UNIVERSITY OF AGRONOMIC SCIENCES AND VETERINARY MEDICINE OF BUCHAREST

FACULTY OF LAND RECLAMATION AND ENVIRONMENTAL ENGINEERING

INTERNATIONAL STUDENT SYMPOSIUM "IF IM CAD"

SYMPOSIUM PROGRAM & BOOK OF ABSTRACTS

LAND RECLAMATION, EARTH OBSERVATION & SURVEYING, ENVIRONMENTAL ENGINEERING

May 8, 2026

BUCHAREST

International Student Symposium
"IF IM CAD"

Organized by:

University of Agronomic Sciences and Veterinary Medicine of Bucharest
Faculty of Land Reclamation and Environmental Engineering

Partner:

Romanian Surveyors Union

Romanian Surveyors Union District 1

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SYMPOSIUM PROGRAM

Friday, 8th May	
Time	**Activity**
10:00 – 10:30	Registration of participants & Welcome coffee
10:30 – 11:00	Opening ceremony
11:00 – 13:30	Paper presentations – parallel sessions
13:30 – 14:30	Lunch
14:30 – 15:50	Paper presentations
15:50 – 16:10	Special guest - Research best practices: Insights from doctoral studies
	Viewing posters and discussions
16:45	Participants Award Ceremony & Closing ceremony

DETAILED PROGRAM

LAND RECLAMATION, EARTH OBSERVATION & SURVEYING, ENVIRONMENTAL ENGINEERING

FIFIM BUILDING, CESAR NICOLAU AMPHITHEATER, AII1

Session chairpersons:
Prof. PhD Ana VÎRSTA
Lect. PhD Mihai CORCHEŞ

Time: 11:00 – 13:30, May 8th
ORAL PRESENTATIONS

Paper ID	Authors	Institution	Paper Title
1.	Iudith Maria SARA, Lucian Alexandru PANAIT	University of Agronomic Sciences and Veterinary Medicine of Bucharest	COMPOSTING SEWAGE SLUDGE FROM URBAN WASTEWATER TREATMENT PLANTS: A SUSTAINABLE STRATEGY FOR WASTE REDUCTION AND USE AS FERTILIZER IN AGRICULTURE
2.	Răzvan HAJA, Alexandra CIOLPAN, Raul PAPP	University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca	MONITORING PARTICULATE MATTER POLLUTION IN URBAN AREAS. A CASE STUDY CLUJ-NAPOCA
3.	Rareș STANCU, Maria-Larisa BOSTAN	"1 Decembrie 1918" University of Alba Iulia	IMPACT OF HIGHWAY DEVELOPMENT ON ENVIRONMENTAL NOISE LEVELS: A COMPARATIVE STUDY IN LANCRĂM (2015–2026)
4.	Livia IVAN, Alexandru PETRE, Luca MARTINESCU, Alexandru COMAN	University of Agronomic Sciences and Veterinary Medicine of Bucharest	INFLUENCE OF UV TREATMENT IN AN AQUAPONIC SYSTEM MONITORED WITH TUYA IOT

Paper ID	Authors	Institution	Paper Title
5.	Nicușor-Valentin RADU	University of Agronomic Sciences and Veterinary Medicine of Bucharest	MYCELIUM-BASED CONSTRUCTION MATERIALS – A SUSTAINABLE ALTERNATIVE FOR THE FUTURE – REVIEW
6.	Mihai TUDOSE[1], Alessandra FIORUCCI[2]	[1]"Ion Ionescu de la Brad" Iasi University of Life Sciences, [2]Alma Mater Studiorum-Università di Bologna	WATER QUALITY DYNAMICS IN THE DANUBE DELTA AND THE ENVIRONMENTAL PERFORMANCE OF A NATURE-BASED SOLUTIONS SCENARIO
7.	Constantin Valentin CRĂCĂOANU	University of Agronomic Sciences and Veterinary Medicine of Bucharest	COMBATING THE DEGRADATION OF FOREST LAND IN THE BRĂNEȘTI AREA BY APPLYING IRRIGATION TO YOUNG PLANTATIONS IN THE CONTEXT OF CLIMATE CHANGE
8.	Maria-Larisa BOSTAN, Rareș STANCU	"1 Decembrie 1918" University of Alba Iulia	ASSESSMENT OF VOC EMISSIONS AT GAS STATIONS: IMPLICATIONS FOR AIR QUALITY AND HUMAN HEALTH
9.	Adrian Liviu OLTEANU, Vlad HINTA	University of Agronomic Sciences and Veterinary Medicine of Bucharest	WHAT IS THE FUTURE OF WATER SERVICES?
10.	Laura-Diana BOAR	University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca	SUSTAINABLE BREWING THROUGH BREAD WASTE VALORIZATION: PRODUCTION OF PALE ALE
11.	Adrian Liviu OLTEANU, Alexandru-Paul	University of Agronomic Sciences and Veterinary	FROM POTENTIAL TO PERFORMANCE: TRANSFORMING THE

Paper ID	Authors	Institution	Paper Title
	DOROBANȚU, Alexandru-Caius UNGUR	Medicine of Bucharest	ROMANIAN AGRI-FOOD SECTOR IN THE EUROPEAN CONTEXT (2020–2030)
12.	Cristian BACIU	University of Agronomic Sciences and Veterinary Medicine of Bucharest	WHEN THE GROUND SHAKES, THE WATER FAILS. NATECH CASCADE RISK IN A HIGH-SEISMICITY ROMANIAN CITY
13.	Adrian Liviu OLTEANU, Alexandru Valentin ANDREI	University of Agronomic Sciences and Veterinary Medicine of Bucharest	LIVING IN A SMART CITY OR A CLASSICAL CITY?
14.	Mircea Mihail BUZNEA	University of Agronomic Sciences and Veterinary Medicine of Bucharest	WHAT DO WE KNOW ABOUT THE WATER WARS?
15.	Alexandru-Paul DOROBANȚU, Alexandru-Caius UNGUR	University of Agronomic Sciences and Veterinary Medicine of Bucharest	THE BEHAVIOR OF RIVER REGULATION WORKS IN THE CONTEXT OF CLIMATE CHANGE

FIFIM BUILDING, SIMION HÂNCU AMPHITHEATER, AII2

Session chairpersons:
Prof. PhD Raluca MANEA
Lect. PhD Iulia COROIAN

Time: 11:00 – 13:30, May 8th
ORAL PRESENTATIONS

Paper ID	Authors	Institution	Paper Title
1.	Ștefana-Ruxandra IONEANU[1], Andra VIȘAN[2]	[1]Komora Engineering SRL,[2]University of Agronomic Sciences and Veterinary Medicine of Bucharest	APPLICATIONS OF 3D LASER SCANNING IN THE DIGITAL PRESERVATIONOF CULTURAL HERITAGE
2.	Paul-Andrei TRIFU, Mădălina ȚERMURE	University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca	INTEGRATION OF AUTOCAD AND PYTHON FOR ADVANCED CAD WORKFLOW AUTOMATION AND COMPUTATIONAL EFFICIENCY
3.	Balázs KIRÁLY	Óbuda University	DETECTION OF FOREST CLEAR-CUTTING USING SENTINEL-1 AND SENTINEL-2 DATA
4.	Lorena-Denisa SARCA	University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca	DISCOVERING IDEAL CAMPING ZONES THROUGH ADVANCED GEOSPATIAL ANALYSIS
5.	Ionuț-Mihai GONGEA, Viviana-Ioana PEPENEAȚĂ, Mădălina-Iulia POPESCU, Cristian RADU	Military Technical Academy „Ferdinand I”	MONITORING AGRICULTURAL LAND DEGRADATION DYNAMICS AND ASSESSING DESERTIFICATION RISK IN THE ROMANIAN PLAIN USING REMOTE SENSING AND GIS TECHNIQUES

