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BOOK OF ABSTRACTS

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Analysis of shoreline dynamics using spectral indices in Google Earth Engine, reproducible Python workflows in MiniConda and DSAS. Case study of Naxos Island (1990-2025)

Carmen-Florentina DOBRE✉

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The study presents a geospatial approach to the morphological analysis of the shoreline, by monitoring spectral indices derived from multitemporal satellite images of the island of Naxos (Greece) during the period 1990-2025. The methodology is based on data processing in Google Earth Engine, reproducible flows in Python through MiniConda and DSAS. The analysis of the shoreline dynamics was analyzed based on the annual positions of the coastlines extracted from satellite images, resulting in an evolution expressed in meters per year. The spatial distribution was visualized in the form of a histogram and profile along the shoreline. The results obtained provide a quantitative analysis of the existing coastal geomorphological processes. The spectral index analysis included NDVI (Normalized Difference Vegetation Index), MNDWI (Modified NDWI) and NDWI (Normalized Difference Water Index), calculated from Released Images 5, 7 and 8. The evolution of NDVI was used to assess the stability of coastal vegetation, and the correlations between the indices were used to identify the interdependencies between water dynamics and vegetation cover. The two components, morphological and spectral, provide a complementary perspective on the vulnerability of the coastal area in the context of climate change.

Modeling the spatio-temporal relationships between green infrastructure and built density in the urban environment: the case of Focșani Municipality

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Urban green spaces represent an essential factor for quality of life and the sustainable development of cities; however, the expansion of built-up areas and recent climatic events are leading to their reduction. The present study aims to evaluate the green space – built space relationship in Focșani Municipality, highlighting the impact of anthropogenic pressure and climate change on the

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urban environment. For the spatial and temporal analysis, Sentinel-2 satellite imagery (NDVI – vegetation), Copernicus (NDBI – built-up surfaces), and Landsat 8/9 (LST – land surface temperature) were used, processed in Google Earth Engine and QGIS. The calculated indicators allow the clear identification and delineation of green and built-up spaces, as well as their correlation with surface temperature, providing an integrated perspective on urban structure and microclimatic conditions. The results show a significant reduction in green spaces between 2015 and 2025, caused both by urban expansion and by the pedological drought during 2020–2022. The analysis of spatial correlations between NDVI, NDBI, and LST highlights a pronounced imbalance between green and built areas, implying risks for urban quality of life and climate change adaptation. The study emphasizes the need to conserve and expand green infrastructure through sustainable urban planning, control of built-up expansion, and continuous monitoring based on GIS and satellite data. Thus, the results provide scientific support for urban policies aimed at ensuring a balance between urban development and environmental protection, contributing to increased resilience and sustainability of the city of Focșani.

Assessing the Potential of Urban Blue Spaces for Sustainable Mobility in Bucharest: A GIS-Based Multi-Criteria Analysis

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In the context of rapid urbanization and the pressing need for sustainable mobility solutions, urban blue spaces (rivers, lakes, and canals) offer significant yet often untapped potential for active transit and public recreation. This research evaluates the capacity of Bucharest's blue areas to be integrated into a sustainable mobility system, proposing an original methodological tool: the Blue Areas Accessibility Index (BAAI).The methodology is based on a GIS-integrated Multi-Criteria Analysis (MCA), processing eight fundamental spatial parameters: proximity to blue areas, green spaces, public transport stops, cycling routes, economic hubs, and industrial zones, alongside population density and main street network density. The weighting of these criteria was performed using the Analytic Hierarchy Process (AHP), which identified proximity to blue resources (33.1%) and access to public transport (20.4%) as the primary determinants of accessibility. Spatial data were standardized on a 1-to-5 Likert scale and aggregated through Weighted Linear Combination (WLC) using the Raster Calculator tool at a high spatial resolution of 10 meters. The

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results indicate that only 1.53% of Bucharest's territory benefits from Very High accessibility, primarily clustered around Drumul Taberei, Titan, and Cișmigiu lakes, as well as specific central sections of the Dâmbovița River. In contrast, approximately 27% of the city exhibits low or very low accessibility, particularly in the southwestern peripheral areas. In these regions, the presence of industrial barriers and a deficit in connective infrastructure significantly fragment the urban landscape. Model validation was conducted using the MaxEnt (Maximum Entropy) machine learning algorithm of ArcGis Pro, utilizing 103 presence points collected through Public Participation GIS (PPGIS) field research. The Area Under the Curve (AUC) score of 0.81 confirms the high predictive accuracy of the model and its ability to correctly discriminate zones with real accessibility potential. Furthermore, a Pearson correlation analysis revealed a significant "spatial mismatch" between blue resource availability and population density, suggesting that the city's most water-rich corridors are not necessarily the most densely populated or the best served by existing transit infrastructure. The discussions highlight that while the Dâmbovița River represents the backbone of the city's hydrographic system, its functional utility is hindered by structural bottlenecks such as low-clearance bridges and transversal weirs. The study concludes that the BAAI serves as an essential diagnostic tool for urban planners, providing a data-driven foundation for future investments in blue-green infrastructure.

Assessment of drought variability and propagation in the Botna River Basin through the analysis of the SDI (Streamflow Drought Index) and SPEI (Standardized Precipitation Evapotranspiration Index) indices

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This research aims to analyze the evolution and characteristics of drought in the Botna River basin (Republic of Moldova) by using two standardized indices: SDI for hydrological drought and SPEI for climatic drought. The study will investigate the connections between climatic deficit and the hydrological response of the basin, highlighting periods of disparity between the lack of precipitation and the decrease in river discharge. Furthermore, the temporal trends of drought will be analyzed, and periods of elevated risk for water resources within the basin will be identified. Proposed methodology:

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• Collection of time-series data: daily/monthly streamflow data from hydrometric stations within the basin; daily/monthly precipitation and temperature data for the calculation of the SPEI index.
• Calculation of SPEI at different time scales (e.g., 3, 6, and 12 months) in order to identify short- and medium-term drought conditions.
• Calculation of SDI based on streamflow time series to characterize hydrological drought.
• Statistical analysis of the correlation and temporal lag between SPEI and SDI.
• Trend analysis tests (e.g., Mann–Kendall test and Sen's slope estimator) to determine significant changes over time.

