and supporting sustainable agricultural systems. The framework provides a structured basis for further applied research and technology development in viticulture-related waste management.

Key words: *environmental engineering, grape seed valorization, sustainable processing, vineyard by-products, waste reduction.*

HOLISTIC ASSESSMENT OF HEAVY METAL BIOACCUMULATION IN AQUATIC BIOTIC AND ABIOTIC COMPARTMENTS

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Abstract

Given the critical need to update water quality monitoring in the Danube River basin, this study adopted a holistic approach by analyzing selected physicochemical indicators in the pre-deltaic region, where the Siret, Prut, and Danube rivers converge, a zone of particular significance, as it serves as a primary source of water supply. The present research aims to evaluate the quality and contamination levels of the Lower Danube's water, sediments, and fish communities, with a focus on assessing the impacts of anthropogenic and industrial activities delivered via tributary inflows. The study covered a stretch of over 50 kilometers along the Lower Danube, including the area corresponding to the entrance of the Danube Delta Biosphere Reserve. To this end, pollution maps based on Water Quality Index (WQI) were generated, to clarify the contribution of various processes to seasonal variations and to assess the river's self-purification potential. Furthermore, these analyses also enabled the estimation of bioaccumulation factors, providing a coherent explanation for the measured contaminant levels.

Key words: *bioaccumulation, Water Quality Index, contamination, self-purification capacity.*

**DISASTER RESILIENCE
AND SUSTAINABLE
DEVELOPMENT**

OPTIONAL MEASURES TO PROTECT HERITAGE BUILDINGS FROM SEISMIC VULNERABILITY

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Abstract

The paper outlines key characteristics of heritage buildings and explains why they require protection against strong seismic motions generated by the Vrancea source. One of the most common challenges these structures face is differential settlement during earthquakes; to mitigate this, several supplementary measures can be implemented. Resonant column or dynamic triaxial tests, used alongside standard geotechnical investigations, provide additional insight into soil behaviour. These methods focus on evaluating the variation of the shear modulus with strain, enabling a more accurate assessment of soil properties. The resulting data support the selection of appropriate interventions to improve site conditions and reduce the risk of structural damage during future major seismic events. Structural protection can also be enhanced through base-isolation techniques, applied according to site conditions and the specific characteristics of each building. This approach reduces seismic forces and modifies critical response parameters to safer levels. The paper highlights the advantages of these optional measures for safeguarding historical monuments and older administrative buildings, emphasizing both their technical effectiveness and their broader economic and social benefits.

Key words: heritage buildings, seismic vulnerability, settlements, seismic isolation, resonant column.

STRUCTURAL PERFORMANCE ASSESSMENT OF ECOLOGICALLY STABILIZED ROAD LAYERS

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Abstract

The long-term durability and structural integrity of stabilised layers are essential for sustainable infrastructure. Eco-friendly materials that utilise environmentally friendly binders and additives have the potential to improve mechanical performance while minimising environmental impact. Assessing the effectiveness of these materials requires a thorough framework that considers various parameters impacting mechanical stability, thermal resistance, and load-bearing capacity. A performance index (PI) approach is used to assess the structural performance of stabilised layers, incorporating a catalyst to enhance the bitumen-aggregate interface within the bitumen matrix and modifying physicochemical reactions during operation. Key mechanical and physical parameters—including compressive strength, degree of compaction, load-bearing capacity, dynamic modulus, and resistance to mechanical and thermal stresses—were measured or estimated for the stabilised layers. Compared to baseline or minimally compliant layers, the calculated PI showed a significant improvement in overall structural integrity. This reflects enhanced load transfer, stiffness, and durability. These findings support the adoption of environmentally sustainable stabilisation techniques as reliable alternatives for infrastructure applications, providing long-term performance.

Key words: eco-friendly materials, sustainable, stabilisation, performance.

THE CHALLENGES OF CLIMATE CHANGE ADAPTATION IN ROMANIA’S LAND RECLAMATION SYSTEMS: BETWEEN GREY INFRASTRUCTURE AND NATURE-BASED SOLUTIONS

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Abstract

Climate change is placing increasing pressure on Romania’s agricultural sector through intensified drought, greater precipitation variability, and more frequent hydrometeorological extremes. In this context, land reclamation systems, including irrigation, drainage and dewatering works, and anti-erosion measures, are becoming essential for reducing vulnerability and strengthening agroecosystem resilience. This article analyzes the main challenges in adapting these systems to climate change from an integrated technical, ecological, economic, and institutional perspective. It highlights outdated infrastructure, limited modernization, high water and energy demands, and environmental impacts, especially on hydrological regimes and biodiversity. At the same time, it examines economic and institutional barriers, and the gap between stated policies and practical implementation. The paper also explores the potential of Nature-based Solutions, and integrated green infrastructure, as viable complements or alternatives to traditional grey infrastructure. The findings emphasize the need for adaptive management, combining technological modernization, efficient water use, and green solutions, to support climate resilience, food security, and territorial sustainability. In addition, the paper includes a case study of the Comlod polder project (Bistrița-Năsăud County, Romania), illustrating how flood retention infrastructure can function as a hybrid grey-green system contributing to climate adaptation and integrated water management.

Key words: climate change, adaptation, nature-based solutions, environmental impacts.

CASE STUDY ON THE ASSESSMENT OF THE EFFECTS OF CONTROLLED BLASTING DEMOLITION ON NEARBY BUILDINGS

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Abstract

Some of the civil and industrial buildings in Romania, have exceeded or will exceed in the coming period, the expected operating life. This fact requires the establishment of a strategy for their replacement and one of the methods that responds to a high degree to these requirements is the demolition of buildings using explosives. This paper presents a theoretical study assessing the impact of the explosive demolition of an industrial building on an adjacent 10-story residential structure. The evaluated effects included the aerial shock wave, seismic impact, thrown fragments, and environmental pollution. To this end, both pyrotechnic parameters and calculation formulas derived from specific legislation were utilized. The demolition impact assessment was carried out during the design stage, providing the necessary documentation to obtain the demolition permit for the industrial building.

Key words: *buildings, explosives, explosive demolition, blast effects, impact assessment.*

CORRELATION BETWEEN DENSITY, ULTRASONIC PULSE VELOCITY AND DRYING SHRINKAGE IN ECO-CLAY POURED-EARTH

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Abstract

This paper presents an experimental investigation on the interrelationship between physically measured density, ultrasonic pulse velocity (UPV), and drying shrinkage of Eco-Clay poured-earth materials. Five representative mixtures, covering optimized mineral compositions and biopolymer-modified formulations, were selected from a larger experimental program. Density was determined by direct physical measurements and estimated using UPV as a non-destructive method. Drying shrinkage was monitored throughout the natural curing period. The results indicate that optimized Eco-Clay mixtures exhibit high and narrowly distributed dry densities, increased UPV responses, and reduced shrinkage, confirming the formation of a dense and homogeneous internal structure. In contrast, biopolymer-modified compositions show higher variability, increased sensitivity to curing conditions, and amplified shrinkage. A strong correlation between density, ultrasonic response, and shrinkage is demonstrated, validating the use of UPV as a reliable early-stage quality control indicator for poured-earth materials, with notable limitations for biopolymer-modified systems.

Key words: *biopolymer stabilization, drying shrinkage, Eco-Clay, poured earth, ultrasonic pulse velocity.*

SEISMIC PERFORMANCE ENHANCEMENT OF TEN-STORY ECCENTRICALLY BRACED FRAMES

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Abstract

The present paper intendeds to compare the behaviour under severe seismic actions of some traditional eccentrically braced frames compared to eccentrically bracing systems equipped with additional vertical connection elements (vertical truss elements between the ends of all dissipative members that are not connected directly to columns, except for the bottom story). Each considered structural type (with and without additional vertical truss elements) was subjected to three dynamic nonlinear analyses using Vrancea earthquakes acceleration records. The analyzed frames had ten story of 3.5m and two spans of 6.6m. All the frames (with and without truss elements) had short dissipative elements with a length of 1.2m. The values of different parameters recorded during nonlinear analyses were compared: extreme base shear forces, maximum plastic deformations in the dissipative members, greatest member forces in different structural elements, extreme horizontal floor displacements. The amount of dissipated energy and the estimated steel consumption for each considered frame was analyzed.

Key words: *dynamic nonlinear analyses, estimated steel consumption, inelastic deformations, uniform distribution of plastic deformations, vertical truss elements.*

SEISMIC RESPONSE ANALYSIS OF A LONG-TERM MONITORED BUILDING USING CO-LOCATED STRUCTURAL AND FREE-FIELD RECORDS

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Abstract

Monitoring building vibrations provides important information on structural health and, through on the detection of changes in dynamic characteristics, can serve as an early indicator of potential degradation or damage. However, detection reliability depends substantially on appropriate instrumentation capable of clearly capturing the building response to ambient, natural and anthropogenic vibrations. The paper presents an in-depth study based on data recorded during recent seismic events on a higher-education building in Bucharest, Romania. The building has been continuously monitored for vibrations for more than a decade. Unlike many other urban buildings monitored in Romania, the building's location within a university campus - characterized by large open spaces - enabled the installation of a free-field-type station approximately 30 m away from the building, such that reference ground motion records were also available. Based on multiple types of analyses, the study provides valuable insights into the building's dynamic characteristics, soil-structure interaction phenomena and kinematic effects.

Key words: *structural health monitoring, building vibrations, dynamic characteristics, soil-structure interaction, kinematic effects.*

INFLUENCE OF CONSTITUTIVE MODELS ON DEEP EXCAVATIONS: A COMPARATIVE STUDY

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Abstract

Accurate prediction of soil–structure interaction is essential for the safe design of deep excavations in urban environments. This paper presents a three-dimensional numerical investigation assessing the influence of different soil constitutive models on the predicted behavior of a deep excavation. Finite element analyses were carried out using the Mohr–Coulomb (MC), Hardening Soil (HS), and Hardening Soil with Small-Strain Stiffness (HSS) models, applied to a real excavation case supported by retaining walls. The comparative study focuses on excavation-induced stress redistribution and horizontal wall deformations. The results indicate that the MC and HS models overestimate wall deformations, whereas the HSS model offers a significantly improved prediction due to its ability to capture soil stiffness at small strain levels. The study confirms that incorporating small-strain stiffness is critical for realistic deformation assessment and reliable design of deep excavations.

Key words: *constitutive model, deep excavation, MEF.*

THERMAL AND MECHANICAL PERFORMANCE OF GROUTING MATERIALS IN GEOTHERMAL BOREHOLES: IMPLICATIONS FOR HEAT TRANSFER EFFICIENCY AND ENVIRONMENTAL PERSPECTIVE

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Abstract

Grouting materials used in geothermal boreholes represent a key component in the efficient operation of ground source heat pump (GSHP) systems, as they simultaneously control heat transfer between the borehole heat exchanger and the surrounding geological formation while ensuring hydraulic sealing of the annular space between the pipes and the borehole wall. The thermo-hydraulic and mechanical performance of these materials directly influences the long-term energy efficiency of geothermal systems and contributes to groundwater protection by limiting vertical fluid migration between permeable geological layers intersected by the borehole. In this context, the present study presents a laboratory-based experimental program aimed at evaluating the thermal and mechanical performance of water-based grout mixtures composed of mineral binders and clay additives (bentonite), with controlled variation of the granular fraction (sand) and bentonite content. The research investigates the relationships between material composition, microstructural characteristics and the physical-mechanical properties relevant for geothermal applications. The experimental methodology includes the determination of thermal conductivity, saturated hydraulic permeability, uniaxial compressive strength and shrinkage or segregation behaviour, complemented by the analysis of rheological characteristics such as injectability and mixture stability under installation conditions. The results highlight the inherent trade-off between enhancing thermal conductivity through the introduction of granular materials and maintaining effective hydraulic sealing by reducing permeability and controlling pore structure. The findings contribute to the development of technical recommendations for optimizing grout formulations used in geothermal boreholes, with the aim of improving heat transfer efficiency, ensuring mechanical integrity and protecting groundwater resources in geothermal systems designed for nearly zero-energy buildings (NZEB).