Paper ID	Authors	Institution	Paper Title
6.	Cristian-Ioan PUIE, Andrei-Gabriel CÎMPEANU, Alexandru-Mihai CÎMPEANU	University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca	COMPARATIVE STUDY ON THE DETERMINATION OF TOPOGRAPHIC POINT COORDINATES IN THE USAMV CLUJ-NAPOCA CAMPUS USING MOBILE APPLICATIONS
7.	Giorgia-Alessia MEDINȚU	University of Agronomic Sciences and Veterinary Medicine of Bucharest	TRACKING MINING-INDUCED LANDSLIDE DYNAMICS IN ALUNU (ROMANIA) USING SENTINEL-2 TIME SERIES ANALYSIS
8.	Alicia-Dumitrița TĂMĂȘAN, Ovidiu-Alexandru VILT	University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca	GEOMETRIC MODELING AND SPATIAL ANALYSIS OF THE ORCHARD AND VINEYARD IN THE USAMV CLUJ-NAPOCA CAMPUS USING GOOGLE EARTH, PYCHARM, AND MAPLE
9.	Cristian–Samuel TEREȘNEU	Transilvania University of Brasov	GEOMATICS AND SPORTS
10.	Codruț-Daniel DANCIU, Roberth-Christian GHERDAN	University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca	ALTITUDINAL ANALYSIS AND THREE-DIMENSIONAL REPRESENTATION OF TOPOGRAPHIC POINTS WITHIN THE USAMV CLUJ-NAPOCA CAMPUS USING PYTHON
11.	Alex ERDÉLYI	Óbuda University	ACCELERATED GEOREFERENCING
12.	Ana-Maria BOGOȘEL, Daniela-Andreea BUHAI,	University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca	AUTOMATIC DETERMINATION OF URBAN GREEN SPACE AREA USING MOBILE DATA ACQUISITION AND PYTHON-

Paper ID	Authors	Institution	Paper Title
	Naomi Debora BURDUHOS		BASED GEOSPATIAL ANALYSIS
13.	Tunahan BAYRAK	Zonguldak Bülent Ecevit University	DEVELOPMENT OF LOW-COST MOBILE 3D DATA ACQUISITION SYSTEMS FOR DIGITAL TWIN APPLICATIONS
14.	Károly Áron ÁKOM	Óbuda University	GEOREFERENCING OF HUNGARY'S FIRST MILITARY SURVEY SECTIONS USING CONSTRAINT CONDITIONS
15.	Emre KELEPİRCİOĞLU	Zonguldak Bülent Ecevit University	COMPARATIVE BENCHMARKING OF SUPER-RESOLUTION METHODS FOR SENTINEL-2 MULTISPECTRAL IMAGERY: A MULTI-DATASET EVALUATION

FIFIM BUILDING, SIMION HÂNCU AMPHITHEATER, AII2

Session chairpersons:
Prof. PhD Eng. Cornel Cristian TEREŞNEU
Assoc Prof. PhD Luisa ANDRONIE

Time: 14:30 – 15:50, May 8th
ORAL PRESENTATIONS

Paper ID	Authors	Institution	Paper Title
16.	Răzvan-Ionuț ILEA	University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca	RESILIENT BUCHAREST: GIS-BASED URBAN EVACUATION PLANNING IN SEISMIC SCENARIOS
17.	Pierrot Evrard NGUEMBOU FOUMENA	Zonguldak Bülent Ecevit University	MONITORING FOREST FIRES IN THE İÇMELER–MARMARIS AREA (TURKEY) USING SENTINEL-2 DATA
18.	Cătălin MALEŞ, Oana-Cristina MIRON	Technical University of Civil Engineering Bucharest	SFM-BASED AUTOMATIC DBH ESTIMATION IN URBAN PARKS
19.	Marinela-Laura COSTEA, Alex-Tobias MAN	University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca	ANALYTICAL MODELING OF A LAND SURFACE AND DETERMINATION OF PLANIMETRIC AREA AND REAL 3D SURFACE USING MAPLE
20.	Tamas NAGY, Árpad TURUCZKO, Mădălina ȚERMURE	University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca	AUTOMATED CLASSIFICATION AND SPATIAL CONNECTIVITY ANALYSIS OF GEODETIC BENCHMARKS USING PYTHON AND AUTOCAD
21.	Romina-Gabriela HARDA, Ana-Lenuța CUCIUREAN	University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca	OPTIMAL POSITIONING OF A SURVEYING STATION USING NUMERICAL OPTIMIZATION AND SPATIAL CONSTRAINTS IN PYTHON

Paper ID	Authors	Institution	Paper Title
22.	Roxana-Maria HAICAN, Alexandra-Ionela NISTOR, Nicoleta PAVEL, Ana-Maria SAVU Iulian-Sebastian HAGIU, Vlad-Andrei HAICAN	University of Agronomic Sciences and Veterinary Medicine of Bucharest	DEVELOPMENT OF A DIGITAL TWIN FOR THE UNIVERSITY OF AGRONOMIC SCIENCES AND VETERINARY MEDICINE OF BUCHAREST CAMPUS USING TERRESTRIAL SCANNING AND GEOSPATIAL TECHNOLOGIES: A COMPARATIVE ANALYSIS BETWEEN ROMANIA AND NORDIC COUNTRIES
23.	Marian Alexandru RUSU, Denis-Gabriel ȚICU	University of Agronomic Sciences and Veterinary Medicine of Bucharest	EXPLORING A CHANGING PLANET: AN INTERACTIVE 3D GEOSPATIAL PLATFORM FOR ENVIRONMENTAL HAZARD VISUALIZATION USING EARTH OBSERVATION DATA

FIFIM BUILDING, SECOND FLOOR

POSTER PRESENTATIONS

Paper ID	Authors	Institution	Paper Title
1.	Daniel AILINCĂI, Rareş CIOPONEA	University of Agronomic Sciences and Veterinary Medicine of Bucharest	DIFFERENTIAL CURVES AND APPLICATIONS
2.	Ioana-Mădălina MANTU	University of Agronomic Sciences and Veterinary Medicine of Bucharest	EARTH OBSERVATION FOR RISK MANAGEMENT: USING THE COPERNICUS EMERGENCY SERVICES AND PROXIMITY ANALYSIS FOR THE EMSR802 FLOODS IN CENTRAL ROMANIA
3.	Ioan-Traian NICA	University of Agronomic Sciences and Veterinary Medicine of Bucharest	APPLYING THE GOLDEN PROPORTION IN LE CORBUSIER'S MODULOR

BOOK OF ABSTRACTS

DIFFERENTIAL CURVES AND APPLICATIONS

Daniel AILINCĂI[1], Rareș CIOPONEA[2]

Scientific Coordinator: Lect. PhD Cosmin-Constantin NIȚU[1]

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Abstract

A differentiable curve is a function defined on closed interval [a,b]⊂R, with all its components functions derivable. Obviously, such a function is continuous. The simplest way to view a curve the path of a moving point. In this paper we present some classical curves, but also some new curves of our own, focusing on their properties (length, curvature, torsion etc) and applications.

Key words: *differential curve, graphs, parametrization, curvature, torsion*.

GEOREFERENCING OF HUNGARY'S FIRST MILITARY SURVEY SECTIONS USING CONSTRAINT CONDITIONS

Károly Áron ÁKOM

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Abstract

As the result of georeferencing, spatial coordinates are assigned to individual pixels of the digitized map, which allows geographic information systems to place the raster into the coordinate system belonging to the given reference system. This can be done using ground control points (GCPs), whose image and projection coordinates are known. The map sheets of the first military surveys were subject to a mean error of several hundred meters, and if each sheet was georeferenced using its own control points, their boundaries would not match. To avoid this, the transformation can be performed using constraint equations using higher order (in my thesis, third order) transformation formulas. The constraint equations allow us to condition the fit of each boundary, which is represented as the connection between the transformation parameters of each sheet. In my thesis, I implemented the calculation of the transformation parameters and the generation of map sheets in Python (using the NumPy modules for the calculations and the GDAL module for georeferencing) and displayed the georeferenced sheets in QGIS.