Estimation and spatial mapping of extreme sub-daily precipitation return periods in Romania using R

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Sub-daily precipitation extremes constitute a critical component of climate variability, particularly in regions affected by intense convective storms. This study assesses the probability of extreme rainfall amounts occurring over short durations (5, 10, and 60 minutes; 3, 6, and 24 hours) by applying the Gumbel distribution to high-resolution precipitation datasets for the period 1970-2025. The analysis is based on sub-hourly observations from 104 weather stations across Romania, provided by the National Meteorological Administration. Rainfall measurements were recorded using two types of automatic gauges: USSR-type pluviographs (primarily until 2007-2008) and tipping-bucket rain gauges installed at Vaisala automatic weather stations thereafter. To better capture convective precipitation regimes, the statistical analysis was restricted to the April-October period. Return levels of annual maximum sub-daily precipitation were estimated using the extRemes package in R. The resulting values, commonly employed in the construction of intensity-duration-frequency (IDF) curves, were subsequently spatially mapped using R. The results indicate that, for most analyzed durations and return periods, the highest estimated precipitation amounts are concentrated in southern and southeastern Romania, particularly in the Romanian Plain, the Getic and Dobrudja Plateaus, and the Southern Subcarpathians. However, for certain durations and return periods (e.g., 24-hour maxima associated with 5-, 10-, and 50-year return periods), high or locally dominant precipitation amounts are also identified in western

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Romania (Stâna de Vale, Western Carpathians) and eastern Romania (Moldova Plateau). In certain cases (e.g., 60-minute duration at Bacău station), the Gumbel-derived return levels are lower than historically observed maxima, suggesting that some extreme events exceed the recurrence intervals considered in this study. Conversely, in southern regions, sub-hourly extremes are particularly pronounced, reaching 22-25 mm in 5 minutes and exceeding 55-65 mm in 60 minutes for return periods of 50-100 years (e.g., Giurgiu, Caracal, Adjud, and Câmpina weather stations). These findings highlight the importance of high-resolution precipitation data for accurately characterizing extreme rainfall behavior, as sub-hourly and sub-daily extremes display spatial and statistical patterns distinct from those observed at daily scales. Furthermore, the use of R for statistical estimation and spatial analysis significantly streamlines the computational workflow. Given Romania's susceptibility to flash floods triggered by short-duration heavy rainfall, these results provide valuable support for improved flood risk assessment and climate adaptation strategies.

Statistical database of exceptional situations in the Republic of Moldova managed by the General Inspectorate for Emergency Situations of the Ministry of Internal Affairs

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The Republic of Moldova has been, and continues to be, exposed to a broad and diverse range of natural emergency situations generated both by meteorological conditions and its geographical location, as well as by various socio-economic vulnerabilities. Among the main natural emergency situations occurring on the territory of the Republic of Moldova are extreme meteorological phenomena such as floods, torrential rains accompanied by hail, large hailstorms, landslides, heavy snowfalls, and, in recent years, droughts, which occur almost annually. The impact of these emergency situations is reflected significantly in the agricultural sector, infrastructure, the environment, and the population. All emergency situations occurring in the Republic of Moldova are managed and recorded in the statistical database of emergency situations, which is based on the GISCUIT platform. This system has been implemented and administered by the General Inspectorate for Emergency Situations of the Ministry of Internal Affairs since 2013. It represents an essential instrument for the monitoring, analysis, and management of emergency situations, as well as of potential risks with major impacts on public safety, the agricultural sector, and national infrastructure. This platform provides a systematic and comparable record of emergency

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situations occurring across the country on both annual and multiannual time scales. It includes detailed information regarding the number, typology, and geographical distribution of emergency situations in the localities where they occur, as well as their consequences, expressed through loss of human lives, the number of affected or rescued persons, and the estimated material damages expressed in Moldovan lei (MDL). The statistical data accumulated on the GISCUIT platform reveal that natural emergency situations—such as droughts, floods, large hailstorms, and other extreme meteorological phenomena—generally have a significant impact on the national economy, particularly on the agricultural sector and local infrastructure. These data also allow for the identification and implementation of effective measures in the sectors or localities where such events occur repeatedly, and facilitate the development of response plans aimed at mitigating the consequences of these emergency situations.

In conclusion, the statistical database of emergency situations managed by the General Inspectorate for Emergency Situations of the Ministry of Internal Affairs of the Republic of Moldova, based on the GISCUIT platform, serves to maintain statistical records of emergency situations and their consequences regardless of the location of their occurrence. This system represents a fundamental pillar of the national emergency management framework in the Republic of Moldova, playing a decisive role in the prevention, management, and mitigation of emergency situations and their impacts on the population and the national economy.

Agricultural drought risk assessment: a spatial analysis of hazard, exposure, and vulnerability in Prut River Valley

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Agriculture has long constituted a strategic sector of economic development in both Romania and the Republic of Moldova, playing a decisive role in rural livelihoods and regional stability. In the Prut River Valley, where the settlement structure is predominantly rural and economic activities are closely linked to land resources, agricultural drought represents a critical challenge for food security and socio-economic resilience. Within the framework of the transboundary research project Exploring the Paths to Cope with Hydro-Climatic

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Risks in Transboundary Rural Areas Along the Prut Valley: A Multi-Criteria Analysis, the present study aims to evaluate agricultural drought risk across the study area by integrating geographic exposure and climatic indicators with the vulnerability characteristics of agricultural land. The assessment is based on a multi-criteria spatial analysis approach, envolving the scoring method to quantify exposure levels using ArcGIS sofware. In this study were incorporated thermal conditions during the warm season, spring precipitation totals, and distanceto surface water bodies. To determine the spatial distribution of agricultural lands, land-use information derived from the CORINE Land Cover 2018 for Romania and CORINE Land Cover 2023 for the Republic of Moldova datasets was used. These datasets enabled the identification and delineation of agricultural land categories most susceptible to drought impacts within the transboundary region. The resulting agricultural drought risk map reveals a distinctly heterogeneous spatial pattern, characterized by a gradual increase in exposure and overall risk from the northern to the southern sectors of the valley. Validation of the model outputs through comparison with historical drought data for the study area confirms the robustness and practical relevance of the present assessment. The generated risk map provides an evidence-based spatial framework to support local and regional authorities in prioritizing intervention actions, optimizing resource allocation, and developing proactive strategies for agricultural drought mitigation and adaptation in the Prut River Valley.