Key words: *grouting materials, thermal conductivity, nearly zero-energy buildings (NZEB), environmental sustainability.*

INFLUENCE OF TESTING METHODS ON THERMAL PERFORMANCE CHARACTERIZATION OF SHEEP WOOL-BASED INSULATION

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Abstract

Thermal insulation materials used in construction exhibit diverse structural morphologies that directly influence their thermal performance. Unconventional solutions based on recovered agro-industrial by-products, such as sheep wool mattresses, offer sustainable and eco-friendly alternatives. This paper comparatively analyzes the thermal insulation performance of sheep wool-based mattresses and evaluates the influence of testing methodology on measurement accuracy. Thermal conductivity was determined as a function of density using two complementary approaches: steady-state measurements with the λ -Meter EP500e (guarded hot plate method) and transient measurements with the ISOMET 2114 (dynamic method), both conducted at controlled, variable laboratory temperatures. The results reveal significant differences between steady-state and transient measurement techniques regarding method suitability and accuracy. Polynomial regression models accurately predict thermal behavior under non-compression conditions, enabling complete material characterization across the operational range relevant for building insulation applications. This comparative study provides practical guidance for selecting appropriate testing methods for fibrous insulation materials.

Key words: *unconventional thermal insulation materials, non-woven sheep wool mattress, thermal conductivity coefficient, λ -Meter EP500e, ISOMET 2114.*

AQUIFER THERMAL ENERGY STORAGE SYSTEMS FOR NEARLY ZERO ENERGY BUILDINGS: A CASE STUDY ASSESSMENT FOR ROMANIAN CLIMATE CONDITIONS

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Abstract

The European Union's Energy Performance of Buildings Directive (EPBD), as amended by Directive (EU) 2024/1275, mandates the transition from nearly Zero Energy Buildings (nZEB), with very high energy performance and substantial renewable energy coverage, to Zero Emission Buildings, with an annual zero emissions balance. Aquifer Thermal Energy Storage (ATES) offers an environmental-friendly and cost-effective technology for supporting nZEB through seasonal thermal energy storage in groundwater aquifers. This paper assesses ATES feasibility for an office building in Bucharest, Romania (climatic zone 2), using dynamic simulations for both existing and nZEB-renovated configurations. The analysis reveals significant deployment barriers including shallow unconfined aquifers (7-10 m), regulatory constraints on groundwater reinjection, and pronounced heating-cooling demand imbalances characteristic of Romania's continental climate. The proposed system integrates ATES with solar thermal technology to mitigate demand asymmetry and enhance efficiency. Results indicate that successful ATES implementation in Romania requires updated legislation, site-specific hydrogeological assessment, and hybrid renewable configurations enabling balanced seasonal thermal storage.

Key words: *nearly zero energy buildings (nZEB), aquifer thermal energy storage (ATES), seasonal thermal storage, ground source heat pump, building energy efficiency.*

THE FUTURE OF SUSTAINABLE DEVELOPMENT IN THE CONTEXT OF ARTIFICIAL INTELLIGENCE

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Abstract

The paper presents the concept of sustainable development highlighting the challenges and future potential of artificial intelligence, from risks to productivity boosts. Sustainable development seeks to meet human needs and depends on communities committed to creating prosperous, environmentally friendly, and sustainable practices. The economic and social development of the world cannot longer be separated from the consequences of human activities and with impact on environment. Nowadays, artificial intelligence is an important part of the modern world and society, transforming industries, innovation and offering solutions to complex problems, yet there is much uncertainty about its future. The emerging relationship between sustainability and artificial intelligence presents substantial potential for solving global issues, even as it confronts the considerable environmental consequences associated with the technology.

Key words: *development, sustainability, goals, artificial intelligences.*

**ASPECTS RELATED TO VEGETATION SUCCESSION,
ON AGRICULTURAL LANDS, IMPROPERLY
EXPLOITED AND ABANDONED, AFFECTED
BY DROUGHT IN NON-COLLECTIVIZED AREAS**

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Abstract

*The paper aims to study and analyze the succession process of arboreal and shrub vegetation on a series of agricultural lands, which have not been administered and exploited in accordance with their use category, in a non-collectivized hill area, in the Vîrfurile locality, Arad County. The study was carried out for the period 1990-2025, with observations, inventories, comparisons, simulations, and magnetic recordings of relevant images related to the studied lands. Also, the records from the agricultural register and the parcel plan that was drawn up by the Cadastre and Real Estate Advertising Office of Arad County were analyzed, on the occasion of the systematic registration works of the real estates in the rural areas, for this location. The results obtained confirm that on the studied lands, a succession of arborescent and shrub vegetation was triggered, with a relatively active dynamic. Consequently, a series of pioneer, invasive tree species were highlighted, as well as forest tree species of the genus *Quercus*, which settled on areas ranging between 10-100% of the mentioned location.*

Key words: *use category, agricultural lands, non-collectivized areas, improper exploitation, vegetation succession, shrub species, tree species.*

INTERNAL AIR RECIRCULATION FOR CONDENSATION RISK CONTROL IN PASSIVE SOLAR GREENHOUSES

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Abstract

During winter operation, passive solar greenhouses with limited auxiliary heating are frequently affected by nocturnal thermal stratification and elevated humidity, promoting condensation on structural surfaces and increasing fungal disease risk at canopy level. This study evaluates an internal air recirculation strategy for condensation prevention, implemented in a double-layer Chinese solar greenhouse at the University of Agronomic Sciences and Veterinary Medicine of Bucharest. Twenty axial fans were installed at 3.5 m height along both longitudinal sides, controlled by adaptive dew margin thresholds derived from a distributed canopy sensor network. Two experimental phases were compared: Phase I used synchronized control of both ventilation units driven by the worst-case canopy dew margin; Phase II introduced asynchronous zonal control, with each unit independently responding to its local canopy sensor. Results indicate that canopy-based recirculation control successfully maintained positive dew margins at plant level throughout the monitoring period, with no leaf wetness events detected at canopy level in either phase, while structural condensation on the inner polyethylene cover persisted. The dew margin indicator proved more operationally discriminating than relative humidity alone under the conditions observed.

Key words: condensation risk, dew point, internal recirculation, passive greenhouse, zonal microclimate control.

A DATA-DRIVEN ANALYSIS OF SEISMIC RESPONSE AND STRUCTURAL PERFORMANCE

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Abstract

Data obtained from seismic instrumentation campaigns enable the identification of buildings' dynamic characteristics, the objective evaluation of structural performance, and the investigation of damage and degradation mechanisms induced by earthquake loading. For each monitored building, detailed information is compiled, including location (city or municipality), year of construction, applicable seismic design code, structural system characteristics, type of functionality (research institutes, administrative, education, healthcare, residential, commercial), site and soil conditions (where available), and the seismic events recorded during its service life. Using simplified dynamic models with natural periods of vibration matching those of instrumented buildings, this paper analyses their structural response to the 1977, 1986, and 1990 Vrancea earthquakes through time-history, linear, and elasto-plastic comparative approaches, and evaluates their seismic performance. Relevant regulatory provisions and findings from previous studies are considered to establish correlations between the exceedance of admissible inter-story drift limits and observed damage levels. The results demonstrate that long-term seismic instrumentation campaigns are integral to structural health monitoring, providing a robust basis for post-earthquake assessment and risk-informed decision-making.

Key words: *measured response, structural behaviour, performance evaluation.*

**ASPECTS REGARDING CLIMATE RESILIENCE
AND URBAN HEAT ISLAND EFFECT MITIGATION
IN URBAN AREAS RENOVATION PROJECTS**

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Abstract

The current context requires the networking of planning decisions on increasing the energy performance of the built environment for sustainability purposes and decisions on reconfiguring urban areas in order to obtain a resilient environment. The paper aims to highlight ways of multicriterial evaluation on energy performance, environmental performance and resilience in urban areas renovation projects in complementarity with applicable solutions in order to improve the characteristics of the area microclimate. Beyond the aspect of the high energy performance associated with nZEB buildings (Nearly Zero Energy Buildings), we must understand the conditions deriving from the quality of anthropogenic factor that the building has in relation to the urban microclimate, contributing to the amplification of the effect of Urban Thermal Island, a phenomenon with significant impact on the health and quality of life of the inhabitants.

Key words: Urban Heat Island (UHI), climate resilience, urban retrofitting, local climate zones, nearly Zero Energy Buildings (nZEB).

COMPARATIVE STUDY ON DETERMINING THE FIRE RESISTANCE OF MASONRY WALLS

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Abstract

In the current context of the implementation of the provisions of the new P118-1:2025 on the fire safety of buildings in Romania, an important role falls to testing laboratories for determining the fire resistance of building elements, in order to increase the fire safety of the built environment. For these reasons, the assessment of the fire behaviour of building elements made of non-load-bearing masonry is an essential component for fulfilling the fundamental requirement of fire safety of buildings. The tests for determining the fire resistance of building elements in Romania, are carried out within the INCERC Testing Laboratory from Bucharest and consist of applying standardized fire resistance testing methods that are harmonized at the level of the countries of the European Union. Recently, researchers from this laboratory conducted several experimental tests to compare the fire resistance of non-load-bearing masonry walls of varying thicknesses.

Key words: *experimental research, compartment fires, fire resistance tests, cladding systems.*

A NOVEL CONCEPT FOR A SUBMERGED WAVE ENERGY CONVERTER

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Abstract

Wave energy represents an important renewable resource with significant potential for sustainable energy production. As interest in alternative energy sources continues to grow, this paper presents the conceptual design and preliminary laboratory testing of a novel submerged wave energy converter based on differential pressure conversion. The submerged wave energy converter will be evaluated and optimized in the Hydraulics and Environmental Protection Laboratory of the Technical University of Civil Engineering Bucharest, under controlled wave conditions with varying wavelengths and periods. Preparatory measurements of wave characteristics will guide the optimal dimensioning of the device to maximize energy capture efficiency. Preliminary results identify relevant wave parameters and indicate potential power generation efficiency. The advantages of the device are primarily based on the concentration of the large but diffuse hydraulic energy of waves into the high-pressure hydraulic energy of a working fluid, enabling operation of industrial installations with superior efficiency. Additionally, the research investigates the device's effect on reducing wave energy, contributing to coastal protection and the preservation of marine ecosystems.

Key words: *wave energy, submerged wave energy convertor, differential pressure conversion, energy capture efficiency, costal protection.*

**REINFORCEMENT SHAPE AS A KEY DESIGN
VARIABLE FOR SUSTAINABLE PLASTIC FIBER-
REINFORCED CONCRETE IN AGRICULTURAL
CONSTRUCTIONS FLOORS AND SLABS:
A NUMERICAL AND EXPERIMENTAL APPROACH**

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Abstract

The increasing demand for farming facilities which need durable and sustainable floor systems has prompted research into alternative reinforcement materials. This paper investigates the effect of recycled plastic reinforcement shape on the mechanical characteristics of concrete slabs used in industrial applications. The study combines a comprehensive literature review, an experimental campaign on prismatic specimens (100 x 100 x 400 mm), and numerical simulations. Four concrete mixes were tested: plain reference concrete (C30/37), two mixes with Sika chemical admixture at different dosages (2.4 g and 25 g), and one mix with 25 g of recycled polyethylene shreds. Additionally, four plastic fiber geometries were numerically modeled to assess the influence of shape parameters (length, diameter, aspect ratio) on displacement, factor of safety, and plastic deformation. Results demonstrate that fiber geometry significantly affects concrete performance. The Folgar-Tucker orientation model was employed to simulate fiber distribution under flow conditions. Findings support the feasibility of using shape-optimized recycled plastic reinforcement as a partial alternative to conventional systems in industrial slab-on-grade construction.