***Key words**: georeferencing, polynomial transformation, Python, GDAL.*

WHEN THE GROUND SHAKES, THE WATER FAILS. NATECH CASCADE RISK IN A HIGH-SEISMICITY ROMANIAN CITY

Eng. Cristian BACIU

Scientific Coordinators:
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Abstract

Major earthquakes trigger complex, multi-sectoral NATECH (Natural Hazard Triggering Technological Accidents) cascades. While building collapses dominate immediate life-safety metrics, simultaneous failures in water, gas, and wastewater systems generate humanitarian and ecological consequences that current emergency frameworks are structurally unprepared to address. This paper presents a quantitative NATECH analysis for a high-seismicity Romanian city exposed to Vrancea intermediate-depth seismicity at PGA=0.50g. Integrating HAZUS-MH pipeline fragility functions, ALA damage coefficients, and the Streeter-Phelps framework, three sequential failure mechanisms are quantified. Water network failure (45–69 breaks) disables firefighting across 71% of sectors within four hours; gas ignitions exceed response capacity by a factor of 4.8 where hydrants are non-operational. Wastewater plant bypass releases 24,000 m3/day of raw effluent, suppressing dissolved oxygen below Water Framework Directive Class II thresholds along a 34 km corridor within 26 hours. A Priority Emergency Environmental Monitoring Protocol is proposed as an original operational instrument for seismic resilience. In municipalities with pre-1977 infrastructure, NATECH cascades generate consequences outlasting structural damage – impacts that current frameworks fail to mitigate.

Key words: *NATECH cascade, seismic risk, water network fragility, post-earthquake fire, Streeter-Phelps, Water Framework Directive, urban resilience*

DEVELOPMENT OF LOW-COST MOBILE 3D DATA ACQUISITION SYSTEMS FOR DIGITAL TWIN APPLICATIONS

Tunahan BAYRAK[1]

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Abstract

The rapid generation and analysis of 3D spatial data are of critical importance for modern surveying, digital twin applications, and infrastructure management. Although traditional methods such as terrestrial laser scanning provide high accuracy, they involve high equipment costs and operational complexity. This study presents a low-cost and accessible mobile photogrammetry system developed by the authors for generating and analysing metric data from 3D models. The proposed system is based on the integration of a mobile application for sensor-supported image acquisition and a server-based photogrammetric reconstruction workflow utilizing SfM/MVS techniques. Within the system, the reconstructed 3D model is transferred back to the mobile device. The model is placed and visualized in the real environment using an Augmented Reality (AR) module, while all metric analysis operations, including scaling, distance measurement, and area calculation, are performed directly within the Viewer module of the mobile application. The alignment of the model with real-world dimensions is achieved through a user-defined scaling approach based on reference lengths measured in the field. In this study, the accuracy of the measurements derived from the photogrammetric model is evaluated through comparison with independent control measurements using error analysis (RMSE). In addition, the effects of surface noise, edge sharpness loss, and manual point selection on measurement accuracy are investigated. The results demonstrate that the proposed mobile-based approach provides sufficient accuracy for practical field measurements and spatial analysis, offering a cost-effective alternative solution.

Key words*: Mobile Photogrammetry, Augmented Reality, In-situ Visualization, 3D Measurement, Error Analysis, Digital Twin.*

SUSTAINABLE BREWING THROUGH BREAD WASTE VALORIZATION: PRODUCTION OF PALE ALE

Laura-Diana BOAR

Scientific Coordinators: Assoc. Prof. PhD Luisa ANDRONIE, Lect. PhD Iulia COROIAN

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Abstract

Food waste is a significant challenge in many developed countries, with bread being one of the most commonly discarded food products. This is largely due to high grain production, which lowers the cost of bread and increases its availability, often leading to overconsumption and waste.
This study introduces Bread down, a product designed to reduce food waste by substituting 25–30% of barley malt with dried white bread, providing a sustainable alternative source of fermentable carbohydrates in the brewing process.
The results demonstrate that incorporating baked bread into beer production is a viable approach, offering an effective alternative raw material while contributing to the reduction of food waste.

Keywords: *Beer, bread, food waste, pale ale.*

AUTOMATIC DETERMINATION OF URBAN GREEN SPACE AREA USING MOBILE DATA ACQUISITION AND PYTHON-BASED GEOSPATIAL ANALYSIS

Ana-Maria BOGOȘEL, Daniela-Andreea BUHAI, Naomi Debora BURDUHOS

Scientific Coordinators: Lect. PhD Iulia COROIAN, Assoc. Prof. PhD Rodica SOBOLU, Assoc. Prof. PhD Luisa ANDRONIE, Prof. PhD Tudor SĂLĂGEAN

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Abstract

The assessment and quantification of urban green spaces represent an essential component in environmental analysis and spatial planning. This study focuses on the delineation and area determination of a green space located in the Central Park "Simion Bărnuțiu" in Cluj-Napoca, Romania, based on a dataset consisting of approximately 1100 spatial points.

The data acquisition process was carried out using the mobile application Measure Map, which enabled the collection of geographic coordinates (latitude and longitude) corresponding to significant points outlining the analyzed area. The resulting dataset was subsequently processed in the Python programming environment using specialized geospatial libraries.

To ensure the accuracy and spatial consistency of the collected data, the points were visualized over a cartographic basemap, allowing for graphical validation of their distribution and alignment with real-world features. The geographic coordinates were then transformed into a projected coordinate system, enabling precise metric computations.

The area of the green space was determined by constructing a representative polygon of the study area and applying built-in computational functions available within Python libraries. Additionally, a differentiated analysis of component surfaces was performed in order to exclude non-green elements such as pathways, built-up areas, and water bodies.

The results demonstrate the efficiency and applicability of integrating mobile data acquisition tools with Python-based geospatial analysis for rapid and reliable estimation of urban green space areas. This approach provides a practical and accessible solution for applications in surveying, cadastre, and urban environmental management.

Key words: *Python, green space, Measure Map.*

ASSESSMENT OF VOC EMISSIONS AT GAS STATIONS: IMPLICATIONS FOR AIR QUALITY AND HUMAN HEALTH

Maria-Larisa BOSTAN, Rareş STANCU

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Abstract

This study assesses the presence of volatile organic compounds (VOCs) in the vicinity of gas stations, with a focus on aromatic hydrocarbons: benzene, toluene, ethylbenzene, and o-xylene (BTEX). Concentrations were measured under different operational conditions, including vehicle refuelling and fuel delivery. The results highlight significant variability in pollutant levels and indicate potential risks for air quality and human health, particularly due to elevated benzene concentrations exceeding regulatory thresholds. Moreover, gas stations located near residential areas may pose an increased health risk for nearby populations through chronic exposure to VOCs. The findings emphasize the need for improved emission control strategies, continuous monitoring, and careful urban planning to minimize population exposure.

***Key words**: volatile organic compounds (VOCs), air quality, health risk, human exposure, gas stations.*

WHAT DO WE KNOW ABOUT THE WATER WARS?

Mircea Mihail BUZNEA

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Abstract

The concept of "water wars" refers to conflicts driven by competition over water resources, particularly in regions where water is scarce or unevenly distributed. While large-scale wars exclusively caused by water remain rare, tensions related to water access, allocation, and control are intensifying worldwide.

Water scarcity is increasingly recognized as a critical global challenge with significant geopolitical implications. This paper examines the concept of "water wars" through a multidisciplinary lens, integrating hydrological constraints, climate change projections, and geopolitical dynamics. While historical evidence suggests that water disputes have more often led to cooperation than armed conflict, emerging pressures, including population growth, climate variability, and large-scale hydraulic infrastructure—are intensifying competition over shared water resources.

Focusing on key transboundary river basins such as the Nile River and the Indus River, the study evaluates how upstream control, dam construction, and fluctuating water availability may influence regional stability. A comparative analysis highlights the dual role of water infrastructure as both a tool for development and a potential instrument of geopolitical leverage.

The paper argues that future conflicts are unlikely to manifest as conventional "water wars," but rather as complex crises involving political pressure, economic disruption, and localized instability. Engineering solutions, including improved water management systems and desalination technologies, are assessed as mitigating factors. Ultimately, the findings suggest that cooperation mechanisms and adaptive infrastructure will be decisive in determining whether water scarcity leads to conflict or collaboration in the coming decades.

Key words: *water wars, water scarcity, geopolitical implications, key transboundary river basins.*

ANALYTICAL MODELING OF A LAND SURFACE AND DETERMINATION OF PLANIMETRIC AREA AND REAL 3D SURFACE USING MAPLE

Marinela Laura COSTEA, Alex Tobias MAN

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Abstract

This paper presents a methodology for the analytical modeling of a land surface based on a set of discrete spatial points, using the Maple environment to integrate interpolation, approximation, and numerical computation techniques. In the first stage, the boundary of the studied region is defined by two distinct frontiers, modeled through a Lagrange interpolation polynomial for the right boundary and a cubic spline for the left boundary, thus providing a continuous and coherent planar representation of the domain. Based on these functions, the planimetric area of the region is computed by numerical integration, while the result is validated through the shoelace polygonal control method, ensuring the geometric consistency of the model.