Mapping active slope deformations within the Iasi Metropolitan Area

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Ground deformations, in many cases, hinder the proper development of built-up space, which is in accelerated expansion, especially in suburban areas. These deformations have different origins, induced either by natural hazards of surface and near-surface processes, such as landslides, sinkholes, subsidence, and alluvial compaction, or by anthropogenic deformations resulting from groundwater extraction, mining, and urban development that accelerate land subsidence. Moreover, these geohazards are often coupled, especially during the construction of new residential buildings and infrastructure, such as highways and utility networks, as is the case in the territory of the Iasi Metropolitan Area (IMA). IMA was established in 2004 and currently includes the Municipality of Iasi and 26 neighbouring Local Administrative Units with more than 600000 inhabitants and an area of almost 1500 km2. IMA records significant

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development over the past two decades from many perspectives: population growth, territorial expansion as many other LAUs joined the IMA, and expansion of urbanised space. All this anthropic pressure affects the hillslopes that are already unstable, in many cases already modelled by landslides. In this context of urbanised space development, it is important to identify and map active slope displacements affecting the structures and infrastructure networks of the area, given the ongoing construction of residential neighbourhoods that are taking over the slopes. To do that, we use the European Ground Motion Service (EGMS) products, which are InSAR measurements derived from Sentinel-1 SAR images. They provide accurate measurements of ground displacements and multiple temporal datasets spanning ~5 years each. This feature allows us to monitor the displacements of existing landslides, identify potential new landslides, and extend our analysis to create a multi-temporal active landslide inventory.

We identified multiple hotspots with significant displacements exceeding 2 cm/year, not only in Iasi but also in Miroslava and Valea Lupului, which serve as dormitory neighbourhoods for the city. These displacements are specific to slow-moving and very slow-moving landslides; in many cases, these damage-leading displacements could be mitigated through proper slope management and utility infrastructure maintenance. However, there are also cases that require additional investigation and a more sustained involvement of the authorities to stabilise active landslides.

Geomorphological analysis of the Câlnău River basin using GIS applications

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This study aims to analyze the main elements of the natural environment from a geomorphological perspective using GIS techniques. Throughout this work, various thematic maps created in a GIS environment (using ArcGIS and QGIS software) can be observed, such as the slope aspect map, the slope gradient map, and others. The main methods used are those generally specific to the sciences, as well as some found exclusively within the field of geography. They are divided into two major categories: methods specific to the desk-based stage (e.g., analysis, deduction, synthesis, cartographic methods, etc.) and methods specific to the fieldwork stage (e.g., observation, comparison, etc.), which form the foundation of this study. This material also presents the results of the fieldwork stage, which will be correlated with the graphical materials included in the study. In a slightly different manner, a multicriteria and interdisciplinary

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analysis is carried out to examine the implications of natural and anthropogenic factors in the development of geomorphological processes that shape the natural environment within the study area. The natural factors influencing the environment include soil type, slope gradient, slope aspect, and others, while anthropogenic factors include illegal deforestation, land-use changes, the development of road and telecommunications infrastructure, as well as other everyday human activities. The results suggest that both natural and anthropogenic factors have a significant impact on the occurrence and evolution of geophysical processes in the Câlnău River basin, with a particular emphasis on the influence of anthropogenic factors.

On the mapping of Thracian onomastics

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We aim to briefly highlight both elements related to the theoretical and methodological aspects of the cartographic representation of Thracian names, as well as some geographical particularities that the onomastics of our ancestor's mark. We included in our analysis both anthroponymy – mainly based on a comprehensive onomastic repertoire, created by Dan Dana (2014), with subsequent updates – and toponymy – where we focused on highlighting the formants that created Thracian oiconyms – benefiting from research conducted by Sorin Olteanu, with additions. In the case of anthroponymy, first, we inventoried the names in the inventory, after which we moved on to introducing onomastic data by administrative units and historical periods. The chronological grouping of the names had to take into account the fact that, in the case of many onomastic attestations, the exact moment of recording is not given, which forced us to work with several periods, of at least three centuries, covering the interval between the 13th century BC and the 12th century AD. Also, in order to have a unitary, timeless level of geographical analysis, for data comparability, we decided to use as an administrative division, the level of the provinces of the Roman Empire, from the beginning of the Christian era (1st-3rd centuries), especially since more than three quarters of the inventoried onomastic mentions are from this interval. Other problems encountered refer both to the fact that several onomastic attestations are found in two or even more provinces, and to their "passage" from one period to another. Thus, it was necessary, for the strictly conventional introduction of an anthroponym, to record it in both places where it is mentioned and, since the bearer of the name lived and in two different intervals, this name

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appears in both. There are, on the other hand, epigraphic sources in which the geographical location of some names is not specified – noted by Dan Dana with "Provincia ignota", and other attestations appear in areas located outside the map background used (south of the Atlas Mountains, therefore, in the Sahara, or in Central Asia). In order to represent these occurrences, we created a geometric figure, both for "Provincia ignota", and for attestations located "outside the map", a situation called, in the data table, "Ex-charta".

After introducing of onomastic data by administrative entities and chronological intervals and processing them, we have produced several cartographic materials, which highlight both the chrono-spatial distribution of Thracian onomastics, as well as several of its particularities, inherited by the descendants of the Romanized Thracians, the Romanians. An increase in the number of onomastic occurrences is observed until the beginning of the Christian era, followed by a sharp decline, from/after the 4th century, and, from a geographical point of view, the fact that over two-thirds of the Thracian onomastic mentions are found in the Carpathian-Balkan space and in the northwestern part of Asia Minor, that is, in the recognized area of Thracian-Dacian-Bithynian habitation.