Key words: *plastic fibers, recycled reinforcement, fiber shape, industrial concrete slabs, numerical modeling.*

WATER RESOURCES MANAGEMENT

**XRF-BASED ASSESSMENT OF ELEMENT
ACCUMULATION IN *PHRAGMITES AUSTRALIS* ACROSS
FRESHWATER, URBAN, AND SALINE AQUATIC
ECOSYSTEMS: IMPLICATIONS FOR NATURAL
FILTRATION AND ENVIRONMENTAL RISK**

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Abstract

*Our study uses X-ray fluorescence spectroscopy to assess element accumulation in *Phragmites australis* across three distinct aquatic environments. We identified spatial patterns reflecting both the natural background and varying levels of human influence. Natural freshwater exhibited moderate concentrations of geogenic elements, including calcium (Ca), strontium (Sr), barium (Ba), manganese (Mn), and titanium (Ti). In contrast, urban freshwater showed higher levels of iron (Fe), aluminium (Al), copper (Cu), zinc (Zn), and lead (Pb). This indicates an anthropogenic signature associated with runoff, wastewater, and urban infrastructure. Saline lakes exhibited distinct elemental profiles, characterised by elevated levels of sodium (Na), potassium (K), calcium (Ca), and chloride (Cl). These patterns suggest mineralisation processes and physiological adjustments to cope with salinity stress. Rare elements (astatine (At), found in deltaic and urban locations) indicate localised geochemical traits. The accumulation patterns across ecosystems highlight the dual ecological role of the reed. It acts as a natural filtration system, and it can also serve as a potential vector for transferring elements within food webs. These findings support the use of *Phragmites* as a bioindicator for assessing environmental quality.*

Key words: *phragmites australis, element accumulation, aquatic ecosystems, natural filtration, environmental risk.*

MICROBIAL PATTERNS IN URBAN AND PERI-URBAN LAKES FROM SOUTHERN ROMANIA: IMPLICATIONS FOR WATER QUALITY AND ECOSYSTEM HEALTH

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Abstract

Urbanisation strongly influences water quality and the structure of microbial communities in aquatic ecosystems. This study investigates seasonal variations in physicochemical parameters and microorganisms in three urban lakes in Bucharest (Tineretului, Titan 1 and Titan 2) and one peri-urban lake (Comana). Samples were collected from five stations per lake during summer and autumn. Physicochemical parameters (temperature, pH, ORP, dissolved oxygen and TDS) were measured in situ, and bacterial communities were assessed by determining heterotrophic bacteria, total and faecal coliforms, and faecal streptococci, respectively.

The results revealed clear differences between urban and peri-urban lakes. The lakes in Bucharest presented increased TDS values (up to 738 ppm) and an alkaline pH (up to 10 in Titan 2), reflecting anthropogenic pressure. Bacterial abundance was higher in Titan 1 and Titan 2, where heterotroph density exceeded 10^3 CFU/mL. Faecal coliforms were sporadically detected in urban lakes, but were absent in Comana, indicating point sources of contamination. The findings suggest that urbanisation causes significant changes in water quality and microbial load, highlighting the need for integrated monitoring for sustainable management of urban lakes.

Key words: *urban lakes, water quality, microbial contamination, physico-chemical parameters, anthropogenic impact.*

PHYSICOCHEMICAL DYNAMICS OF WATER QUALITY IN SAND AND GRAVEL POST-EXPLOITATION LAKES

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Abstract

The present study aims to evaluate the water quality of five recreational lakes formed as a result of mineral aggregate extraction (sand and gravel) located in the administrative area of Ineu de Criş, Bihor County, Romania. To achieve this objective, a monitoring program was conducted during the period 2024-2025, focusing on relevant physico-chemical indicators used to assess the ecological status of post-extraction lakes, including pH, dissolved oxygen (OD), biochemical oxygen demand (CBO₅), chemical oxygen demand (CCO-ST), total nitrogen (Nt), total phosphorus (Pt), and potassium (K⁺). The obtained results indicated relatively small differences in water quality among the five analysed lakes. Based on the concentrations of total nitrogen (Nt) and total phosphorus (Pt), all lakes were classified in quality class I (very good ecological status) according to the national water quality standards. In terms of dissolved oxygen (OD), lake L3 showed a very good ecological status, while the other lakes presented moderate variations, with the lowest values recorded in lake L2. Slight variations were observed for the CBO₅ indicator, with most lakes falling within quality class I, while lake Camelot was classified in quality class II. Overall, the results suggest that the analysed lakes currently maintain a good to very good water quality status, with no significant deterioration in the ecological condition of the investigated surface water bodies.

Key words: anthropogenic lakes, gravel pit lakes, post-exploitation lakes, NDVI, NDMI, water quality, Water Quality Index (WQI).

SPATIAL VARIATION OF MICROBIAL COMMUNITIES IN THE BAHLUI RIVER ACROSS THE URBAN AREA OF IASI

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Abstract

The Bahlui River, flowing through the urban area of Iași, is subjected to significant anthropogenic pressures that influence its microbial communities. This study assessed the structure and temporal dynamics of microbial populations along a 24 km urban stretch of the river, using six sampling sites distributed from the river's entry into the city to its exit. Water samples collected in April and July 2025 were analyzed for total bacterial counts, Gram-positive bacteria (G^+), and micromycetes. Results revealed significant spatial and temporal variations: total bacterial and Gram-positive abundances increased from April to July, with point 3 consistently exhibiting the highest counts, while micromycete abundance was lower but also displayed site-specific and seasonal variation. Two-way ANOVA confirmed that both sampling location and period significantly influenced microbial abundance, with interactions indicating non-uniform temporal changes along the river. These findings highlight the combined effects of urbanization and seasonal dynamics on microbial community structure and provide valuable insights for monitoring and managing urban aquatic ecosystems.

Key words: *DPSIR, microbial communities, aquatic microbiology, spatial variation, urban river, Bahlui river.*

**STATE-OF-THE-ART APPLICATIONS
FOR THE REHABILITATION
OF IRRIGATION MAIN-CANAL CROSSINGS**

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Abstract

The main irrigation infrastructure in Romania includes numerous underpasses of the main canals built of prestressed concrete or large-diameter metal pipes. After decades of operation, these structures show advanced degradation, such as cracks, corrosion, and leaks, leading to water losses and reduced hydraulic efficiency. Their location under roads and other types of infrastructure makes traditional replacement and dismantling of existing pipes difficult, highlighting the need for trenchless rehabilitation technologies. This article analyzes the applicability of CIPP (Cured-In-Place Pipe) technology for the rehabilitation of culverts in irrigation systems, based on experience in the maintenance of urban water supply and sewerage networks. It presents the steps leading up to the intervention, including inspection and structural assessment, as well as the principles of liner manufacturing, highlighting the specific limitations of large diameter pipes. It also addresses the general methodology for designing liner thickness in accordance with international standards and technical criteria relevant to water conveyance systems. The installation process is analysed in terms of operational requirements and equipment, highlighting the advantages of no-dig technologies in restricted-access areas. The results demonstrate the potential of CIPP as a sustainable and hydraulically efficient solution for irrigation infrastructure modernisation in Romania.

Key words: no-dig rehabilitation, irrigation canal crossings, Cured-In-Place Pipe (CIPP), water loss reduction, hydraulic efficiency.

PHOTOCHEMICAL DEGRADATION OF IMIDACLOPRID IN WATER UNDER UV RADIATION THROUGH CFD MODELING

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Abstract

Photochemical degradation under ultraviolet (UV) radiation is a significant transformation process that modifies pesticide concentration dynamics in aquatic environments. This study investigates the UV-induced photochemical degradation of imidacloprid in water through Computational Fluid Dynamics (CFD) modelling. Imidacloprid, a widely used agricultural insecticide, is frequently detected in surface waters, underscoring the importance of its photochemical behaviour for understanding concentration fluctuations in aquatic systems. The numerical model couples fluid flow and species transport with a UV-dependent photochemical degradation term to simulate the spatial and temporal evolution of imidacloprid concentrations. The degradation process is represented by a pseudo-first-order kinetic model, in which the reaction rate is determined solely by the local UV radiation intensity. Transient simulations were conducted to assess the influence of hydrodynamic conditions and UV exposure on the reduction in imidacloprid concentration within the flow domain. The results reveal a heterogeneous distribution of degradation rates, governed by spatial variations in flow patterns and UV intensity. This study isolates UV-induced photochemical degradation, excluding other chemical or biological transformation mechanisms, to elucidate the specific contribution of photochemical processes to pesticide concentration dynamics in aquatic environments.

Key words: CFD modelling, imidacloprid, pesticide pollution, photochemical processes, UV radiation, water quality.

**MONITORING THE ECOLOGICAL STATE
AND ANTHROPOGENIC LOADING OF THE LUDA YANA
RIVER THROUGH THE USE
OF INDICATOR MACROZOOBENTHOS**

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Abstract

The study aims to monitor the ecological state and anthropogenic load of the Luda Yana River, part of the Maritsa River catchment. For this purpose, five biotopes of the Luda Yana River and its tributary Strelchanska Luda Yana (Strelcha, Popintsi, Svoboda, Rosen and Pazardzhik) were visited in 2025. A total of 711 specimens of 23 taxa of macroinvertebrate organisms belonging to Oligochaeta, Mollusca, Crustacea, Plecoptera, Ephemeroptera, Trichoptera, Odonata, Heteroptera, Coleoptera, Diptera, Chironomidae and Hydracarina were collected from all biotopes. Basic metrics and indices concerning the abundance and number of the collected indicator macrozoobenthos were calculated. The ecological state of the Luda Yana River is presented and discussed. The content of Al, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Cd, Hg, and Pb in samples of macrozoobenthos, waters and sediments was determined. The bioconcentration factor was considered. National and international legislative norms were used to compare the results of the chemical analyses.

Key words: *bioindication, Bulgaria, ecological indices, heavy metals and metalloids, river ecosystem.*

CYANOBACTERIA AS KEY FACTORS IN STRUCTURING PLANKTONIC COMMUNITIES IN THE DANUBE DELTA

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Abstract

*Cyanobacteria exert intense ecological pressure within aquatic systems of the Danube Delta, shaping both phytoplankton and zooplankton community dynamics. Their summer intense development can disrupt the balance between phytoplankton and zooplankton functional groups. Cyanobacteria dominated the phytoplankton, often outcompeting other algal taxa. Abundance indicated high concentrations of Cyanobacteria (10^7 – 10^8 cells L⁻¹), reflecting the high productivity. Their competitive advantage modifies species composition, reducing overall diversity and altering trophic interactions. The zooplankton displayed adaptive responses to shifts in phytoplankton, reflecting changes in food quality and availability. Among the dominant phytoplankton species were *Anabaena variabilis*, *Aphanizomenon* spp., and filamentous forms of the genera *Microcystis* spp., and *Oscillatoria* spp. In contrast, the zooplankton was predominantly structured by rotifers and cladocerans, among which *Keratella cochlearis*, *Brachionus calyciflorus*, and *Bosmina longirostris* were frequently found, indicating a high ecological tolerance. These temporal patterns highlight a complex interplay between communities, emphasising the regulatory role of cyanobacterial pressure in structuring aquatic community dynamics and influencing the trophic functioning of Delta ecosystems.*

Key words: phytoplankton, zooplankton, trophic interactions, cyanobacterial blooms, Danube Delta.