In the second stage, the points are extended by including the elevation coordinate, and the terrain surface is approximated by a two-variable polynomial function of the form, obtained through the least squares method. This representation enables the computation of partial derivatives and the evaluation of the real 3D surface of the terrain over the previously delimited domain, using the differential surface formula in space. The obtained results make it possible to compare the planar area with the actual 3D surface, highlighting the influence of relief on the effective size of the land surface. The proposed methodology provides a rigorous mathematical framework with direct applicability in topography, cadastre, and digital terrain modeling, being suitable for both quantitative analysis and 2D–3D graphical representation of irregular surfaces.

Key words: *Maple, cubic spline, Lagrange interpolation*

COMBATING THE DEGRADATION OF FOREST LAND IN THE BRĂNEȘTI AREA BY APPLYING IRRIGATION TO YOUNG PLANTATIONS IN THE CONTEXT OF CLIMATE CHANGE

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Abstract

Climate change over the past decade has left a significant imprint on forest areas in southern Romania. Prolonged drought periods have adversely affected tree stands, which, under hydric stress, have begun to decline and dry out, thereby necessitating their removal and the implementation of reforestation works. To ensure the successful establishment of these plantations, species appropriate to the natural fundamental forest type have been employed—species characteristic of the study area, which, under optimal climatic conditions, can develop without supplementary interventions such as irrigation. In recent years, however, this has no longer been feasible, requiring repeated reforestation of the same areas. Moreover, the direct exposure of forest lands to adverse climatic factors, particularly drought, constitutes an initial step toward land degradation.The study area is located in the north-eastern part of Ilfov County, is state-owned, and is administered by the Branesti Forest District. The ten plots comprising the study area have undergone restoration–substitution silvicultural treatments in accordance with the 2021 Forest Management Plan, while the key stage of canopy closure in the plantations has been delayed in recent years due to insufficient precipitation during the months of June, July, August, and September .To limit land degradation processes, drip irrigation has been proposed as a control measure. This method is intended to ensure the water requirements of the planted forest seedlings, thereby facilitating the establishment of forest cover on areas currently exposed to unfavorable climatic conditions.

Key words*: degradation, afforestation, irrigation works, water deficit, climate changes.*

ALTITUDINAL ANALYSIS AND THREE-DIMENSIONAL REPRESENTATION OF TOPOGRAPHIC POINTS WITHIN THE USAMV CLUJ-NAPOCA CAMPUS USING PYTHON

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Abstract

This paper presents a methodology for analyzing the terrain surface within the campus of the University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca, based on a set of points characterized by planimetric coordinates in the national Stereo 70 coordinate system and associated elevation values.
The data processing was carried out in the Python environment, using specialized libraries for numerical analysis and graphical representation. In the initial stage, fundamental statistical parameters of the terrain were determined, including minimum and maximum elevation values, as well as the total elevation range, providing an overall perspective on the altitudinal variability of the study area.
Subsequently, a three-dimensional representation of the points was performed, in which spatial coordinates were used to highlight their distribution in both planimetric and vertical dimensions. This approach enables a clear visualization of the terrain configuration and facilitates the identification of areas characterized by significant elevation changes.
The analysis was further extended by computing elevation differences and slopes between points, expressed both as percentages and angular values in degrees, allowing for a quantitative assessment of terrain inclination. Additionally, a relative elevation analysis was conducted by referencing all points to the minimum elevation point, providing insight into the vertical distribution of the dataset.
The obtained results demonstrate the effectiveness of Python as a flexible and accessible tool for topographic data analysis and three-dimensional point representation, offering valuable support for terrain studies in surveying and cadastral applications.

Key words: *Python, elevation, slope.*

THE BEHAVIOR OF RIVER REGULATION WORKS IN THE CONTEXT OF CLIMATE CHANGE

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Abstract

Climate change is one of the most important factors influencing the dynamics of hydrological systems at a global level. The increase in the frequency and intensity of extreme phenomena, such as flash floods or prolonged drought periods, causes significant changes in the flow regime of rivers.
In this context, river regulation works, designed on the basis of historical series considered stationary, may lose their efficiency and operational safety.
Thus, it becomes essential to analyze the behavior of the existing hydrotechnical infrastructure under the conditions of new climatic realities, as well as to identify sustainable adaptive solutions.
To meet the new challenges, adaptive solutions are promoted: Nature-Based Solutions (restoring floodplains and reconnecting the river with the adjacent area), River freedom space, (allowing the natural development of the riverbed), Flexible infrastructure (works that can absorb hydrological variations), and Integrating climate models (designing based on future scenarios, not just historical ones).
The article analyzes the behavior of these works under the conditions of new climatic realities, highlighting the processes of hydraulic overload, morphological instability and functional degradation. Relevant examples from Romania and Europe are presented, as well as modern adaptation directions, based on the integration of flexible solutions and ecological approaches. The results emphasize the need to transition from rigid river control to adaptive management strategies, capable of ensuring the resilience of hydrotechnical infrastructure under conditions of climate uncertainty.

Keywords: *climate change, river regulation, extreme floods, hydrotechnical resilience, solid transport, nature-based solutions, hydrological non-stationarity, adaptive management*.

ACCELERATED GEOREFERENCING

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Abstract

Georeferencing satellite imagery from platforms with limited attitude determination accuracy — such as historical satellites or nanosatellites — is often hindered by positional errors of 10–30 km. Manual correction requires hundreds of hand-placed Ground Control Points (GCPs), making the process slow and monotonous. This paper presents two MATLAB-based methods, one for automating and one for accelerating this process, tested on WREN-1 nanosatellite imagery with Sentinel-2 scenes serving as reference. A prior, inaccurately georeferenced image is first produced from trajectory-derived RPC coefficients using GDAL. The automated method then divides this image into tiles, applies normalized cross-correlation against the full reference image, and filters GCP candidates through a correlation threshold and a voting algorithm based on displacement-vector clustering. Because the associated computational load forces a resolution reduction that degrades reliability, this approach typically yields too few usable GCPs for accurate georeferencing. The accelerated method overcomes this by deriving an estimated whole-image offset from a single manually placed GCP, restricting cross-correlation to small search windows and enabling full-resolution computation with predictable, user-defined accuracy.

Key words: *georeferencing, voting algorithm, satellite imagery, cross correlation.*

MONITORING AGRICULTURAL LAND DEGRADATION DYNAMICS AND ASSESSING DESERTIFICATION RISK IN THE ROMANIAN PLAIN USING REMOTE SENSING AND GIS TECHNIQUES

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Abstract

This study investigates the changes of agricultural land degradation and the risk of desertification in the Dăbuleni area, located in the Romanian Plain, using satellite imagery and Geographic Information Systems (GIS) techniques. Based on Sentinel-2 satellite data from May 2021 to May 2025, changes in vegetation condition and soil moisture were analysed by calculating the Normalized Difference Vegetation Index (NDVI) and Normalized Difference Moisture Index (NDMI) indices. The methodology involved processing spectral bands, generating spatial distribution maps, and evaluating temporal trends in order to identify areas affected by degradation processes. The results highlight a general decrease in vegetation health and soil moisture in specific zones, indicating an increasing vulnerability to desertification. Spatial analysis revealed that areas with consistently low NDVI and decreasing NDMI values correspond to zones with higher degradation risk. Merging different geospatial indicators resulted in the development of a geospatial overview of desertification changes over time. The findings demonstrate the effectiveness of Geographic Information Systems (GIS) technologies in monitoring land degradation and support the need for sustainable land management strategies in vulnerable regions.