Assessment of Random Forest algorithm performance for land cover classification in a heterogeneous landscape

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Land-cover mapping and monitoring is one of the major applications of Earth observing satellite sensor data and is essential for the estimation of land cover change. Moreover, land cover monitoring using remotely sensed data requires robust classification methods which allow for the accurate mapping of land cover categories in a heterogeneous landscape.

The aim of the present work is to evaluate the performance of Random Forest classifier within Google Earth Engine cloud-based platform based on three temporal scenarios: (1) entire year of 2025; (2) vegetation season of 2025 and (3) summer of 2025. The input data used for all the three scenarios consist of multi-temporal and multi-sensor Sentinel 1 and Sentinel 2 imagery and derived spectral indices (NDBI, NDVI, NDWI) as auxiliary data. The land cover classification was performed using 1524 sample points, with 70% for training and 30% for validation. The results indicate that the Random Forest algorithm achieved an overall accuracy (OA) of 96.73% and a Kappa coefficient of 0.96. The

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final Random Forest-based land cover mapping shows the following percentage distribution: woodlands (43.47%), croplands (27.98%), grasslands (23.07%), built-up (4.73%), barren lands (0.48%) and water bodies (0.27%).

This replicable approach relies on open-source data (Sentinel 1 and 2) and software (GEE), aligns with the goals of land cover mapping and has the potential to be updated and adapted to other geographical landscapes.

Assessment of Cost Recovery for Water Supply and Sanitation Services within the Southern Region of the Republic of Moldova using Geographic Information Systems

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The Water Framework Directive promotes the “polluter pays” principle and the use of economic instruments, such as cost-efficiency analysis and incentive-based tariffs regarding the use of water resources. However, the general nature of its provisions has generated different interpretations among states. The present research is dedicated to assessing the differentiated degree of cost recovery for water supply and sanitation services within the southern region of the country, highlighted through the use of Geographic Information Systems. The main methods applied include economic–mathematical analysis, comparative analysis, and cartographic analysis. The primary data source is the National Bureau of Statistics. Most of the territory of the study area falls within the Danube–Prut and Black Sea River Basin District (the districts of Leova, Cantemir, Cahul, Taraclia, Cimișlia, Basarabeasca, the Autonomous Territorial Unit of Gagauzia, and partially Căușeni and Ștefan Vodă), while the Dniester River Basin District includes most of the Căușeni district and partially Ștefan Vodă. The comparative analysis of the cost recovery rate for water supply and sanitation services highlights differences between the Dniester Basin District and the Danube–Prut and Black Sea Basin District. In the Dniester Basin District, the cost recovery rate for water supply is approximately 93–95%, while for sanitation it is around 95–96%, indicating a relative balance, though still insufficient for long-term sustainability. In the Danube–Prut and Black Sea Basin District, the cost recovery rate is lower, reaching 85–88% for water supply and 80–82% for sanitation, reflecting a more pronounced level of underfunding.

In the context of the country’s aspirations for European Union accession, adjustments to tariffs and improvements in cost efficiency are necessary in order to achieve European standards.

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Methodological approaches to reservoir sedimentation dynamics via the integration of current bathymetric data and historical cartography

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Artificial reservoirs in the Moldavian Plateau are highly susceptible to accelerated siltation processes due to the region's specific geomorphological conditions, intensive land-use patterns, and high rates of soil erosion. Understanding the dynamics of reservoir sedimentation is crucial for sustainable water resource management, flood attenuation, and agricultural planning. However, quantifying the volume of accumulated sediment over decades presents a significant challenge, especially for small to medium-sized reservoirs that lack continuous hydrological and bathymetric monitoring. This paper presents a preliminary methodological proposal designed to evaluate lacustrine sedimentation dynamics by integrating modern non-invasive geophysical techniques with historical cartographic sources. The proposed research workflow is based on two representative case studies from the Moldavian Plateau: Tungujei Lake and Cuibul Vulturilor Lake.

The methodology relies on a comparative spatial analysis utilizing Geographic Information Systems (GIS). The historical reference state of the reservoir basins was reconstructed by digitizing topographic plans dating back to 1979. Through careful digitization and spatial interpolation, historical Digital Elevation Models (DEMs) of the pre-existing topography were generated. To determine the present-day bathymetry, field surveys were conducted using Ground Penetrating Radar (GPR) technology. The methodology details the rigorous processing of raw GPR profiles using dedicated open-source software such as GPRPy. This processing is followed by the translation of geographic coordinates into the national metric projection system to ensure high spatial alignment. The processed GPR data, consisting of specific bathymetric elevation points extracted from the profiles, were subsequently interpolated to generate the current bathymetric surface models. The core of this methodological framework consists of the spatial integration of the two distinct temporal models. By applying DEM differencing spatial analysis, the methodology

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facilitates the 3D extraction of the sediment budget.

Ultimately, this study highlights an initial technical workflow and the hybrid data integration process rather than focusing solely on quantitative outputs. By bridging the gap between historical archival data and modern geophysical measurements, the proposed methodology offers a robust and highly replicable framework. This approach is instrumental not only for academic geomorphological research but also for stakeholders in elaborating effective strategies for reservoir maintenance and sediment control.

Photovoltaic energy: a GIS-based potential analysis applied in rural areas

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The growing interest in decentralized electricity production and the development of the prosumer sector require a rigorous assessment of photovoltaic potential at the residential level, especially in rural areas, where the installation of a photovoltaic system can lead to household energy independence. This paper proposes a GIS-based modeling methodology for estimating the photovoltaic potential of rural dwellings, with a focus on determining installable capacity and annual electricity production.

The methodology is based on the use of geographic information systems (QGIS and ArcMap) for processing and analyzing data on photovoltaic potential (SolarGIS, Global Solar Atlas) . Residential roofs were vectorized at the level of individual roof planes in order to enable accurate surface area determination, and orientation classes were assigned to each plane. Based on data on annual global horizontal irradiation (GHI) and specific photovoltaic output (PVOut), obtained from specialized platforms such as Global Solar Atlas and SolarGIS, the potential energy production was estimated for several theoretical scenarios.