TECHNICAL CHARACTERISTICS AND EFFICIENCY OF GARDEN SPRINKLERS IN IRRIGATION SYSTEMS

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Abstract

Irrigation represents a central component within the system of agrotechnical practices, serving as a decisive factor for increasing crop yields and ensuring stable plant development. The effectiveness of irrigation processes is strongly influenced by the quality parameters of the sprinklers used, as their hydraulic performance determines the uniformity of water distribution, infiltration dynamics, and the overall efficiency of soil moisture management. Consequently, the selection of an appropriate sprinkler type and the evaluation of its operational characteristics are essential for achieving high agronomic and technical efficiency. The present study focuses on a comparative assessment of two types of garden sprinklers commonly used in small-scale and medium-sized agricultural applications. The analysis emphasizes their hydraulic and functional characteristics under varying operating conditions. The collected data provide insight into the operational behavior of both sprinkler types under different pressure regimes and highlight their respective advantages and limitations. The analysis contributes to the optimization of irrigation practices and supports informed decision-making regarding the selection of suitable sprinkler equipment for specific agrotechnical conditions.

Key words: irrigation efficiency, garden sprinkler, hydraulic performance, spray range, coverage uniformity, flow rate.

**METALS CONTENT IN THE SYSTEM
WATER-SEDIMENTS-CHIRONOMIDAE-
PERCA FLUVIATILIS-PROTEOCEPHALUS PERCAE
FROM TOPOLNITSA DAM, BULGARIA**

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Abstract

*The study aims to track the content of Cr, Mn, Fe and Al in liver and muscle samples of *Perca fluviatilis* Linnaeus, 1758 and its parasite *Proteocephalus percae* (Müller, 1780) Railliet, 1899, in samples of Chironomidae, water and sediments from the anthropogenically influenced ecosystem of Topolnitsa Dam (East Aegean Basin, Bulgaria). The highest exceedances were found for Mn content (171,58 times) in Chironomidae samples. In the studied perch samples, the highest exceedances were recorded in liver samples for Cr (32.27 times), followed by Mn (5.68 times) and Fe (3.85 times) compared to the maximum permissible concentrations set by national legislation. Over shoots in Al values were found only in Chironomidae samples (22.94 times). Bioaccumulation and bioconcentration coefficients were analysed. Highly significant correlations (Spearman's rank correlation coefficient, r_s) were found between the concentration of the studied heavy metals in the liver and muscles of perch, *Pr. percae*, chironomids, *Pr. percae* and sediments ($p < 0.001$). The bioindicator significance of perch (*Pr. percae*) and chironomids was assessed.*

Key words: evolution benthos macroinvertebrates, bioindication, european perch, heavy metals, parasites.

SALT LAKE MICROBIAL ECOSYSTEMS: IMPORTANCE AND CONSERVATION CHALLENGES

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Abstract

High salinity lakes harbor halophilic microbial communities with specialized adaptations to osmotic stress. These ecosystems provide important ecological services and biotechnological potential, yet they face increasing threats from climate change and human activities. Understanding their microbial diversity is essential for conservation efforts. The present study aims to characterize cultivable halophiles from three saline lakes located in Durgau-Valea Sarata area, documenting their diversity, salt tolerance and capacity to produce extracellular enzymes.

*XRF analysis revealed silica, chloride, calcium and titanium throughout all samples, with sporadic traces of bromide, potassium and sulfur. Cultivation on media with different salt concentrations yielded a total of 60 isolates across the three lakes, optimizing recovery of diverse halophiles including both archaea and bacteria. 16S rRNA gene sequencing of representative isolates revealed affiliation to *Salinivibrio*, *Halomonas*, *Chromohalobacter*, *Marinococcus*, *Salicola*, *Halococcus*, *Halobacterium*, *Haloarcula* and *Halorubrum* genera. Bacterial isolates produced exoenzymes (esterase, inulinase, amylase) and five strains demonstrated biofilm formation capacity.*

Our results provide reference data on diversity of cultivable halophiles and functional traits in these threatened saline ecosystems.

Key words: *halophiles, anthropo-saline lakes, biofilm formation, cultivable diversity, exoenzymes.*

OPTIMAL FLOW REGULATION IN WASTEWATER PUMPING STATIONS WITHIN SEWAGE SYSTEMS

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Abstract

In Romania have been built new sewage systems and expansions of sewage systems. The large investments and their implementation in the residential areas led to technical solutions with numerous pumping stations in order to reduce earthworks volume. Construction variants with reduced excavation volumes for sewer networks were adopted, but with numerous pumping stations and high specific energy consumption per unit of pumped volume. Reducing energy consumption for pumping wastewater requires, considering as an important factor the environmental protection, high pumping efficiencies and efficient control systems. The paper aims to highlight aspects related to the efficient regulation of pumped flows within sewage systems, applications where significant hourly variations of system parameters are recorded. Flow rate variations over short time intervals generate important variations in technological parameters in wastewater treatment stations: variable operating levels of grease separators and decanters, variations in oxygen requirements, different recirculation flow rate requirements, all of which depend on the plant size and the regulation capacity. The indications related to how to regulate wastewater pumping stations so that flow variations will be slow are significant in operation.

Key words: *pumping stations, sewage system, flow regulation, characteristic operating level.*

RISK ASSESSMENT OF THE USE OF *RUTILUS RUTILUS* FOR FOOD FROM TWO ANTHROPOGENICALLY INFLUENCED DAMS

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Abstract

The aim of the study is to assess the degree of Cd and Pb contamination and the risk of using roach for human food. Samples of roach muscle from the Dushantsi and Topolnitsa dams were examined. The results indicate a higher content of both elements in the Topolnitsa dam ($C_{Cd/Dushantsi}=0,06\pm 0,001$; $C_{Cd/Topolnitsa}=0,09\pm 0,03$ and $C_{Pb/Dushantsi}=1,00\pm 0,001$; $C_{Pb/Topolnitsa}=1,38\pm 0,06$). The values for the Cd contamination factors of the studied samples from the Dushantsi ($Cf_{Cd/Dushantsi}=1,60$) and the Topolnitsa dams ($Cf_{Cd/Topolnitsa}=2,40$) are low. In contrast, the values for the Pb contamination factors ($Cf_{Pb/Dushantsi}=6,50$ and $Cf_{Pb/Topolnitsa}=9,70$) are significant. The contamination levels are low ($CI_{Dushantsi}=8,10$; $CI_{Topolnitsa}=12,20$). Nevertheless, the potential risk factor for Cd content in the studied samples from the Topolnitsa Dam ($Er_{Cd/Topolnitsa}=72$) is high, as the toxic response factor is higher for Cd than for Pb. According to the study, the use of rudd from the Dushantsi Dam for human consumption is assessed as having a lower risk.

Key words: bioindication, cadmium, degree of contamination, lead, potential ecological risk, roach.

INCREASING THE EFFICIENCY OF BIOLOGICAL SLUDGE STABILIZATION PROCESSES WITHIN WASTEWATER TREATMENT PLANTS

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Abstract

Wastewater treatment plants are complex systems designed to deal both with wastewater and with resulting sludge. Physical, chemical and especially biological processes depend significantly on technological factors, the conditions for the development of biochemical reactions having complex dynamics. Due to hourly and seasonal variations in inputs (flows and pollutant concentrations), and to the conditions of the treatment process, continuous technological adjustments are necessary. The economic sizing of wastewater treatment plants can lead to operating situations at the limit in terms of efficiency, making it necessary to adopt additional technological measures. The paper presents a case study on adjusting the stabilization processes and reducing the volume of sludge produced in a wastewater treatment plant based on specialized biopreparations. The results highlight the need to ensure all technological factors for wastewater treatment and for sludge mineralization, simultaneously with the maintaining of desired efficiency and the corrective measures implementation.

Key words: *wastewater treatment plant, biological processes, sludge stabilization, biopreparations.*

**INVESTIGATION OF THE BACTERIAL COMMUNITY
IN SOME DRINKING WATERS FROM
THE DISTRIBUTION NETWORK OF SLOBOZIA CITY
TO ASSESS WATER QUALITY AND BACTERIAL
INVOLVEMENT IN BIOCORROSION PROCESSES**

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Abstract

Bacterial communities play an important role in numerous biogeochemical processes. Numerous studies have demonstrated the involvement of bacterial communities present in the pipes of the water distribution network in the deterioration of its quality. Bacterial communities cause corrosion of water supply pipes and the release of iron, being composed of iron-oxidizing bacteria, ferrobacteria, sulfate-reducing bacteria, sulfur-oxidizing bacteria, etc. Bacterial corrosion (biocorrosion) is frequently encountered in drinking and wastewater pipes, gas and oil pipelines, etc. In some cases, corrosion can extend to the surface and depth of metals, causing perforation of the pipes, water leaks around them and penetration of pathogenic microorganisms from the soil in the case of drinking water pipes. The present study aimed to evaluate the presence and activity of the bacterial community in the drinking water distribution network of the Slobozia city and the potential involvement in biocorrosion processes. The results revealed the presence of heterotrophic bacteria and ferrobacteria in the analyzed samples and the absence of pathogenic bacteria and iron-oxidizing bacteria.

Key words: drinking water distribution, water quality, bacterial community, biocorrosion.

THE USE OF PHOTOVOLTAIC ENERGY IN IRRIGATION SYSTEMS

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Abstract

In the context of climate change, agricultural production technologies must take into account increasingly high demands on water and fertilizers, or production losses, as well as the improvement of environmental factors directly and indirectly. Agricultural production requires significant amounts of energy, especially in the context of irrigation. To minimize the impact on the environment, energy production and use must be achieved through efficient technologies and with the use of minimal amounts of resources and minimal amounts of pollutants. For land irrigation, it is proposed to use photovoltaic energy production systems, combined with pumping stations adaptable to the variable production of photovoltaic energy. The paper analyzes 2 equipment options for small and medium irrigation systems. The result is energy efficiency of equipment regulation, pump efficiencies being high, with possible percentage decreases of 4-5% in certain operating situations. Investments in pumping stations associated with photovoltaic systems can ensure energy and economic efficiency as well as environmental protection and improvement of environmental factors.

Key words: *irrigation, photovoltaic energy, pumping stations, variable speed.*

THE INFLUENCE OF THE ROUGHNESS OF TRAPEZOIDAL IRRIGATION CHANNELS ON WATER LOSSES

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Abstract

Irrigation systems are becoming very important economic and social objectives in the context of climate change. Rising temperatures, especially during the vegetation period, lead to an increase in the water demand of plants, and the distribution of precipitation over a year implies the creation of larger water storage systems. In the case of the Danube as water source, the use of significant volumes of water upstream has led to a significant decrease in flows and levels in the Romanian sector, making it impossible to operate pumping stations. The rehabilitation of pumping stations and efficient transport systems is a mandatory condition for guaranteeing the operation of irrigation systems and the application of irrigation on large areas. Considering the increase in the roughness of the channels due to degradation or their construction without design criteria, as the efficiency leads to an increase in the flow section and the irrigated perimeter and implicitly water losses, the material aims to highlight these losses depending on the roughness of the channels and the need to correct, including, waterproofing systems.

Key words: *irrigation systems, trapezoidal channels, roughness, section, irrigated area, water losses.*

HISTORY, MODERNIZATION AND HYDRAULIC MODELLING OF THE SÂNMIIHAIU ROMÂN LOCK, BEGA CANAL

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Abstract

In 1728, the governor of Banat, Count Claudius Mercy, established a project for the reconstruction of the city of Timișoara, as well as the entire region, which provided for the canalization of the Bega river. In 1728, the Dutch engineer Maximilian Fremaunt designed a canalization plan for the Bega - Timiș connection, with the idea of perfecting the canal started by Mercy and ensuring the necessary flow for navigability on the Bega. After only four years of work in November 1732, the canal was used by ships as far as Pancevo. Between 1735 and 1754, a new version was built, further south, between Timișoara and Klekk. In 1739, the engineer Maximilian Fremaunt continued the canalization by intervening with locks to regulate the course of the Bega. Between 1901 and 1916, the Bega Canal was equipped with modern facilities. In the period 2000-2013, unclogging and modernization works of the Bega Canal were carried out. This work includes the modernization works of the Sanmihaiul Roman lock as well as the hydraulic modelling of the lock performed with the MIKE11 calculation program.