***Key words**: agricultural land degradation, desertification risk, GIS analysis, NDVI, remote sensing.*

DEVELOPMENT OF A DIGITAL TWIN FOR THE UNIVERSITY OF AGRONOMIC SCIENCES AND VETERINARY MEDICINE OF BUCHAREST CAMPUS USING TERRESTRIAL SCANNING AND GEOSPATIAL TECHNOLOGIES: A COMPARATIVE ANALYSIS BETWEEN ROMANIA AND NORDIC COUNTRIES

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Abstract

This study proposes an integrated geospatial methodology for the three-dimensional reconstruction and digital representation of built environments, based on the synergistic use of terrestrial laser scanning and UAV-based photogrammetry, while also situating the approach within a comparative framework between Romania and the Nordic countries. The research was conducted within the campus of the University of Agronomic Sciences and Veterinary Medicine of Bucharest (USAMV), a heterogeneous urban space characterized by complex architectural structures, pedestrian networks, and vegetated areas.

The methodological framework combines high-resolution terrestrial LiDAR data with aerial imagery acquired via an unmanned aerial vehicle, facilitating the generation of a geometrically accurate and spatially comprehensive 3D model. Terrestrial scanning ensures high-precision data acquisition at ground level, while UAV photogrammetry provides extended spatial coverage, particularly for rooftops and otherwise inaccessible areas. This approach is analyzed in relation to similar implementations in Nordic countries, where digital twin technologies and geospatial integration are more widely adopted in smart city initiatives.

The integration of these complementary datasets results in a coherent digital twin of the study area, suitable for applications in urban planning, infrastructure management, spatial analysis, and academic research. By contrasting the Romanian case study with Nordic practices, the research highlights both the current developmental stage and the potential for advancement in Romania. The findings emphasize the efficiency of multi-sensor data fusion in overcoming

individual technological limitations and enhancing the accuracy, completeness, and usability of 3D geospatial models, while also underlining regional disparities in technological adoption and implementation.

Keywords: *terrestrial laser scanning, UAV photogrammetry, LiDAR, digital twin, GIS.*

OPTIMAL POSITIONING OF A SURVEYING STATION USING NUMERICAL OPTIMIZATION AND SPATIAL CONSTRAINTS IN PYTHON

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Abstract

This paper presents a numerical methodology for determining the optimal position of a surveying station within a real-world topographic framework, using the Python programming language. The study is based on a set of topographic points, aiming to identify a station location that ensures efficient accessibility and visibility toward the selected target points.

The mathematical model is formulated in the plane (x, y) as an optimization problem, where the objective function minimizes the sum of distances (Manhattan metric) between the unknown station position and the target points. The feasible domain is defined through geometric constraints derived from straight lines determined by known points in the field, which delimit the admissible region for the station placement. The optimal solution is obtained through a discrete numerical approach (grid search), allowing a systematic exploration of the solution space and identification of the global minimum.

The obtained solution is further validated in three-dimensional space by incorporating the vertical coordinate z, taking into account the terrain elevation and the instrument height. For each target point, the horizontal distance, elevation difference, and vertical angle are computed and compared against admissible thresholds commonly used in surveying practice, ensuring the practical feasibility of the solution.

The results highlight the effectiveness of Python as a computational tool for solving optimization problems in surveying and cadastre, providing a flexible and reproducible framework for spatial analysis and decision support in terrestrial measurements.

***Key words**: Python, objective function, surveying station.*

RESILIENT BUCHAREST: GIS-BASED URBAN EVACUATION PLANNING IN SEISMIC SCENARIOS

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Abstract

This study focuses on the identification of safe areas in case of an earthquake in Bucharest. The city is exposed to significant seismic hazard due to the influence of the Vrancea seismic zone, compounded by a vulnerable building stock and a complex urban structure. Using Geographic Information Systems (GIS), spatial data on buildings, road networks, and green spaces were integrated and analyzed. The methodology involved identifying vulnerable buildings, classifying the road network according to safety levels in relation to designated evacuation open spaces, and delineating safe zones based on urban parks exceeding 500 m^2. An accessibility analysis was conducted to assess the distance between residential areas and these safe zones. The results highlight critical areas with limited access to safe spaces and identify evacuation routes that avoid high-risk streets. Overall, the study provides valuable cartographic support for urban planning and disaster risk management.

APPLICATIONS OF 3D LASER SCANNING IN THE DIGITAL PRESERVATIONOF CULTURAL HERITAGE

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Abstract

This paper presents the use of 3D laser scanning for documenting cultural heritage, with the Church of the Assumption of the Virgin Mary in Căuşeni, Republic of Moldova, built between 1763–1769, as a case study. The church has suffered from natural degradation and human interventions. The scanning enabled the creation of a precise digital model of its current state, capturing architectural and pictorial elements, providing a solid basis for conservation, restoration, and analysis. The project demonstrates how digital technologies expand the role of geodetic engineering beyond traditional surveying, supporting the protection of cultural heritage.

Key words: *3D Laser Scanning, Digital Preservation, Cultural Heritage, Reality Capture.*

INFLUENCE OF UV TREATMENT IN AN AQUAPONIC SYSTEM MONITORED WITH TUYA IOT

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Abstract

In the context of climate instability and urban expansion, aquaponic systems represent a sustainable alternative for food production. This study evaluates the impact of UV treatment on water quality and microbial load in an aquaponic system monitored via Tuya IoT technology. Two aquaponic systems were analyzed over 8 weeks: a UV-treated experimental system and a control system without UV exposure. Key physicochemical parameters (NH_4^+, NO_2^-, NO_3^-, DO, EC and T) and microbial load were monitored. UV treatment removed pathogens and harmful bacteria, but also reduced beneficial nitrifying bacteria, affecting the nitrification process. Both systems initially showed high NH_4^+ levels followed by a decrease. The control declined rapidly to normal values, whereas the UV-treated system showed a slower reduction, indicating delayed nitrification. Similarly, pH decreased in both systems, but only the control stabilized, while the UV-treated system remained at low values (pH = 4÷5), suggesting impaired buffering capacity. Overall, UV improves disinfection but may reduce system stability. IoT technology offers efficient real-time tracking.

***Key words**: aquaponics, IoT monitoring, nitrification process, UV treatment, water quality.*

MONITORING PARTICULATE MATTER POLLUTION IN URBAN AREAS. A CASE STUDY CLUJ-NAPOCA

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Abstract

One of the major concerns of our society is air quality, mainly in large urban spaces. The aim of our research is to monitor the particulate matter ($PM_{2.5}$ and PM_{10}) air concentrations in the municipality of Cluj-Napoca to determine air quality. The study was conducted in the municipality of Cluj-Napoca in four different areas from the point of view of air quality (residential, mixed-urban, traffic, industrial). Data concerning PM, environmental temperature, and relative air humidity were collected weekly during a five-week period, three times by day, using a Hti-9600 Particle Counter mobile device. Statistical processing was performed using XLSTAT program. The results of our study show that air quality in the monitored period was within the limits. The correlations between $PM_{2.5}$ and PM_{10} and meteorological factors indicate that temperature and humidity influence the distribution and variability of particulate matters. Because of the possibility of local vulnerabilities due to emissions generated by anthropogenic activities in Cluj-Napoca, continuous monitoring and the implementation of preventive measures, particularly in high-traffic and industrial areas is recommended.

***Key words**: correlation, high-traffic area, industrial-area, urban area.*

COMPARATIVE BENCHMARKING OF SUPER-RESOLUTION METHODS FOR SENTINEL-2 MULTISPECTRAL IMAGERY: A MULTI-DATASET EVALUATION

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Abstract

This paper presents a systematic benchmark of six super-resolution (SR) methods applied to Sentinel-2 Level-2A multispectral imagery targeting a 4× spatial enhancement (10 m to 2.5 m). The models evaluated span four families: classical interpolation (Bicubic, Lanczos), a deterministic convolutional network trained on satellite data (SuperImage/Han), two deep learning models trained on natural images (SwinIR, Real-ESRGAN), and a latent diffusion generative model (OpenSR-LDM). Experiments are carried out on three benchmark datasets from the opensr-test suite—NAIP (n=62), SPOT (n=9), and Venμs (n=59)—under two complementary protocols: the Wald consistency protocol (PSNR, SSIM, SAM, ERGAS, SCC) and the opensr-test perceptual framework (synthesis, hallucination, omission, improvement scores). Results show that classical interpolation achieves the highest Wald-PSNR (Lanczos: 39.76 dB) precisely because it introduces no hallucinated detail, while SuperImage produces the most aggressive spectral modifications (SAM = 0.217 rad, ERGAS = 8.73). Under the opensr-test protocol, SwinIR exhibits a pathological hallucination score (0.233), roughly three times higher than other models, whereas OpenSR-LDM attains the best improvement score (0.817). These findings highlight the fundamental tension between pixel-fidelity metrics and perceptual enhancement goals in remote sensing SR, and underscore the importance of multi-protocol, multi-dataset evaluation.