The study integrated correction factors according to roof orientation and slope, as well as the efficiency of photovoltaic panels. The determination of installable capacity was carried out based on the usable roof surface and standard technical parameters. Subsequently, the annual electricity production and the degree of coverage of the average consumption of a rural household were estimated. The results highlight differences in photovoltaic potential, mainly determined by roof orientation and available surface area. GIS modeling enables not only the quantification of installable capacity at the individual level, but also the assessment of the energy potential of the rural residential sector.

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Due to its replicable nature, the proposed methodology can be applied to other territorial units, providing a useful tool both for public authorities and for any individual seeking to obtain an estimate of the amount of photovoltaic energy that can be produced.

The delineation of tourist destinations - a GIS and social media perspective

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The concept of a tourism region has been widely discussed in tourism and regional studies, yet it has remained difficult to precisely define and operationalize. Traditionally, tourism regions have been identified through administrative boundaries or marketing constructs designed to facilitate branding and destination promotion. However, such approaches often fail to capture the complex spatial dynamics and socio-cultural processes that actually shape tourist experiences and flows. Existing studies have shown that tourism regions are more likely to be socially constructed, temporally fluid, and functionally heterogeneous. From a methodological perspective, multiple approaches have been proposed for delineating tourism regions, such as spatial interaction models, that were used to map tourism flows and functional tourism areas based on visitor mobility patterns. GIS has been used to integrate various data layers and build empirically grounded regional boundaries. Our study proposes an original approach to the spatial delineation of tourism regions, based on geolocated social media information. Social media is widely recognized as a major factor shaping visitors' perceptions of destinations and visiting patterns. User generated content is usually perceived as more credible than traditional tourism marketing, hence its impact on tourist decisions and spatial representations. In this study we use Instagram posts associated with a famous tourist region – Bukovina, in order to delineate its perceived boundaries. Instagram is one of the most popular social media platforms that inspire travel choices and behaviour. We used geolocated posts associated with the hashtag #DiscoverBucovina and mapped their spatial distribution and spatial intensity based on the number of posts, as well as the number of likes and comments. We compared the results with official (i.e. administrative and historical) delineations of Bukovina.

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The study highlights significant differences in perceptions between the social-media- based maps and the administrative and historical perspectives. Most of the posts about Bukovina are within the county limits but their distribution is closely linked to the main transport axes, the presence of tourist facilities and the trajectory of the main tourist itineraries proposed by travel agencies. The tourist limits shaped by social media appear less influenced by administrative perceptions and more by visiting patterns that emphasize clusters of iconic tourist places built by traditional marketing and reinforced by social media discourses. The study provides valuable insights for local and national authorities involved in the management of tourist regions and destinations.

Utilization of GIS in the Organization and Dissemination of Censuses

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Geographic Information Systems (GIS) are essential in the organizational phase of modern censuses. They support creation and updating of digital enumeration area map, delimitation of census areas and workload allocation, integration of administrative boundaries and geospatial databases, identification of newly developed or hard-to-access areas and monitoring territorial coverage to prevent overlaps or omissions. During implementation, GIS facilitates real-time supervision of field operations, GPS-based tracking of enumerators, route optimization and logistical planning, detection of gaps in territorial coverage, all this improves operational efficiency and reduces errors in data collection. In the dissemination phase, GIS plays a key role by producing thematic maps (population density, structure, migration, housing conditions), developing interactive online dashboards and geoportals, supporting spatial analysis of demographic and socio-economic indicators. Spatial visualization makes complex statistical information more understandable for policymakers, researchers, and the general public. In the 2024 Population and Housing Census of the Republic of Moldova, Geographic Information Systems (GIS) played a central role in both planning and execution. GIS technology was used to update digital maps, delimit enumeration areas, and integrate administrative boundaries, ensuring complete territorial coverage and reducing overlaps. During field operations, enumerators employed GPS-enabled tablets, allowing real-time monitoring and verification of visited areas, which improved data quality and operational efficiency. Post-census, GIS facilitated the production of thematic maps and spatial analyses of population distribution, density, age structure, and migration patterns. The integration of GIS strengthened the

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accuracy, transparency, and analytical capacity of the census, aligning Moldova's statistical practices with international and EU standards.

Monitoring ice cover periods of Lake Izvorul Muntelui (Romania) using Sentinel-2 imagery

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Understanding the freeze–thaw dynamics of large reservoir lakes is essential for hydrological monitoring, climate interpretation, and environmental management. The present study aims to identify and analyse the ice-cover periods of Lake Izvorul Muntelui (Bicaz), Neamț County, Romania, using a multi-year time series of Sentinel-2 imagery processed in Google Earth Engine. Cloud-free observations were selected using the Sentinel 2 Cloud Probability product, while surface ice was detected through the Normalised Difference Snow Index (NDSI) computed from green and shortwave infrared spectral bands. A workflow was developed to extract representative NDSI values for key winter periods, evaluate them against manually collected in situ labels, and identify an optimal NDSI threshold for mapping compact ice cover. The method minimises computational load by combining vector-based lake masks, resolution harmonisation, and robust cloud filtering. In addition, an animated time series visualisation was generated to illustrate multi-annual winter variability from 2015 to 2025. The results demonstrate that Sentinel 2 NDSI reliably characterises the extent and timing of freeze events on the reservoir and provide a reproducible framework for monitoring ice phenology in other mountainous lake systems.