Key words: *hydraulic modelling, lock, navigation.*

**ADVANCED MODELING OF THE BARZAVA RIVER
IN THE BOCSA-GATAIA SECTOR,
CARAS-SEVERIN COUNTY**

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Abstract

The present case study investigates a reach of the Bârzava River located in Caraş-Severin County, Romania. To analyze the hydrodynamic behavior of the river and to address the theoretical aspects of water flow, including the effects of river training and channel regulation works, a one-dimensional numerical flow model was developed. The numerical modeling was carried out using the MIKE 11 software package, which provides advanced computational modules for simulating unsteady flow in natural river channels and for representing flow over and through hydraulic structures, including their operational characteristics. The model input data consisted of the study area layout with the spatial distribution of cross-sections, detailed topographic data of the cross-sections, riverbed roughness coefficients, and the flood discharge hydrograph used as the upstream boundary condition. The MIKE 11 simulations yielded water surface elevations for each analyzed cross-section along the modeled river reach.

Key words: hydraulic modelling, roughness of river bed.

HYDRAULIC MODELING APPLIED TO THE DETERMINATION OF SANITARY PROTECTION ZONES FOR LAKE BUHUI

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Abstract

In order to assess the impact of deforestation on the water quality of Lake Buhui, runoff modeling was conducted for the slopes of the lake's tributary catchments, with particular emphasis on the spatial configuration and morphological characteristics of the small hydrographic basins. Lake Buhui, the first artificial lake in Romania, has a storage capacity of approximately 610,000 m³ and is situated at an elevation of 640 m. Lake is additionally supplied by groundwater sources originating from crystalline schists and limestone formations, as well as by four karst springs located in the western sector of the lake, below the mean water level. Runoff generation from the slopes within the studied catchments was simulated using the rainfall-runoff (RR) module of the MIKE 11 modeling system, under the assumption of a representative annual rainfall regime. The simulation results obtained for all tributaries of Lake Buhui are presented in the form of hydrographs corresponding to forested slopes and degraded pasture areas. Furthermore, the results allow for the delineation of the lake's protection zone.

Key words: hydraulic modelling, protection zone, deforestation.

HYDRO-MECHANICAL ANALYSIS AND NUMERICAL SIMULATION OF WATER INFILTRATION PROCESSES IN RAILWAY EMBANKMENTS

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Abstract

Railway embankments represent critical components of railway infrastructure, and water infiltration constitutes a major factor in their degradation. This paper presents methods for modelling water infiltration through embankments, with an emphasis on hydro-mechanical analysis and the implications for the stability and durability of railway structures. The use of fundamental flow equations in porous media and the implementation of numerical models for simulating saturated and unsaturated conditions are discussed, providing a basis for optimizing drainage systems and preventing embankment degradation. Numerical simulations allow for the identification of areas vulnerable to infiltration, the optimization of drainage systems, and the prevention of accelerated ballast deterioration. In embankments with insufficient drainage, water accumulation leads to increased pore pressures, reduced material strength, and the occurrence of differential settlements. Integrating infiltration modelling with field monitoring and predictive maintenance methods can significantly contribute to extending the service life of the railway and reducing operational costs.

Key words: railway, modelling, water infiltration.

LONG-TERM CHANGES IN AREAS EQUIPPED WITH DRAINAGE AND DEWATERING SYSTEMS UNDER DIFFERENT LAND USES

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Abstract

This paper examines long-term changes in agricultural and non-agricultural areas equipped with drainage and dewatering systems, which are essential for managing excess moisture and maintaining land functionality. The analysis is based on official national statistical data, complemented by relevant scientific literature, and covers a period of approximately 28 years. The study investigates both the temporal evolution of equipped areas and the influence of different land-use types on hydrological regimes, soil properties, and the operational efficiency of drainage infrastructure. The results indicate an overall declining trend in equipped areas, particularly pronounced for arable land, accompanied by structural shifts among land-use categories. These changes are primarily associated with the progressive degradation of hydrotechnical systems, insufficient financial investment, and land ownership fragmentation. The findings underline the need for integrated drainage and land-use management strategies adapted to current environmental conditions in order to sustain agricultural productivity, protect soil resources, and strengthen the resilience of agroecosystems to climatic variability and the increasing occurrence of extreme weather events.

Key words: *land reclamation, excess moisture, drainage, dewatering systems, improved land, dynamics.*

COMPARATIVE ASSESSMENT OF ANNUAL DYNAMICS IN WATER QUALITY OF HERASTRAU LAKE, ROMANIA

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Abstract

Water quality assessment is vital to environmental management. Regular monitoring of lakes helps protect environmental integrity and human health. This study assessed annual changes in water quality in Herastrau Lake (Bucharest, Romania) using field and laboratory measurements complemented by satellite observations. Water samples were collected from ten sites in autumn 2024 and 2025 and analyzed for pH, electrical conductivity, total dissolved solids, salinity, dissolved oxygen, turbidity, chloride, nitrite, nitrate, ammonium, total suspended solids, hardness, and iron. Results were compared with Romanian standards (HG No. 932/20.11.2013), and Pearson correlations were performed. The lake remained alkaline in both years (pH 8.50), while dissolved oxygen declined markedly in 2025 (2.59 mg/L) compared with 2024 (6.82 mg/L). Turbidity exceeded 5 NTU, and ammonium nitrogen showed elevated concentrations (12.07 mg N-NH₄⁺/L in 2024; 13.50 mg N-NH₄⁺/L in 2025), suggesting persistent eutrophication pressure. Sentinel-2 imagery (10 m) was used to estimate surface turbidity and chlorophyll a using spectral indices (NDWI and red-edge proxies B5–B7), and the results were validated with laboratory data. The water quality underscores the need for targeted pollution control measures.

Key words: water quality, eutrophication, Herastrau, Romania, Sentinel-2.

GLOBAL CHALLENGES CONCERNING WATER RESOURCES AND THEIR MANAGEMENT: CASE STUDY – THE DANUBE

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Abstract

This paper analyses the impact of global factors on the availability and quality of water resources, highlighting the need for sustainable management. In the context of climate change, population growth and intensification of economic activities, water resources are subject to significant pressures, such as pollution, overexploitation and unequal distribution. The case study on the Danube River illustrates the complexity of managing a transboundary resource, affected by upstream pollution, hydrological variations and multiple uses. European policies and integrated management strategies applied to protect water quality, and its sustainable use are analysed. The results highlight the importance of international cooperation, infrastructure modernization and the implementation of innovative solutions. In conclusion, efficient management of water resources is an essential condition for sustainable development and the prevention of future water crises.

Key words: *water, Danube, management, resources.*

REMOTE SENSING AND GEOINFORMATICS

THE ALGORITHMIC LANDSCAPE OF AI BASED LAND USE INTERPRETATION

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Abstract

This study investigates the application of Artificial Intelligence (AI) techniques in land cover classification based on satellite imagery, with the objective of improving the accuracy and efficiency of traditional geospatial workflows. The research evaluates how conventional Geographic Information System (GIS) procedures can be enhanced through the integration of machine learning algorithms, particularly those designed for raster segmentation and automated image classification. A comparative analysis between classical supervised methods and AI-based approaches was conducted to detect land use and land cover (LULC) changes in the city of Satu Mare using multitemporal satellite data. Results show that AI-driven models offer improved classification consistency and reduced manual processing efforts. The results underline the relevance of AI-assisted image interpretation for land monitoring and its potential contribution to sustainable spatial planning. The proposed approach can be transferred to similar LULC studies.

Key words: *artificial intelligence, automated classification, Land Use and Land Cover (LULC), satellite imagery, urban expansion.*

HIGH-DENSITY AIRBORNE LIDAR POINT CLOUD FOR DIGITAL TERRAIN MODELS IN SMALL STREAM ASSESSMENT AND REHABILITATION

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Abstract

Accurate topographic data are essential for the assessment and planning of interventions along small streams and narrow valleys, where traditional survey methods are often constrained by limited access, dense vegetation, and complex terrain. Airborne LiDAR represents a reliable solution, producing high-density point clouds that capture topographic variations, channel geometry, old hydraulic works, and subtle landscape features often missed by conventional techniques. This study aims to demonstrate the workflow for UAS-LiDAR data acquisition and processing, including flight planning, PPK data processing, point cloud classification and filtering, and the generation of high-resolution Digital Terrain Models. These results provide a basis for hydrological analysis, planning, and regulatory approvals, supporting engineers and hydrologists in intervention design planning.

Key words: design planning, DIGITAL TERRAIN MODELS, LiDAR, small streams, UAS.

HIGH-RESOLUTION MAPPING OF VEGETATION TYPES, STRUCTURE, HEIGHT, AND DENSITY IN THE USAMV CLUJ-NAPOCA CAMPUS USING LiDAR, PHOTOGRAMMETRY AND MULTISPECTRAL SENSING

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Abstract

Metropolitan areas are most often affected by the weak presence of „green” infrastructure so that the climate can be affected. This work aims to evaluate the vegetation within the USAMV Cluj-Napoca campus, in terms of its spatial distribution, the types of vegetation and their characteristics. In an attempt to overcome the disadvantages of classical vegetation assessment methods, an approach that integrates several types of geospatial data was proposed. More specifically, LiDAR technology was used to determine, among other things, the height of forest vegetation and its density, aerial photogrammetric technology was used for contextual and texture information, and multispectral sensors helped to differentiate vegetation types. Data acquisition was carried out using the DJI MAVIC 3M, respectively the South SF 1200 with SG130 scanner. Data processing was carried out using various softwares, including Lidar360 Professional, Agisoft Metashape, Global Mapper and GIS platforms. This research highlights the advantages brought by the use of the most modern geodetic and topographic technologies in the evaluation of green areas within large urban areas and their contribution to the most correct management of green areas.

Key words: *vegetation, LiDAR, photogrammetry, multispectral.*

DIGITAL TRANSFORMATION OF TREE INVENTORY THROUGH GIS: OPTIMIZING FORESTRY PROCESSES VIA SPATIAL DATA COLLECTION, INTEGRATION AND ANALYSIS

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Abstract

The digital transformation of tree inventory through Geographic Information Systems (GIS) is reshaping contemporary forestry practices by enabling higher accuracy, enhanced data integration, and increased operational efficiency. GIS technologies revolutionize forest inventory workflows by facilitating precise spatial data collection and supporting advanced analytical processes. The integration of spatial datasets with modern analytical tools allows for dynamic monitoring of forest resources and provides a robust foundation for informed and sustainable management decisions. The aim of this article is to demonstrate how GIS-based digital methodologies improve the efficiency, standardization, and analytical depth of forest inventory processes, while highlighting their role in supporting modern forestry management. To achieve this, a dedicated field data collection form was developed using Survey123, specifically designed for tree inventory and analysis. This standardized form ensures consistent data acquisition and seamless integration into GIS platforms for subsequent spatial processing and interpretation. Overall, the proposed workflow illustrates the transformative potential of GIS technologies in optimizing forestry operations and advancing sustainable forest resource management.

Key words: Digital Tree Inventory, Forestry Management, GIS, Survey123.

DEFORESTATION PREDICTIONS IN NORTHERN ROMANIA USING LONG SHORT-TERM MEMORY NETWORKS

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Abstract

Forests are among Earth's most important ecosystems, but unfortunately are vanishing at alarming rates. Thus, deforestation is a global challenge with serious impacts. This paper utilizes Google Earth Engine Landsat data, together with climatic and land-cover data in order to predict the annual deforestation rate in Suceava County. This is being accomplished by using deep learning techniques, more precisely by using Long Short-Term Memory Neural Networks in order to forecast the land changes. These offer distinct advantages in handling time-series data with long-term dependencies, thus making them particularly suitable for tracking changes in vegetation over time. The results have shown an average prediction of 0.45% tree cover loss every year for the next 10 years timeframe. Deforestation studies in Romania have largely focused on spatial analysis but predictive temporal modelling using LSTM remained underexplored. By leveraging the collected data, the paper demonstrates how deep learning techniques can enhance the monitoring and forecasting of forest loss, supporting more sustainable forest management and policy-making. Integrating such approaches could pave the way to anticipating risk and protecting high risk zones before deforestation occurs.