Key words: *Sentinel-2, super-resolution, benchmark, Wald protocol, deep learning, latent diffusion, remote sensing.*

DETECTION OF FOREST CLEAR-CUTTING USING SENTINEL-1 AND SENTINEL-2 DATA

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Abstract

The paper is aimed to present a method for detecting forest clear-cuttings in Hungary, between 2021 and 2025 based on Sentinel-1, Sentinel-2, and Copernicus Land Cover data, provided by ESA.
The main objective of the study is to develop a tool that helps the work of civil conservationists and NGOs, addressing the lack of publicly available official data on clear-cutting activities.
The workflow is implemented in the Google Earth Engine (GEE) cloud-based earth observatory platform.
The output of the workflow is a GEE based map published on the internet. The results indicate that remote sensing could be a helpful tool for independent environmental protection organizations.

***Key words**: deforestation, clear-cuts, remote sensing, Google Earth Engine.*

SFM-BASED AUTOMATIC DBH ESTIMATION IN URBAN PARKS

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Abstract

Stem diameter at breast height (DBH) is a key parameter for assessing tree growth, biomass, and carbon storage in urban ecosystems. This study presents an automated workflow for tree detection and DBH estimation using Structure-from-Motion (SfM) photogrammetry in an urban park environment. High-resolution point clouds were generated from image-based data and processed through filtering, terrain modelling, stem extraction, and cylindrical fitting. Field reference measurements for 35 trees were collected using a forestry caliper. Results indicate that detection performance decreases with lower point density, while DBH estimation accuracy remains relatively stable. Overall, the findings confirm that SfM photogrammetry can provide reliable DBH estimates in complex urban environments, with performance primarily influenced by point cloud quality and acquisition conditions. The approach offers a cost-effective and flexible alternative for urban tree inventory and monitoring.

Key words: *SfM photogrammetry, Diameter at Breast Height (DBH), automatic workflow, urban forestry.*

EARTH OBSERVATION FOR RISK MANAGEMENT: USING THE COPERNICUS EMERGENCY SERVICES AND PROXIMITY ANALYSIS FOR THE EMSR802 FLOODS IN CENTRAL ROMANIA

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Abstract

This study evaluates the utility of Copernicus Emergency Management Service (CEMS) products for flood impact assessment, focusing on the May 2025 flood events in Romania (EMSR802 activation). The research analyzes three highly affected areas in the Braşov Depression: Lunca Mărcuşului, Boroşneu Mare, and Ghimbav. Relying on CEMS Rapid Mapping vector data, the methodology expands traditional damage evaluation by integrating a GIS-based spatial proximity analysis (100m, 300m, and 500m buffers from the flooded extent) to assess latent exposure risks. Results indicate that Lunca Mărcuşului sustained the largest direct impact, severely threatening extensive agricultural lands and rural networks. Conversely, the proximity analysis highlights Boroşneu Mare as having the highest overall vulnerability regarding exposed residential and transportation infrastructure. Ultimately, combining Earth Observation data with customized spatial exposure modeling provides essential decision-support, enabling authorities to transition from reactive damage assessment to proactive disaster management.

***Key words**: Floods, Earth Observation, Copernicus Emergency Services, GIS Analysis, Hazard Management, Vulnerability Assessment, Romania*

AUTOMATED CLASSIFICATION AND SPATIAL CONNECTIVITY ANALYSIS OF GEODETIC BENCHMARKS USING PYTHON AND AUTOCAD

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Abstract

Geodetic benchmarks represent fundamental reference elements used in topographic measurements, cadastral surveys, and territorial management. The efficient organization and spatial analysis of these benchmarks are essential for ensuring accurate geospatial data processing and improving field measurement workflows. This study proposes an automated approach for the classification and spatial analysis of geodetic benchmarks located in Sălaj County through the integration of Python programming within the PyCharm development environment and the AutoCAD platform.

The proposed methodology is based on the use of Python libraries that enable communication with AutoCAD through the Component Object Model (COM) interface, allowing direct programmatic control of graphical entities and their associated attributes. The automation process involves several key stages. First, the geodetic benchmarks are automatically classified into dedicated CAD layers according to predefined criteria, ensuring an organized spatial structure of the dataset. Second, the algorithm generates graphical connections between benchmarks in order to visualize and analyze their spatial relationships and network configuration. Third, an interactive procedure is implemented that allows the user to select a reference benchmark directly from the keyboard, after which the program automatically identifies and determines the neighboring benchmarks that are visible or connected to the selected point.

The proposed workflow significantly reduces manual processing time and minimizes human errors in the management of geodetic datasets within CAD environments. Furthermore, the integration of Python scripting with AutoCAD provides a flexible framework for developing advanced geospatial analysis tools that can support topographic planning, cadastral updates, and geodetic network analysis.

The results demonstrate that the automation of benchmark classification and connectivity analysis improves both the efficiency and the reliability of geodetic data processing, highlighting the potential of combining programming environments with CAD platforms in modern geospatial workflows.

***Key words**: geodetic benchmarks, CAD automation, Python, AutoCAD, spatial analysis, geodetic networks.*

MONITORING FOREST FIRES IN THE İÇMELER–MARMARIS AREA (TURKEY) USING SENTINEL-2 DATA

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Abstract

Forest fires represent a major environmental hazard in Mediterranean regions, with significant impacts on ecosystems, biodiversity, and land use dynamics. The İçmeler–Marmaris area in Turkey has experienced recurrent wildfire events, emphasizing the need for efficient monitoring approaches. This study aims to assess forest fire effects using multi-temporal satellite imagery provided by the Sentinel-2 mission. The methodology involves the analysis of pre- and post-fire images and the application of spectral indices, including the Normalized Difference Vegetation Index (NDVI) and the Normalized Burn Ratio (NBR), to detect burned areas and evaluate fire severity. The results highlight significant changes in vegetation cover and reveal the spatial extent of affected areas. The study demonstrates the effectiveness of Earth Observation data for rapid and accurate wildfire assessment, providing valuable support for environmental management and sustainable land use planning.

Key words*: forest fire monitoring, Earth Observation, Sentinel-2, Spectral indices.*

APPLYING THE GOLDEN PROPORTION IN LE CORBUSIER'S MODULOR

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Abstract

This study details the geometric constructions of the Golden Proportion and the Maillard-Corbusier Construction. It states several definitions of the Fibonacci Sequence. The study details the use of the Fibonacci Sequence to calculate the lengths of some segments in the Maillard-Corbusier Construction without drawing it. It also presents an instance of Le Corbusier's Modulor, the Unite d'Habitation in Marseille.

***Key words**: Fibonacci Sequence, Golden Proportion, Maillard-Corbusier construction.*

LIVING IN A SMART CITY OR A CLASSICAL CITY?

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Abstract

The rapid evolution of digital technologies has transformed urban environments, giving rise to the concept of the smart city. This paper explores the fundamental differences between living in a smart city and a classical city, focusing on infrastructure, governance, sustainability, and quality of life. Smart cities leverage data-driven systems, Internet of Things (IoT) devices, and real-time analytics to optimize services such as transportation, energy consumption, and public safety. In contrast, classical cities rely on traditional urban planning models, often characterized by slower adaptation to technological change but stronger preservation of cultural identity and social cohesion.

Through comparative analysis, this study examines the benefits and challenges associated with each model. While smart cities offer efficiency, convenience, and environmental advantages, they also raise concerns regarding privacy, digital inequality, and over-dependence on technology. Classical cities, on the other hand, provide stability and heritage continuity but may struggle with scalability and resource management in the face of growing urban populations.

The evolution from classical to smart cities represents not only a technological shift but a redefinition of urban life itself. While smart cities promise efficiency and optimization, classical cities remind us of the importance of identity, memory, and human connection. The challenge for future urban development lies in reconciling these two paradigms, creating cities that are not only intelligent but also meaningful places to live.