GIS Technologies for Mapping and Enhancing Dark Tourism at Șerban Vodă – Bellu Cemetery

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Șerban Vodă "Bellu" Cemetery is one of the most significant cultural and historical heritage sites in Romania, often regarded as an open-air museum. This paper explores how GIS technologies can be used to map, analyze, and enhance the cultural assets of this urban funerary site, with the aim of supporting both documentation efforts and its touristic promotion. The study is based on the collection and integration of data from bibliographic sources, field observations,

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questionnaires, and interviews, followed by their processing and analysis in GIS environments such as QGIS, ArcGIS Pro, Google Earth Pro, and QField/My Maps. The research includes the development of thematic maps illustrating the location of representative funerary monuments, the distribution of cultural attractions, accessibility patterns, and the condition of tourist infrastructure, as well as proposals for thematic visitor routes. The results highlight the essential role of GIS applications and digital datasets in organizing spatial information and increasing the touristic attractiveness of funerary heritage sites. The study demonstrates that geospatial tools can provide a solid foundation for developing interactive and replicable cartographic solutions that support the sustainable management and enhancement of cultural heritage spaces.

Landscape as war archive: identification of World War II defensive structures in the Ozana Valley using GIS

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World War II left lasting imprints not only on human societies but also on the physical landscape. In Romania, the military events of 1944 led to the establishment of defensive systems as German forces attempted to delay the Soviet advance following Romania's change of allegiance on August 23, 1944. One such defensive alignment was constructed near Târgu Neamț, including the fortified line along Pleșului Ridge, designed to control strategic access routes in eastern Romania. The Ozana Valley, located in Neamț County, represented a key geomorphological corridor due to its terrain configuration and connectivity. This study aims to identify, map, and analyze preserved World War II defensive structures, such as trench networks and fortified positions, using GIS and remote sensing techniques. Satellite imagery and DEM were used to detect microtopographic features associated with military landforms. The identified structures were digitized and analyzed in relation to terrain characteristics, including elevation, slope, and visibility, to assess their strategic positioning. The results reveal that remnants of defensive structures remain visible in the present-day landscape, particularly in forested areas with limited anthropogenic disturbance. This research demonstrates the effectiveness of GIS and remote sensing in investigating recent conflict landscapes and highlights the landscape's role as a spatial archive preserving the material legacy of war.

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Spatial patterns of wildfires in relation to infrastructure and protected areas. Case study: Vaslui County, Romania

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This research presents a spatial analysis of areas affected by wildfires in Vaslui County, using Geographic Information Systems (GIS), remote sensing techniques and photointerpretation. The study uses Sentinel-2 satellite images from the high-risk periods in March and April, due to human practices induced by field burning and their negligence in fire management. The identification and evaluation of fire severity were carried out by calculating the Normalized Burn Ratio (NBR) spectral index, which highlights the changes produced at the vegetation level through reflectance variations in the NIR and SWIR bands. The identified burned areas were integrated into comparative spatial analysis regarding their proximity to residential areas and the road network, as well as the incidence of fires within protected natural areas. The anthropogenic dimension was analyzed by determining the minimum distance between fire perimeters and the road network, respectively the built-up areas, using the Near function in ArcMap. By using spatial analysis, this study provides an overview of fire distribution and distances from the human factor. The conclusions based on this research contribute to a better understanding of the risk faced by local communities in proximity of wildfires and the impact on the protected natural landscape. At the same time, the research highlights the potential of integrating remote sensing and GIS proximity analysis in evaluating the relationship between fires, the anthropogenic factor and protected natural areas.

Integrating OSINT (open-source intelligence) in GIS - detecting conflicts' patterns during the War on Ukraine

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Since the inception of the War on Ukraine, the military aggression was systematically mapped by different OSINT (open-source intelligence) platforms, making thus available the visualization of the conflicts' development at local scale. It is the first largely extended military conflict in history that benefits from such intense geo-spatial detailing. However, due to technical and

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epistemological constraints, the scientific literature seems to have rather a limited following of the empirical data, focusing on other topics connected to the war. Our investigation explores the OSINT sources integration in GIS analysis, subordinating it to one major objective: the detection of chromo-spatial patterns in the conflict's diffusion. In order to explore these patterns, we use three datasets provided by the OSINT (Geoconfirmed, Liveuamap and Project Owl) and we generate a spatial database of conflicts events. Once localized, the events are analyzed via an indicators' transformation that calculates chrono-spatial concentration trends in a 5km kernel. The transformation is based on the evaluation of local quotients (LQ) for 2023, 2024 and 2025. When mapped, these quotients reveal the territorial trends of conflict diffusion, eliminating the spatial noise inherent for large datasets (more than 100 000 events analyzed). The main limitations of the study are provided by the lack of qualitative analysis of the incidents, given the fact that their description is rather sparse and, in precise contexts, unreliable. The cartographic output of this methodological approach enables the detection of the strategic objectives of both sides involved in the dyad, emphasizing why the common knowledge of the war is rooted in confusion, deception and limited information. Given the extent of the conflict, a general map of the observed diffusion has limited added value, explaining why focalized regional analysis are much more useful to extract key-findings related to the Russian military aggression.

Three pillars of war against Iran: deception, surprise and confusion. A GIS analysis applied to the detection of conflict's spatial patterns

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Both the USA and NATO military doctrines emphasize the role of strategic surprise and deception against the targeted enemy, even when the military conflict is supposed to take place in an asymmetric context, such as the war against Iran. The main intention of this doctrinal approach is to paralyze the enemy's decision-making process by increasing confusion, disrupting contingency management, and disrupting the chain of command. Our research investigates how these elements of strategy were implemented in the early phases of the confrontation, focusing on the geographic selection of targets to maximize tactical impact. As the information flow stabilizes after the start of operations, more and more data becomes available for processing and integration into GIS visualization tools. The main sources used by our approach

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are provided by GDELT Project (Global Database of Events, Language, and Tone), ACLED (Armed Conflict Location & Event Data Project) and Liveuamap Iran (Live Universal Awareness Map). Each of these three platforms has its own logic for data dissemination, introducing separate challenges for integrating indicators into GIS. After finalizing the spatial database, the locations of military events were integrated into analytical processes that clustered the information and enabled the detection of local patterns of similar strategic approaches by both the US and Iran. The research shows that these observed approaches are scale-dependent spatial processes, allowing us to decode the geographical levels of strategic representation of what being a target means in what military analysts might consider a great reset of warfare. Overall, the study we propose cannot be considered a predictive tool derived from geostatistical analysis, but rather the rolling back of a dyad lacking a clear, objective sense.