Key words: deep learning, deforestation, predictions, climate protection.

SATELLITE-DERIVED TURBIDITY AS AN INDICATOR OF SMALL-SCALE GOLD MINING ACTIVITY AROUND THE BROKOPONDO RESERVOIR, SURINAME

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Abstract

The rapid expansion of illegal gold mining over the past decade has emerged as one of the most critical environmental challenges in Suriname, driven by its severe impacts on both terrestrial and aquatic ecosystems. Monitoring these activities is difficult due to the remoteness of affected areas, limited accessibility, and safety constraints. This study explores the potential of Sentinel-2 Level-2A imagery for detecting and monitoring artisanal and small-scale gold mining (ASGM) activity around the Brokopondo Reservoir without relying on in-situ measurements. A Python-based workflow developed in Google Colab was used to pre-process the imagery and calculate the Normalized Difference Turbidity Index (NDTI) for the period 2021–2025. Spatial relationships between high and low NDTI clusters and their proximity to ASGM sites were examined using Moran’s I, the Mann–Whitney U test, and Cliff’s delta. The results indicate that NDTI is a reliable remote-sensing indicator of ASGM-related water turbidity, offering valuable support for environmental monitoring in remote tropical forest regions of the Guiana Shield.

Key words: *gold mining activity, water turbidity, indication, monitoring, proximity.*

COMPARATIVE ANALYSIS OF ALTIMETRIC VARIATIONS IN THE SLĂNIC PRAHOVA AREA BASED ON LEVELING MEASUREMENTS

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Abstract

The levelling measurement campaign carried out in Slănic Prahova, Prahova County, year 2025, aimed to monitor altitude variations in the locality urban area. The measurements were performed with a high-precision Leica LS15 instrument and differential compensation methods, using the national E-TransDatRO system and the EGG97&MN75 geoid model. The route included locations between stations, with double observations, over length of over 2.19 km. The comparison of the two campaigns suggested a minimal evolution of the topographic surface, within the limits of the instrumental tolerances. The results obtained indicated a very good closure of the networks, with insignificant differences, which confirmed the quality of the observation and the general stability of the terrain during the analyzed interval. The configuration of the altimetric profile highlighted areas of maximum in the center of the route and progressive decreases towards the extremities, consistent with the local relief and the structure of the salt massif.

Key words: *altimetric profile, altitude variation, monitoring, subsidence, topographic surface.*

**LAND USE CHANGES INDUCED BY CONSTRUCTION
MATERIAL EXTRACTION IN SURFACE QUARRIES
WITHIN THE INEU ADMINISTRATIVE TERRITORY
(BIHOR COUNTY, ROMANIA)**

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Abstract

This study analyses long-term land use changes within the administrative boundaries of Ineu Commune, Bihor County, Romania, over a 39-year period (1985–2024), using QGIS and multi-temporal satellite imagery. While previous studies have examined land use change at regional or national levels, few have offered long-term, high-resolution assessments focused on rural areas affected by construction material extraction. This research addresses that gap by examining a single administrative unit undergoing substantial landscape transformation driven by sand and gravel quarrying. The analysis documents major shifts in agricultural land use influenced by anthropogenic pressures, economic development, urban expansion, policy changes, and climate variability. The results reveal the emergence of 56 artificial lakes and six sand and gravel extraction and processing units, which have replaced significant agricultural areas. By 2024, artificial lakes occupied 144.57 ha, indicating a marked transition in land cover. Discrepancies between official local statistics and satellite-derived datasets underscore the importance of geospatial technologies in generating accurate land use information. Overall, the study highlights both the environmental and socio-economic implications of these landscape changes and provides empirical evidence to support more informed and sustainable land management in rural regions experiencing extraction-driven pressures.

Key words: agriculture, Copernicus, Corine Land Cover (CLC), GIS, gravel pit, public policies.

SEISMIC SURVEY FOR SHALLOW INVESTIGATION OF CO₂ MIGRATION PATHWAYS IN BĂILE LĂZĂREȘTI, ROMANIA

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Abstract

At the Lăzărești mofette site in Transylvania, Romania, carbon dioxide migrates upward from depth along fault systems, reaching the shallow subsurface where these pathways branch into faults and fissures. To identify these structures, active-source seismic reflection measurements were performed along a linear profile. Seismic energy was generated using a 10-kg sledgehammer at shot points spaced 1 m apart. Forty SmartSolo vertical-component (5 Hz) receivers were deployed at 1 m spacing along a seismic profile located near two natural carbonated water springs, with the aim of imaging the subsurface pathways that enable carbonated water to reach the surface. After data processing, high-amplitude reflections were identified, corresponding to CO₂-bearing, water-saturated formations. Understanding the natural mechanisms of CO₂ migration to the surface provides a valuable natural analog for assessing the safety and long-term behavior of geological CO₂ storage associated with major industrial emitters, such as thermal power plants or cement factories.

Key words: carbon dioxide, faults, mofettes, reflection, seismics.

APPLICATION OF PHOTOGRAMMETRIC TECHNOLOGIES FOR CROP MONITORING IN PRECISION AGRICULTURE

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Abstract

This article examines the application of modern photogrammetric technologies for crop monitoring in the context of precision agriculture. Effective assessment of crop condition and spatial variability remains a critical challenge for improving productivity and optimizing resource use in large and heterogeneous agricultural areas. To address this issue, the proposed methodology employs unmanned aerial vehicles equipped with a high-resolution camera, combined with structure-from-motion photogrammetric processing, to generate detailed orthomosaics and crop surface models. Vegetation indices and canopy metrics are derived to support spatial analysis of crop vigor and growth patterns throughout the growing season. The study evaluates alfalfa fields located in the agricultural area surrounding Alba Iulia, employing UAV-based photogrammetry to quantify crop surface characteristics. The workflow generated a high-density point cloud and a high-precision 3D surface model, enabling detailed assessment of canopy structure and health and spatial variability. The results provide the basis for monitoring crop condition, support future analysis of field parameters, and demonstrate that photogrammetric products enable timely and accurate detection of stress conditions, biomass variability, and development anomalies at field scale. The study confirms that modern photogrammetric techniques provide a reliable, cost-effective, and scalable solution for supporting data-driven decision-making in crop monitoring and management.

Key words: *photogrammetry, crop monitoring, precision agriculture, unmanned aerial vehicles, vegetation indices.*

INTEGRATED COMPENSATION OF TERRESTRIAL GEODETIC AND GNSS NETWORKS USING A MODULAR 3D SOFTWARE PLATFORM. CASE STUDY: UCC MĂNECIU NETWORK

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Abstract

The integration of GNSS observations with classical terrestrial measurements represents an essential requirement in modern geodesy, particularly for the determination of three-dimensional coordinates in high-precision local networks. Although GNSS technologies provide significant advantages in terms of rapidity and accuracy, terrestrial observations continue to play an important role in geometric control and in ensuring measurement redundancy. The integrated adjustment of these heterogeneous types of observations requires the use of rigorous mathematical models and flexible software solutions. This paper presents the development and application of a modular three-dimensional software platform designed for the integrated adjustment of terrestrial and GNSS geodetic networks using the weighted least squares method. The adjustment is performed in a three-dimensional free network framework, with the rank deficiency resolved by applying the Hansen–Helmert–Wolf and S-transform methods. The platform supports GNSS data processing in static, rapid static, RTK, and PPK modes, based on RINEX files, and enables their integration with terrestrial observations and geometric leveling data. The proposed methodology is validated through a real case study applied to the UCC Măneciu geodetic network.

Key words: *geodetic networks, GNSS, compensation, weighted least squares, 3D free network, variance component estimation, error ellipsoids, WebGIS.*

LINKING FIELD VEGETATION DATA AND UAV OBSERVATIONS FOR HABITAT CONDITION ASSESSMENT IN NATURA 2000 GRASSLANDS

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Abstract

Traditional assessments of Natura 2000 habitats rely largely on field-based vegetation surveys, which can be difficult to implement consistently across large or heterogeneous landscapes. Unmanned Aerial Vehicles (UAVs) offer new opportunities for habitat monitoring by providing high-resolution spatial and spectral data capable of capturing vegetation structure and dynamics. While UAV applications have advanced considerably in habitat mapping, their use for evaluating habitat conservation condition remains less developed, particularly in grassland ecosystems characterized by complex vegetation mosaics and ecological gradients. This study explores the integration of UAV-derived information with phytosociological vegetation data to support the assessment of grassland habitat condition within the Natura 2000 framework. Vegetation relevés are used to provide ecological information on species composition and habitat characteristics, while UAV observations supply spatially continuous indicators derived from vegetation structure and spectral responses. The proposed approach illustrates how field-based ecological observations and UAV-derived remote sensing data can be combined to support habitat condition evaluation.

Key words: remote sensing, multi-sensor data, phytosociological relevés, natura 2000 grasslands.

UAV-DERIVED VEGETATION INDICES FOR SPATIAL ASSESSMENT OF WEED INFESTATION IN ARABLE CROPS

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Abstract

Early identification of weed infestation is essential for improving the efficiency and sustainability of crop protection practices. This poster presents a spatial assessment of weed infestation in arable crops based on vegetation indices derived from unmanned aerial vehicle (UAV) multispectral imagery. UAV flights were conducted during early crop development stages, and the acquired data were processed to generate NDVI-based spatial maps. Spatial variability analysis was applied to differentiate crop-dominated areas from zones affected by weeds and to identify infestation hotspots within the field. The results indicate that UAV-derived vegetation indices provide valuable information for early weed detection and support site-specific management decisions. The proposed approach contributes to reducing unnecessary agrochemical inputs and promotes more environmentally responsible weed control strategies. This work highlights the potential of UAV-based monitoring as a practical tool for supporting precision agriculture and integrated weed management in arable farming systems.

Key words: UAV, NDVI, weed infestation, spatial analysis, precision farming.

REAL-TIME PATHOGEN RISK MAPPING IN CEREAL FIELDS THROUGH INTEGRATED UAV, GIS AND SMART FORECASTING TOOLS

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Abstract

Cereal crop production faces persistent threats from biotic stresses caused by pathogenic organisms, resulting in significant yield loss and increased management costs. Conventional disease monitoring methods are often limited by spatial resolution, labor intensity, and delayed detection. Integrating unmanned aerial vehicles (UAVs), geographic information systems (GIS), and smart forecasting tools offers potential for real-time, spatially explicit pathogen risk mapping in cereal fields. This review synthesizes state-of-the-art methodologies in UAV remote sensing, GIS spatial analysis, and predictive modelling, emphasizing advances in machine learning for disease detection and risk assessment. Current challenges including data integration, operational constraints, and technological gaps are identified, and future research directions are outlined to facilitate adoption within precision agriculture and environmental engineering frameworks.

Key words: *cereal crops, UAV remote sensing, GIS, pathogen detection, risk mapping, smart forecasting.*

SUSTAINABLE LAND USE BY MULTI-CRITERIA ASSESSMENT AND GIS PLATFORM

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Abstract

Suitability analysis is the decision making part which is the vital of the suitability assessment job. It is influenced by many parameters- soil, land parameters, climatic attributes, terrain, social characteristics, cultural aspects, infrastructure, human development, services available, market situations, live-hood of population, standard of living, ecology and many more. All of them can logically be classified into following categories: physical characteristics, environmental parameters and socio-economic condition. There is a method of mixing necessary information, named multi-criteria analysis. The main idea of this report is laying down the multi-criteria assessment for established development of crops production. Multi-criteria horticulture assessment of studied region is felt increasingly for the sustainable land use and better production. In this case physical land evaluation includes parameter that satisfy requirement of the crops and multi-criteria analysis evaluated social and economic indicators. By calculating important indicators for sustainable crops cultivation, using GIS applications to form assessment maps is the main idea.