The paper argues that the future of urban living lies not in choosing one model over the other, but in integrating the strengths of both approaches. By balancing technological innovation with human-centered design and cultural preservation, cities can create more resilient, inclusive, and sustainable environments for their inhabitants.

Key words: *urban environment, smart city, classical city, IoT, resource management, technological innovation*

FROM POTENTIAL TO PERFORMANCE: TRANSFORMING THE ROMANIAN AGRI-FOOD SECTOR IN THE EUROPEAN CONTEXT (2020–2030)

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Abstract

The development strategy of the agri-food sector in Romania for the period 2020–2030 aims to modernize agriculture by: increasing competitiveness, developing domestic processing, digitalization, adapting to climate change.

An essential element is the transition from the export of raw materials to the export of finished products, with higher added value. However, the implementation of these objectives is hampered by several structural problems, such as: the fragmentation of agricultural land represents a major obstacle, noting that most farms are small in size, which limits economic efficiency, the low level of technology and capitalization that reduces productivity, keeping Romania below the European average, the irrigation infrastructure is insufficiently developed, which makes agriculture vulnerable to climate change, and last but not least, the lack of domestic processing determines the export of raw materials and the import of finished products, which negatively affects the trade balance.

The paper analyzes the 2020–2030 strategy, highlighting both the high potential of national agriculture and the structural limitations that prevent its exploitation. The main strategic directions are addressed, such as increasing competitiveness, developing domestic processing, digitalization and adapting to climate change, in the context of European policies.

The comparative analysis with countries such as the Netherlands, France and Poland highlights significant differences in terms of productivity, technological level and integration in the agri-food value chain. While Romania has considerable natural resources and occupies important positions in European agricultural production, its economic performance is affected by the fragmentation of farms, undercapitalization and insufficiently developed infrastructure.

The paper concludes that the success of the 2020–2030 strategy depends essentially on the efficiency of public policy implementation, and the development

of domestic value chains. In the absence of these transformations, Romania risks remaining an exporter of raw materials, without fully capitalizing on its competitive advantages.

Keywords: *agri-food sector, agricultural competitiveness, value chain, rural development, agricultural productivity, European agricultural policies, digitalization in agriculture, sustainability, farm fragmentation, agri-food processing.*

WHAT IS THE FUTURE OF WATER SERVICES*?*

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Abstract

The future of water services is being reshaped by the convergence of climate change, rapid urbanization, technological innovation, and evolving governance models. Increasing water scarcity, extreme weather events, and aging infrastructure are placing unprecedented pressure on traditional water management systems, requiring a shift toward more resilient, adaptive, and sustainable approaches. This paper explores how water services are transitioning from centralized, supply-driven models to integrated, demand-responsive systems that prioritize efficiency, circular resource use, and environmental stewardship.

Emerging technologies—such as digital monitoring, smart metering, artificial intelligence, and decentralized treatment solutions—are enabling utilities to optimize operations, reduce losses, and enhance service delivery. At the same time, nature-based solutions and green infrastructure are gaining traction as complementary strategies to conventional engineering, improving both water quality and ecosystem resilience. Governance is also evolving, with greater emphasis on stakeholder participation, transparency, and cross-sector collaboration.

The paper argues that the future of water services lies in hybrid systems that combine technological innovation with institutional reform and community engagement. Ensuring equitable access, financial sustainability, and long-term resilience will require rethinking regulatory frameworks, investment strategies, and the role of public and private actors. By examining current trends and future scenarios, this study provides a comprehensive perspective on how water services can adapt to meet the complex challenges of the 21st century.

The future lies in adaptive, integrated systems that leverage innovation while ensuring sustainability and social equity. Policymakers, utilities, and communities must collaborate to redesign water services in ways that are resilient, efficient, and inclusive.

Key words: *climate change, water scarcity, digital monitoring, artificial intelligence, governance, adaptive systems.*

COMPARATIVE STUDY ON THE DETERMINATION OF TOPOGRAPHIC POINT COORDINATES IN THE USAMV CLUJ-NAPOCA CAMPUS USING MOBILE APPLICATIONS

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Abstract

The determination of topographic point coordinates constitutes a fundamental element in the field of terrestrial surveying, directly influencing the accuracy of spatial models and the quality of subsequent analyses. In this context, the present study proposes a comparative analysis of coordinate determination accuracy using accessible mobile applications, as a rapid alternative for preliminary topographic surveys.

The study was conducted within the USAMV Cluj-Napoca campus, where several representative points were selected, and their coordinates were determined using three mobile applications: Google Earth, Geo Tracker, and GPS Map Camera. The resulting coordinate datasets were comparatively analyzed against a reference dataset using specific quantitative indicators, such as Euclidean distance, root mean square error (RMSE), and axis-based errors.

The results reveal significant differences among the three applications, with statistical analysis indicating that Google Earth provides the best agreement with the reference dataset, recording the lowest error values and demonstrating superior consistency in coordinate determination. Based on these findings, the coordinates obtained using Google Earth were adopted as the reference for extending the study and were subsequently used to determine the positions of 15 additional objectives located in the municipality of Cluj-Napoca.

The study highlights the potential of mobile applications for rapid spatial data acquisition, while also emphasizing the necessity of rigorous mathematical validation when such tools are employed in topographic and cadastral applications.

Key words: *Python, GPS, Google Earth.*

MYCELIUM-BASED CONSTRUCTION MATERIALS – A SUSTAINABLE ALTERNATIVE FOR THE FUTURE – REVIEW

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Abstract

The construction industry faces a major challenge related to the environmental impact, especially through the carbon emissions generated by the materials used. Conventional construction materials, such as brick or cement, constitute between 33 and 39% of the carbon emissions from this sector. At the same time, the linear economy model of "produce, use, discard" contributes significantly to the increase in carbon emissions, through waste and the lack of reuse of resources. In contrast, the principles of the circular economy propose keeping materials in use for as long as possible, reducing waste and reintegrating resources into use cycles. Current trends indicate that, without changes, total carbon emissions from the construction sector could double in the next 25 years. In this context, there is a need to adopt sustainable materials with a reduced carbon footprint, as well as a circular economy that can help combat or slow down these emissions. Integrating circular principles in the construction sector involves not only choosing more environmentally friendly materials, but also rethinking the way in which they are produced, used and reused.

Key words: ***c****arbon emission, construction materials, Mycelium, properties, sustainable.*

EXPLORING A CHANGING PLANET: AN INTERACTIVE 3D GEOSPATIAL PLATFORM FOR ENVIRONMENTAL HAZARD VISUALIZATION USING EARTH OBSERVATION DATA

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Abstract

This paper presents the development of an interactive 3D geospatial visualization platform designed to integrate and visualize environmental hazards within a unified framework. The increasing availability of Earth Observation data from multiple sources creates challenges in terms of accessibility, interoperability, and interpretation for non-expert users. To address this issue, the application aggregates open-access datasets from authoritative providers such as the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), and the European Space Agency (ESA), covering phenomena such as forest fires, floods, droughts, air quality, earthquakes, landslides, cyclones, and tsunamis. The methodology involves data collection, harmonization, and spatial visualization within an interactive 3D environment that enables intuitive exploration of global patterns. The results demonstrate that complex and heterogeneous environmental data can be effectively transformed into an accessible visual tool, improving user understanding without requiring advanced GIS knowledge. The project highlights the potential of 3D geovisualization to support environmental awareness and informed decision-making.