An In-Depth UAS-PPK Georeferencing Analysis at different Flight Heights for an Urban Area

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Acquiring UAS images in urban environments presents a significant importance for various applications but presents challenges, particularly with flight missions and the reliability of the Global Navigation Satellite System (GNSS) signal. Georeferencing the UAS images in real-world locations is typically done through GNSS-assisted Real-Time Kinematic (RTK)/ Post-Processing Kinematic (PPK) or indirect georeferencing methods. Due to the time intensive nature for ground-based measurement and materialization of Ground Control Points (GCPs), the GNSS-assisted RTK/PPK method is often preferred. Nevertheless, the accuracy provided by onboard devices is highly contingent on various factors. In densely built-up areas, RTK positioning is prone to signal interruptions, signal losses, radio link outages, and multipath effects, the PPK georeferencing offers a more reliable and precise solution. The aim of this research is to perform an in-depth analysis of the PPK georeferencing results when using three different Continuously Operating Reference Station (CORS) stations and one local base station, with focus only on nadir flights. Two flights were conducted over an 8.6 ha urban area at 60 m and 100 m heights with a DJI Phantom 4 Pro v2 equipped with a TeoKIT GNSS PPK module. The accuracy of

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the PPK georeferencing process was assessed using 33 Check Points (ChPs) across different scenarios with varying numbers of GCPs and PPK trajectory computations derived from distinct base stations. Comparing the results at 100 m and 60 m flight heights, the best accuracy, with an RMSE of 3.7 cm for all CORS stations, was achieved at the 100 m flight height, reflecting an accuracy improvement of approximately 43% for the RS2 local base station and 75% for the CORS stations with respect to 60 m flight height. The effectiveness of our proposed workflow is demonstrated by the results obtained for the RS2 local base station at 60mflight height, achieving the highest accuracy (9.2 cm) compared to the CORS stations in the 0 GCP scenario, with a 30%-40% improvement due to good satellite visibility and low levels of multipath and SNR interference. However, the RMS values for the 60 m flight were four times worse than the 100 m flight, primarily due to multipath effects and signal interruptions.

Identification of wetlands in the Prut floodplain (within the perimeter of the "Pădurea Domnească" nature reserve)

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The environment and land use in the Prut floodplain changed significantly during the Soviet period. Topographic maps from that period are very important for understanding and tracking these changes. This, in turn, is important for implementing wetland restoration projects, which can be carried out to reverse and reduce the harmful and unsustainable effects of land use changes.

In this study, information on the location and geographical distribution of wetlands (rivers, lakes and marshes) was manually extracted from Soviet topographic maps at a scale of 1:25,000 from 1960, as well as their current distribution, identified based on topographic maps at a scale of 1:50,000 from 2013, and subsequently based on current satellite imagery. The study area has 13,539 ha and is located between the Prut Riverbed to the west and the Camenca River meadow to the east, the village of Cobani to the north and the village of Valea Rusului in the south. Preliminary results show a 163-fold increase! of the areas covered by water during the period 1960-2013, against the background of the construction of several reservoirs and ponds, as well as the complete damming of the Camenca River in its lower course (which turned into a lake with

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a length of about 50 km). The areas occupied by swamps during the same period were reduced from 707 ha to 26 ha (27 times!). The main causes that contributed to these essential changes were the drainage works for the purpose of agricultural valorization, for which about 72 km of canals were built until 1982, but also the construction of two parallel protective dams (6.6 km in total) on the Camenca River, between the Prut River and the village of Balatina (which do not allow the formation of floods). The data obtained are some intermediate ones, because they are still to be updated based on satellite images (Sentinel-2).

The results presented show that GIS tools can be useful in extracting and digitizing non-textual information from old topographic maps. Based on the obtained GIS data, more precise quantifications and estimates of historical wetlands that have disappeared can be made and the process of their restoration can be argued. We note that the Republic of Moldova tends to rehabilitate some sectors with wetlands, and this sector claims to become a Ramsar site.

Cognitive offloading and the future of critical thinking in geography in academia in the context of the development of artificial intelligence

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The accelerating integration of artificial intelligence (AI) tools into university-level geography education — spanning geographic information systems (GIS), remote sensing, geospatial data analysis, cartographic mapping, satellite image interpretation, and field data acquisition via smartphones, unmanned aerial vehicles (UAVs/drones), and underwater remotely operated vehicles (ROVs) — presents both transformative opportunities and profound epistemic risks. This article argues that while AI substantially augments analytical capacity, its uncritical adoption risks systematically eroding the very cognitive faculties — spatial reasoning, source evaluation, methodological literacy, and interpretive judgment — that constitute the irreducible core competency of the geographer. Drawing on cognitive load theory, distributed cognition frameworks, and empirical evidence from GIScience pedagogy, we demonstrate that cognitive offloading onto AI systems, when unmediated by deliberate instructional scaffolding, produces measurable deficits in students' ability to formulate hypotheses, detect analytical errors, and transfer knowledge to novel spatial problems. We propose the Critical Geospatial Intelligence Framework (CGIF), a

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five-tier pedagogical model that positions human critical thinking not as a relic of pre-AI education, but as the indispensable epistemic foundation upon which all productive AI-augmented geospatial analysis must rest. The framework is operationalised through case studies in satellite image classification using Sentinel-2 and Landsat-9 data, UAV-based land-cover mapping, flood inundation modelling with SAR imagery, and AI-assisted thematic cartography in QGIS and ArcGIS Pro environments.

Historical flood events in the Lower Danube Basin (Romania): An 800-year perspective

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Romania is located in the lower sector of the Danube hydrographic basin, with approximately 98% of its river network draining into the Danube River. The country covers an area of 232,193 km^2 and has a hydrographic network extending over approximately 115,000 km. Water resources are managed through a basin-based administrative structure consisting of 11 Hydrographic Basin Administrations (HBAs), which serve as the main spatial framework used in this study. This research aims to identify and map historical hydrological events that occurred across Romania between 1234 and 2024. To support this objective, a geospatial database named the ROmanian Flood Event Database (RO-FED) was developed. The database integrates historical and contemporary records of flood-related events, including information on their temporal occurrence, spatial distribution, intensity, and magnitude. By organizing these data within a geospatial framework, RO-FED enables the systematic analysis of long-term flood dynamics and spatial patterns. The database also provides a useful analytical resource for researchers and decision-makers interested in flood risk assessment at both national and international scales.