Key words: multi-criteria evaluation, sustainable land use, GIS.

A METHODOLOGICAL FRAMEWORK FOR TERRAIN MORPHOLOGICAL ANALYSIS IN RISK MAPPING BASED ON DEM-DERIVED GEOMORPHOMETRIC PARAMETERS

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Abstract

This study proposes an integrated methodological framework for terrain morphological analysis based on high-resolution digital elevation models (DEMs) and a comprehensive suite of geomorphometric parameters, including slope gradient, slope aspect, profile and plan curvature, relative relief, hypsometric indices, flow accumulation, topographic wetness index (TWI), and terrain roughness. These parameters are quantitatively derived using standardized GIS-based algorithms and systematically analysed to capture terrain heterogeneity, hydrological controls, and structural influences on surface and subsurface processes. The morphometric variables are integrated within a geospatial analytical environment through multi-criteria spatial modelling techniques, enabling the structured assessment of terrain susceptibility and the delineation of areas potentially prone to geomorphological instability. The proposed framework emphasizes methodological consistency, reproducibility, and adaptability across different environmental contexts. By formalizing the relationships between terrain attributes and geomorphological processes, the approach provides a scientifically grounded basis for supporting hazard assessment and risk mapping applications. The framework is intended to contribute to evidence-based decision-making in land-use planning, environmental management, and disaster risk reduction, facilitating the development of consistent and operational risk mapping methodologies.

Key words: terrain morphological analysis, geomorphometric parameters, digital elevation models (DEMs), multi-criteria spatial modeling, geomorphological hazard assessment.

SMART INTEGRATED E-PERMITTING PLATFORM FOR URBAN PLANNING AND CONSTRUCTION MANAGEMENT

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Abstract

This paper proposes a conceptual Smart Integrated e-Permitting Platform for urban planning and construction authorization, designed to address fragmented administrative workflows and limited interoperability between public institutions in Romania. The model integrates beneficiaries, design firms, local authorities, county councils, and technical approval providers within a unified digital environment that supports standardized document management, real-time tracking, and coordinated approval processes. Recognizing the structural imbalance and limited technical capacity within rural administrations, this framework standardizes end-to-end information flows. Furthermore, the conceptual design directly aligns with recent legislative reforms, specifically the strict 15-day response deadlines and tacit approval mechanisms established under Emergency Ordinance no. 31/2025. By structuring the system into a layered architecture and aligning it with European interoperability principles, the proposed solution successfully reduces administrative delays, improves transparency, and provides a highly scalable foundation for future digital governance and broader regulatory integration.

Key words: smart e-permitting system, urban planning, construction authorization, digital public administration, interoperability.

CASE STUDY ON THE ANALYSIS OF GREEN SPACES IN THE URBAN AREA OF CLUJ-NAPOCA USING ARCGIS PRO

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Abstract

This study aims to use recent photogrammetric data obtained from cameras mounted on various aerial platforms and to create interactive maps that support spatial analyses. The research is based on two main fields: Photogrammetry and Geographic Information Systems (GIS). The case study was conducted in the Municipality of Cluj-Napoca using photogrammetric data and GIS analyses. An orthophotomap generated from a high-altitude flight was used to create new databases and to analyze urban areas with development potential for parks and green recreational spaces in Cluj-Napoca and its surroundings. The orthophotomap analysis enabled the graphical representation of cartographic elements in ArcGIS Pro, allowing real-time access to spatial data and providing a modern approach for conducting spatial studies and analyses.

Key words: *photogrammetry, GIS, databases, cartography, spatial analyses.*

INTEGRATION OF GIS TECHNOLOGY IN THE PROCESS OF IDENTIFYING SUITABLE AREAS FOR THE CONSTRUCTION OF PARKING LOTS

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Abstract

This research focuses on determining the most appropriate locations for new parking facilities in the municipality of Cluj-Napoca, with the goal of easing traffic congestion and addressing the lack of parking spaces available to residents. A Geographic Information Systems (GIS) approach was used to build a spatial database that combines key factors, including traffic volume, population density, proximity to major points of interest, existing parking areas, neighborhood land-use functions, and terrain slope. These factors were evaluated through a multi-criteria analysis, resulting in a suitability map that identifies areas best suited for parking development. The results offer practical support for local authorities in urban planning and sustainable mobility strategies and present a flexible methodology that can be applied to other cities experiencing similar parking and traffic pressures.

Key words: *parking, urbanism, GIS analysis, traffic.*

**MOBILE MICROCLIMATE ASSESSMENT
OF URBAN–RURAL THERMAL DIFFERENCES
USING METEOTRACKER MEASUREMENTS
IN SOUTH-EAST OF ROMANIA**

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Abstract

This study presents a microclimate assessment based on mobile measurements carried out on February-March of 2026 using a Meteotracker system along several transects crossing urban and rural environments in southeastern Romania. During the vehicle surveys, high-resolution georeferenced measurements of air temperature, relative humidity, dew point, atmospheric pressure, solar radiation, altitude and vertical thermal gradient were continuously recorded. The analysis focused on identifying thermal contrasts between built-up areas and non-urbanized areas, as well as assessing the influence of altitude on observed thermal variability. Temperature profiles were examined along spatial gradients and normalized thermal differences with respect to altitude were calculated to distinguish topographic effects from possible anthropogenic warming signals. The analysis also included changes in relative humidity, dew point, and derived thermal comfort index (HDX) along the transects. The results highlight measurable thermal differences at the micro-scale between urban sectors and surrounding rural areas under winter conditions. The study demonstrates the ability of mobile weather monitoring to detect fine spatial variability of near-surface atmospheric parameters and provides an appropriate methodological framework for rapid urban climate assessments.

Key words: urban microclimate, mobile measurements, Meteotracker, temperature gradient, altitude correction, urban-rural contrast.

LiDARMAP: A NEW STEREO-BASED APPROACH FOR FAST 3D FEATURE EXTRACTION FROM LiDAR DATA

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Abstract

A new approach is presented here for developing applications that extract 2D and 3D information from data obtained through LiDAR technology. Specifically, stereorestitution technologies are applied to LiDAR point clouds, together with simplified procedures for rapid vectorization. The vector data concept is based on the GIS structure and the shapefile format, which allows the addition of attributes for collecting complex and multiple informations related to the same object. Although it contains functions similar to CAD systems, it is oriented toward the GIS systems concept, featuring point, line, polygon, and GDB topologies, along with all their associated functionalities. Thanks to its highly intuitive handling and advanced navigation functions, even for very large datasets, the application can also be useful in infrastructure development project design and monitoring programs, as well as in road quality inspection and the inspection of other constructions. Mapping transport corridors or territories predominantly covered by vegetation remains one of the leading applications of such software.

Key words: *LiDAR, software, stereo-restitution, mapping, 3D, GIS.*

GIS-BASED SCREENING OF ROAD-INDUCED SPATIAL FRAGMENTATION IN NATURA 2000 SITES IN ROMANIA

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Abstract

Road infrastructure can alter the spatial continuity of protected areas by subdividing habitat blocks and increasing edge-related pressures. This study provides a GIS-based screening of road-induced spatial fragmentation in Natura 2000 sites in Romania, focusing on motorways, express roads and national roads. Natura 2000 site boundaries were overlaid with the major road network to identify intersected sites, quantify the frequency of road intersections and examine the surface distribution of fragments in selected highly affected sites. The analysis showed that 119 out of 232 Natura 2000 sites were intersected at least once by major roads, while several sites presented repeated intersections. Four sites were selected for detailed interpretation: ROSCI0290 Ialomița Corridor, ROSAC0162/ROSPA0071 Lower Siret Floodplain, ROSCI0206 Porțile de Fier/ROSPA0080 Almăjului-Locvei Mountains and ROSPA0091 Babadag Forest. Although the study does not quantify direct ecological effects, it provides a spatial screening framework that can support field surveys, roadkill monitoring, connectivity assessment and mitigation planning.

Key words: *ecological connectivity, GIS; Natura 2000, road infrastructure, spatial fragmentation.*

GIS-BASED NOISE MAPPING OF NATURA 2000 SITES EXPOSED TO A1 MOTORWAY TRAFFIC IN ROMANIA

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Abstract

GIS-based noise mapping provides a spatially explicit approach for assessing traffic-related acoustic pressure in protected areas. This study compares two Natura 2000 sites located along the A1 motorway in Romania: ROSAC0138 Bolintin Forest, directly crossed by the motorway, and ROSAC0106/ROSPA0161 Middle Argeș Floodplain, located in its proximity. Strategic noise maps were generated for Lden/Lzsn and Lnigh/Lnoapte using 2022 traffic data, and the resulting noise contours were integrated in GIS with protected-area boundaries. The analysis quantified the surface of each site exposed to noise levels above 50 dB. Results indicate a clear contrast: in Bolintin Forest, approximately 443 ha, representing 7.8% of the site, are exposed above 50 dB, whereas in Middle Argeș Floodplain only 6.8 ha, representing 0.18% of the site, exceed this threshold. The study demonstrates the usefulness of GIS-based noise mapping for identifying acoustic exposure zones and supporting Natura 2000 management planning.

Key words: *acoustic exposure, GIS; motorway traffic, Natura 2000, noise mapping.*

MISCELLANEOUS

THE SPHAGNUM PEATBOGS OF MOLHAȘUL DE LA RÂȘCA - DEALUL NEGRU, CLUJ COUNTY

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Abstract

Molhașul de la Râșca – Dealul Negru is a montane oligotrophic peatbog complex in Cluj County (1042-1070 m a.s.l.), within the alpine biogeographical region of north-western Romania. Covering 35 ha, it comprises a mosaic of Sphagnum-dominated peat-forming communities, and for S. affine is the only site in Romania. The structure and hydrology of the site have been slightly altered by past drainage, grazing pressure, surrounding land-use changes and the expansion of woody vegetation, leading to anthropogenic habitat fragmentation and partial isolation from the neighbouring Râșca Răchitiș mire. Based on new field surveys, the present study documents the diversity, distribution patterns and habitat preferences of Sphagnum species across the active raised bog and evaluates the conservation value of Molhașul de la Râșca – Dealul Negru as one of the regional reference sites for Sphagnum-dominated ecosystems in the Gilău Massif.

Key words: *Sphagnum, peatbog, Natura 2000, Molhașul de la Râșca, Romania.*

APPLICATIONS OF AI IN DEVELOPING PASSIVE SCREEN SAFETY AGAINST THERMAL RADIATION

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Abstract

Steel sheet metal screens used for protection against thermal radiation must meet specific requirements regarding physical-mechanical and geometric characteristics. This ensures a high level of protection when evacuating personnel from inside buildings during a fire. Recently, researchers from Politehnica Bucharest and INCERC Bucharest conducted a series of theoretical and experimental studies to explore alternative designs for these fire-protection screens. After analyzing how several metal screens with identical chemical compositions and varying thicknesses behave in fire conditions, a neural network (ANN) was trained to predict the thermal performance of these materials. This approach eliminates the need for costly and destructive laboratory tests for each screen variation. Additionally, simulations using artificial intelligence were conducted to generate theoretical results based on practical data on the impact of radiant sources on different types of metal screens. The findings indicated that AI could significantly enhance the analysis of heat flux evolution across metal elements, creating valuable datasets on how different protective screens respond to thermal radiation from fire sources.