Key words: *Earth Observation; geospatial visualization; environmental hazards; 3D geospatial visualization.*

COMPOSTING SEWAGE SLUDGE FROM URBAN WASTEWATER TREATMENT PLANTS: A SUSTAINABLE STRATEGY FOR WASTE REDUCTION AND USE AS FERTILIZER IN AGRICULTURE

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Abstract

*Valorizing sewage sludge through composting is an important direction in the circular economy, as it reduces waste and reintegrates organic matter into the agricultural cycle. This paper presents the process for producing compost from a mixture of sewage sludge and woody waste (branches) at an urban wastewater treatment plant and evaluates its quality for use as an organic fertilizer. Sample characterization covered three categories of parameters: general physicochemical indicators (pH, moisture, dry matter, organic matter, and loss on ignition); nutrients with agronomic relevance - nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), iron (Fe), manganese (Mn), zinc (Zn) **and** copper (Cu); and potentially toxic heavy metals: lead (Pb), cadmium (Cd), nickel (Ni), chromium (Cr), arsenic (As), and mercury (Hg). The results were analyzed in accordance with Regulation (EU) 2019/1009 on fertilizing products, which sets contaminant limits and quality standards for compost used as a fertilizer in the European Union. The findings emphasize the need for thorough analytical characterization of these products as a vital step in evaluating their suitability as fertilizers and in preventing potential contamination of soil and the food chain.*

Keywords: *compost, wastewater treatment plant, heavy metals, nutrients, organic matter, organic fertilizer.*

DISCOVERING IDEAL CAMPING ZONES THROUGH ADVANCED GEOSPATIAL ANALYSIS

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Abstract

This paper presents the development of a fully automated geospatial tool, created in the ArcGIS Pro (Model Builder) environment, designed to identify safe and optimal wild camping locations. To eliminate field uncertainties and associated risks, the model integrates a Digital Terrain Model (DTM) and Sentinel-2 multispectral satellite imagery through a multi-criteria spatial evaluation.

The methodology relies on three analytical pillars: (1) morphometric slope derivation to extract areas with low declivity; (2) hydrological modeling (Flow Direction & Accumulation, complemented by Euclidean Distance) to exclude potential flood zones; and (3) spectral analysis via NDVI calculation, which validates active natural vegetation.

The operational workflow automates parameter reclassification (5 suitability classes), results vectorization, spatial filtering (excluding areas < 900 sqm), and centroid extraction (WGS 1984 GPS coordinates). The final result is exported directly in KMZ format for 3D visualization. In conclusion, the scalable architecture of this algorithm enables the instant identification of optimal locations in any other geographic region by simply updating the input data.

Key words**:** *GIS, KMZ, Model Builder, Multi-criterial analysis, NDVI.*

IMPACT OF HIGHWAY DEVELOPMENT ON ENVIRONMENTAL NOISE LEVELS: A COMPARATIVE STUDY IN LANCRĂM (2015–2026)

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Abstract

Although often overlooked, noise pollution represents a significant environmental factor affecting human well-being. This study aims to highlight the differences in environmental noise levels measured in 2015 and 2018 compared to those recorded in 2026 in the moderately trafficked village of Lancrăm. The analysis focuses on the impact of the highway connecting the localities of Sebeș and Turda, which has significantly altered regional traffic patterns. By diverting transit traffic away from the village, the highway has contributed to a measurable reduction in noise pollution levels. The results indicate a substantial decrease in the equivalent continuous sound level (LAeq), highlighting the indirect environmental benefits of transport infrastructure development.

***Key words**: noise pollution, comparative analysis, highway impact, traffic diversion.*

GEOMETRIC MODELING AND SPATIAL ANALYSIS OF THE ORCHARD AND VINEYARD IN THE USAMV CLUJ-NAPOCA CAMPUS USING GOOGLE EARTH, PYCHARM, AND MAPLE

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Abstract

The study presents an applied methodology for determining, processing, and analyzing the coordinates corresponding to the orchard and vineyard located within the campus of the University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca. The coordinates of the characteristic points were determined using the Google Earth mobile application, which provided a fast and accessible solution for collecting preliminary spatial data. The obtained data were subsequently processed in two complementary computational environments: PyCharm, using the Python programming language, and Maple, for mathematical modeling and advanced geometric analysis.

In PyCharm, the determined points were graphically represented on an Esri basemap, which allowed their geographical positioning to be checked and the contours to be visually validated. This stage contributed to the planimetric modeling of the orchard and vineyard, highlighting the shape, extent, and spatial relationship between the two analyzed surfaces. In Maple, the coordinates were used to determine the three-dimensional area, taking into account both the planimetric position of the points and the altimetric variations. Through this approach, the analysis was not limited only to the projected planar surface but also included the influence of relief on the real surface area.

The obtained results can be used for the geometric interpretation of the terrain, for estimating cultivated areas, and for supporting possible investments within the campus, such as infrastructure modernization, optimization of agricultural works, expansion of plantations, or planning of landscaping interventions. The proposed methodology highlights the usefulness of integrating mobile coordinate collection applications with computational analysis tools, providing an accessible,

reproducible workflow adapted to applied studies in topography, cadastre, and agricultural land management.

***Key words**: Python, Google earth, Cluj-Napoca.*

GEOMATICS AND SPORTS

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Abstract

This paper is the result of an analysis of a tourist area that already features a ski slope (with several runs designed for different categories of skiers), but where there is a desire to develop a sports complex offering a variety of recreational activities. This complex also has another location under consideration for the development of a new ski slope on a north-facing slope. The coordinates (planimetric and altimetric) of over 25,000 points were determined using GNSS equipment. The data was initially processed using AutoCAD Civil 3D and subsequently using ArcGIS.
At the first location, the following were accomplished: for the existing ski slopes, an application was designed using ArcGIS to help skiers choose the most suitable slope based on their age, weight, level of confidence or fear, and experience; also using VBA scripts within ArcGIS, the following were determined: the optimal route for summer sledding, the route for tubing, and the optimal routes for bicycles.
Regarding the second location, the following were analyzed: climatic factors influencing the location of a ski slope, using data from four weather stations in the area (two of which were in conditions similar to the location under study); orographic data using GIS; the two sets of data were then correlated, and it was concluded that the location meets the intended purpose.

Key words*: geomatics, sports complex, programming, GIS.*

INTEGRATION OF AUTOCAD AND PYTHON FOR ADVANCED CAD WORKFLOW AUTOMATION AND COMPUTATIONAL EFFICIENCY

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Abstract

This study presents an applied methodology for the automated processing and geometric analysis of topographic coordinates collected from the campus of the University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca. The proposed workflow integrates Microsoft Excel, Python, and AutoCAD into a unified computational framework designed to optimize the management, visualization, and analysis of spatial data. The coordinate dataset was organized in Excel and processed in Python using specialized libraries for numerical computation, spreadsheet interaction, and AutoCAD communication through the COM interface. The developed application enables the automatic import of topographic points from Excel, their graphical representation in AutoCAD, and the generation of closed polygons corresponding to selected areas within the campus. In addition to graphical construction, the implemented system performs analytical computations including polygon area, perimeter, segment lengths, and interior angles. The application also supports reverse data transfer from AutoCAD to Excel, as well as manual point input directly within the CAD environment, providing a flexible bidirectional workflow for spatial data handling.

The results demonstrate that the proposed approach significantly reduces manual processing time, minimizes data-entry errors, and improves consistency in geometric computations. The possibility of selecting different point subsets allows the rapid analysis of multiple surfaces without modifying the original dataset, making the method suitable for cadastral, topographic, and engineering applications. The integration of Python with Excel and AutoCAD provides an efficient and adaptable solution for computer-assisted geometric analysis based on real topographic data.

Key words*: AutoCad, Python, Excel.*

WATER QUALITY DYNAMICS IN THE DANUBE DELTA AND THE ENVIRONMENTAL PERFORMANCE OF A NATURE-BASED SOLUTIONS SCENARIO

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Abstract

The Danube Delta is one of Europe's most complex and ecologically valuable wetland systems, where natural dynamics intersect with anthropogenic and transboundary pressures. Understanding these interactions is important for guiding sustainable management strategies. This study aims to assess the dynamics of water quality in the Danube Delta during 2023-2025 and to support sustainable management by evaluating the environmental performance of a proposed Nature-Based Solutions (NBS) intervention through Life Cycle Assessment (LCA). The specific objectives include: (i) determining key physico-chemical parameters and selected heavy metals at 19 monitoring points; (ii) analysing spatial and temporal variability relative to legal thresholds; (iii) identifying vulnerable areas influenced by localized anthropogenic pressures; and (iv) comparing the environmental impacts of an NBS scenario with current conditions using LCA. Results show that heavy metals remained within admissible limits, while total suspended solids exceeded thresholds mainly in 2024, with substantial improvement in 2025. Total nitrogen surpassed the limit at one site. Integrating monitoring data with LCA provides a coherent basis for evaluating sustainable intervention options in the Danube Delta.

***Key words**: Danube Delta; heavy metals; Life Cycle Assessment; Nature-Based Solutions; water quality.*