Key words: *metallic screens, fire protection, thermal radiation, artificial intelligence.*

ANALYSIS OF SPATIAL GEODETIC METHODS FOR MONITORING MINING GEOSYSTEMS

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Abstract

The increasing availability of satellite and airborne technologies has changed the way mining-affected areas are monitored and analyzed. Spatial geodetic methods such as GNSS, satellite radar interferometry (InSAR), multispectral remote sensing, and UAV-based photogrammetry and LiDAR now allow continuous and accurate observation of ground behavior over large areas. This paper presents an overview of the main spatial geodetic techniques used for monitoring mining geosystems, focusing on their practical application in detecting ground subsidence, slow surface deformations, structural instabilities, and volumetric changes of waste dumps and tailings dams. The strengths and limitations of each method are discussed from a practical perspective, taking into account accuracy, spatial coverage, operational constraints, and cost efficiency. Examples from Romania and other European mining regions highlight the benefits of combining GNSS, InSAR, UAV data, and GIS platforms into integrated monitoring systems. Such approaches support early detection of hazardous processes and contribute to safer and more sustainable management of mining and post-mining environments.

Key words: *spatial geodesy, GNSS, InSAR, remote sensing, UAV, LiDAR, geotechnical monitoring, mining waste dumps, tailings dams, GIS.*

**SPECIFIC REHABILITATION WORKS
OF DEGRADED AGROSILVOPASTORAL SYSTEMS,
IN NONCOLLECTIVIZED AREAS
IN THE CONTEXT OF CLIMATE CHANGE**

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Abstract

Agrosilvopastoral systems represented alternative and differentiated systems of exploitation of lands with reduced fertility, especially in the non-collectivized areas of medium and high hills. As a result, in these land exploitation systems, the productive potential of the land is exploited through agricultural, horticultural, forestry and zootechnical production. The objectives of the work are represented by the study and analysis of the works necessary for the rehabilitation of the exploitation process of agrosilvopastoral systems in the area of medium and high hills, abandoned after 1989, in the locality of Vîrfurile, Arad county, an area that was not collectivized. Consequently, field observations, inventories, analyses of information from the agricultural register and from the plot plan of the buildings in the study area were carried out. Also, a series of works necessary for the rehabilitation of the exploitation of agro-forestry and pastoral systems were experimented on experimental areas, making a series of comparisons with their situation prior to 1989. In conclusion, the rehabilitation of these land exploitation systems can be efficiently achieved by establishing owners' associations and respectively by accessing financing projects.

Key words: *agrosilvopastoral systems, land exploitation systems, non-collectivized area, agricultural production, horticultural production, forestry production, livestock production.*

THE USE OF FUNCTIONAL APPROACHES TO ANALYZE THE DIFFERENCES IN LAKE WATER MICROBIOME ASSEMBLAGES

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Abstract

Clean water and sanitation are one of the Sustainable development goals of the United Nations, and this resource needs constant monitoring due to its importance for human health. The aim of this paper was to assess the potential use of functional microbiome method to identify the geographical differences in functional microbiome in Lake Vârşolt, from Sălaj county. Basal community showed small-daily changes due to incubation, which represents a constant activity for the general microbial population. Guild activities presented a 50-100% increase each 24 hours, which sustain both the phenomenon of adaptation to substrate and proliferation due to favorable conditions. In terms of separate activities for functional groups, a different pattern of activity increases was observed for the entire 96 period of incubation. In terms of total microbial activity, the growth curves were 4-5 times in 96 hours, which represents an efficient indicator for short-term monitoring potential microbial development. The analysis of the entire database showed that functional profile is a suitable tool that enables the detection of difference in the microbiome assemblage and the forecasting of functional shifts in the community.

Key words: *water monitoring, functional microbiome, activity patterns, guild and group assemblage, geographical distribution.*

RESEARCH ON FREE SURFACE ENERGY DISSIPATION

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Abstract

The paper is a general presentation of the studies undertaken as part of a research project focused on a solution used for energy dissipation applied to free surface currents. The research has involved a series of studies on special shaped artificial roughness elements proposed by the authors of the preset paper. Several placement patterns of these elements were tested. Based on the result, conclusions could be drawn regarding the effects that these elements and their placement have on the flow. Based on the results obtained experimentally, new research directions are possible to be developed, which are aiming at new building materials and maybe a more versatile implementation technology compared to the classical one.

Key words: *free surface current, water current, energy dissipation, artificial roughness.*

COST EFFECTIVE SYSTEM FOR HUMAN PRESENCE DETECTION IN RURAL ENVIRONMENT

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Abstract

The present study investigates methods for detecting human presence in remote natural environments, including nature reserves and protected areas. Such regions play a critical role in environmental sustainability, and excessive human activity may adversely affect these sensitive ecosystems. Conversely, accurate estimation of visitor numbers is essential for effective management and long-term preservation of these areas. Several approaches exist for human detection, including optical systems based on visible-spectrum or infrared imaging. However, these techniques may raise concerns regarding privacy and personal data protection. To address these limitations, this research explores the application of Wi-Fi-based detection methods. Given that a significant proportion of mobile device users keep Wi-Fi functionality enabled, passive monitoring systems can identify and record Wi-Fi signal activity without direct personal identification. A dedicated hardware and software framework was developed to quantify mobile Wi-Fi activity within a designated remote study area. Validation was conducted by simultaneous visual counting, and the results indicate that Wi-Fi-based detection provides a reliable method for estimating the absolute number of visitors, as well as their temporal distribution.

Key words: *environment monitoring, data collection, sensor network, Wi-Fi.*

THREE-DIMENSIONAL BUILDING MODELING AS A DIGITAL STRATEGY FOR ENHANCING RURAL TOURISM PROMOTION

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Abstract

This article investigates the role of three-dimensional building modelling as a digital tool for promoting rural tourism and enhancing the visibility of underrepresented destinations. Rural areas often face challenges related to limited accessibility, low digital presence, and insufficient promotional resources, which constrain their tourism potential. To address these issues, the proposed approach integrates high-resolution spatial data, photogrammetry, and geographic information systems to generate accurate and interactive 3D building models of rural settlements. The methodology emphasizes cost-effective data acquisition and scalable modelling workflows suitable for small municipalities. The resulting 3D models are deployed within web-based visualization platforms and virtual tour environments to support destination marketing and visitor engagement. Results indicate that the use of 3D building models significantly improves the perceived attractiveness and spatial understanding of rural areas, facilitating remote exploration and informed travel planning. The study demonstrates that 3D modelling constitutes an effective and sustainable digital strategy for strengthening rural tourism promotion.

Key words: 3D building modelling, rural tourism, digital heritage, spatial visualization, destination promotion.

ASSESSING STUDENTS' COMPETENCIES IN ADVANCED TECHNOLOGIES FOR A SUSTAINABLE GREEN FUTURE IN ENERGY, AGRICULTURE, AND INDUSTRY

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Abstract

A sustainable green future depends on developing competencies in advanced technologies across energy, agriculture, and industry for graduate students of Master's and Doctoral programs. This study aimed to assess graduate students' perceptions from three European universities regarding the key sustainability strategies through a structured survey focusing on digitalisation, agriculture, biodiversity conservation, and the circular economy. The majority of graduate students agreed that renewable energy reduces carbon footprint, air and water pollution, and enhances public health. Students demonstrated a clear understanding of the EU Green Agriculture objectives, emphasizing food security and environmental footprint reduction. Positive perceptions extended to biodiversity conservation, with support for effective management, monitoring, and clear conservation goals. Respondents endorsed circular economy principles, including resource efficiency, material redesign, and waste recapture, and aligned with the EU's industrial strategy for a progressive and sustainable economic transition. These findings indicate that the graduate students possess both awareness and favorable attitudes toward advanced technological solutions for sustainability. The results underscore the successful implementation of digital resources developed in academic curricula for students from Master's and Doctoral programs from three European universities.

Key words: *graduate student competencies, sustainable, green agriculture.*

GAMIFICATION AS A TOOL FOR ENHANCING PARTICIPATION AND LEARNING IN GREEN DIGITISATION EDUCATION

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Abstract

This study evaluates the student satisfaction with gamification tools learning sessions on green digitization across Spain, Romania, and Portugal. Graduate participants were surveyed to assess how the gaming-based system influenced engagement, learning, and motivation. Questions focused on the effectiveness of gamification in encouraging participation, the perceived value of participation awards, the correlation between game points and progress, and the impact on learning outcomes. Results indicate that students responded positively, reporting increased participation due to gamified elements, satisfaction with awards, and a clear alignment between points and game levels. Moreover, participants highlighted improved learning outcomes and a deeper understanding of course content as a direct result of the gaming system. These findings suggest that gamification can be a powerful tool in higher education for Master`s and Doctoral programs, particularly for courses addressing digital and green transformation, fostering both motivation and effective learning among graduate students from three European universities.

Key words: learning tools, gamification, green.

NUTRITIONALLY RELEVANT MINERALS IN PARSLEY ROOT: AN X-RAY FLUORESCENCE STUDY

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Abstract

*Parsley (*Petroselinum crispum*) is a plant valued for its high nutritional content and functional properties, being an important source of vitamins and essential minerals for human health. This study aims to evaluate the mineral composition of parsley root and assess its potential health benefits. The concentrations of macroelements (calcium, magnesium, potassium, and phosphorus) and microelements (iron, zinc, manganese, and copper) were determined using X-ray fluorescence spectrometry (XRF). Parsley root samples were collected from various supermarkets in Romania and the results were compared with data reported in the literature. The mineral analysis revealed a high and relatively consistent content of essential macro- and microelements across all samples. The measured levels of potassium, calcium, iron, manganese, and zinc were comparable to or slightly higher than those previously reported, highlighting the nutritional potential of parsley root as a natural mineral source. Variations among samples can be attributed to differences in soil composition and cultivation conditions, without significantly impacting the overall nutritional quality. These findings support the inclusion of parsley root as a valuable ingredient in balanced diets and functional food formulations.*

Key words: health benefits, mathematical model, *Petroselinum crispum*, X-ray fluorescence spectrometry.

GEOMETRY AND PHYSICS

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Abstract

All science is connected and the main connection is through the language of mathematics. Some of the most spectacular scientific results are obtained transdisciplinary. The relationship between geometry and physics is one of the most profound in science, evolving from a tool for measurement into the very language used to describe the fundamental laws of the universe. Geometry and physics are deeply intertwined disciplines, where geometry provides the formal language and structural framework for physical laws, while physics often drives the development of new mathematical theories. Differential geometry, for example, is essential for understanding gauge theories in particle physics and Riemannian geometry is fundamental in cosmology. Other branches of mathematics, such topology and Lie groups contribute to both classical and modern physics. In this article we investigate some geometric results obtained via physical methods and we emphasize some other links between geometry and physics.

Key words: *geometry, physics, vectors, string theory, theory of relativity.*

ASSESSING THERMAL AND LIGHTING CONDITIONS IN UNIVERSITY TEACHING SPACES THROUGH FIELD MEASUREMENTS AND STANDARDIZED SURVEYS

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Abstract

The purpose of this study is to quantify the effect of different illuminance levels and correlated colour temperatures on the thermal perception of university students. During the experimental study, the Predicted Mean Vote (PMV) index is evaluated, while illuminance and correlated colour temperature are measured. In addition, subjective data are collected through questionnaires completed by volunteer students. All thermal environmental parameters used for the determination of the PMV index are maintained constantly across the investigated cases. The mean illuminance levels are 817 lx and 226 lx, corresponding to correlated colour temperatures of 5300 K and 4000 K, respectively. Although the calculated PMV values indicated a neutral thermal sensation in both cases, the Thermal Sensation Votes obtained from the questionnaires showed noticeable differences. Participants reported a tendency toward a slightly cool thermal sensation in the hall with a correlated colour temperature of 5300 K, whereas a slightly warm to warm thermal sensation was reported in the hall with a correlated colour temperature of 4000 K.

Key words: indoor environment, teaching hall, thermal comfort, lighting level.



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