The final version of the RO-FED database contains 1,084 documented hydrological events. Analysis of the dataset reveals an increasing tendency in flood occurrence, particularly in recent periods. Seasonal analysis shows that

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summer floods are the most frequent, mainly associated with intense rainfall events. The Carpathian Mountain system also plays an important role in shaping hydrological processes, influencing the occurrence of spring floods in the river basins of western Romania, where snowmelt and precipitation contribute to increased river discharge. Spatial analysis indicates that the most affected HBAs are RO10 (Siret HBA) and RO3 (Olt HBA), while the highest number of casualties was recorded in RO7 (Mureș HBA) and RO10 (Siret HBA).

The impact of climate change on environmental components

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The contemporary global environment is undergoing a period of unprecedented transformation driven primarily by anthropogenic climate change. This phenomenon is not a singular event but a complex catalyst that triggers a "domino effect" across all primary environmental components: the atmosphere, hydrosphere, cryosphere, lithosphere, and biosphere. This paper examines the intricate feedback loops and direct consequences of rising mean global temperatures on these vital systems, highlighting the shift from gradual environmental shifts to abrupt, systemic instabilities. At the core of these changes is the atmosphere, where increased concentrations of greenhouse gases have altered thermal dynamics. This disruption manifests in the hydrosphere through accelerated evaporation-precipitation cycles, leading to a paradox of intensifying droughts in certain regions and catastrophic flooding in others. The hydrosphere is further compromised by ocean acidification and thermal expansion, which threaten marine chemistry and coastal stability. Simultaneously, the cryosphere serves as a critical indicator of planetary health; the rapid melting of polar ice caps and permafrost not only contributes to sea-level rise but also releases sequestered methane, creating a dangerous positive feedback loop that further accelerates warming.

The lithosphere and soil health are equally at risk. Changes in temperature and moisture regimes accelerate soil erosion, reduce nutrient cycling, and promote desertification, thereby undermining the foundations of terrestrial productivity. These abiotic shifts culminate in profound pressures on the biosphere. Species are facing habitat loss and phenological mismatches—where the timing of migration or flowering no longer aligns with food availability. The resulting loss of biodiversity weakens ecosystem resilience, diminishing the "ecosystem services" that humanity relies upon, such as carbon sequestration, water purification, and pollination.

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In conclusion, the impact of climate change is not confined to isolated sectors but represents a holistic degradation of the Earth's life-support systems. This study emphasizes that because environmental components are deeply interconnected, the destabilization of one inevitably leads to the collapse of others. Addressing these impacts requires a shift from reactive mitigation to integrated, systemic adaptation strategies that acknowledge the profound interdependence of our global environment.

GIS technologies as means for assessing territorial accessibility to public health indicators in Romania

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Medical geography is an interdisciplinary branch of human geography that analyzes the spatial relationships between the health status of the population, the medical infrastructure, the health services and the socio-economic and environmental context. This paper represents an incipient study that aims to explore the potential of GIS tools in the spatial analysis of public health phenomena and in investigating the territorial distribution of medical resources in Romania. The research approach is oriented towards the development of a methodological framework capable of highlighting the way in which specific indicators of the health system can be represented, analyzed and interpreted through geospatial technologies. In this sense, the research aims to illustrate the ways in which GIS tools can be used for the cartographic representation of public health indicators, for the evaluation of the distribution of medical infrastructure and for the measurement of the population's accessibility to medical services.

The main objectives of the research are to spatially analyze the distribution of doctors and medical infrastructure in Romania, to systematize the conceptual and methodological elements specific to medical geography, and to assess the feasibility of using GIS technologies in the study of public health phenomena. The study also aims to develop a geospatial model for assessing territorial health vulnerability, to identify existing spatial imbalances within the Romanian health system, and to highlight the potential of GIS as a support tool in the decision-making process in the field of public health. Another important objective is to highlight the current advantages and limitations regarding access to and use of medical data, including in the context of regulations regarding the protection of personal data (GDPR). The research methodology is based on the integration of statistical, demographic, socio-economic and geospatial data in a unified GIS

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environment, which allows for complex spatial analyses of the structure and functionality of the health system. The database used includes information on the medical infrastructure (number of hospitals, beds, medical units), the human resource in the health system (number and distribution of doctors), as well as demographic and socio-economic indicators relevant for assessing the territorial context.The spatial analysis is based on the use of specific GIS techniques, designed to highlight the distribution and concentration of medical resources, as well as the population's accessibility to health services. In this regard, the study uses cartographic representation methods such as the creation of cartograms and cartograms, which allow the visualization of the territorial distribution of health indicators. At the same time, spatial analysis methods are applied to assess accessibility, by relating health indicators to the population and by using proximity analyses and modeling access to medical units. These methods allow the highlighting of territorial differences and the identification of areas characterized by limited access to medical services. By integrating geospatial analyses into the study of the health system, the research aims to demonstrate the usefulness of GIS as an analytical and decision-making tool in the field of public health. The current and subsequent results of the study highlight the potential of these technologies to contribute to a better understanding of territorial disparities and to the substantiation of development strategies aimed at increasing equity in the population's access to medical services.

Road accessibility as a determining factor in the spatial distribution of tourism around Izvorul Muntelui Lake (Romania)

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Tourism development in mountain lacustrine areas is often strongly influenced by the accessibility provided by transportation infrastructure. In many cases, tourist accommodation facilities tend to concentrate along major road corridors rather than being evenly distributed across the landscape. This study investigates the relationship between road accessibility and the spatial distribution of tourism infrastructure around Izvorul Muntelui Lake (Romania), one of the most important artificial lakes in the Eastern Carpathians. The research applies a GIS-based spatial analysis to examine how proximity to the main road network, particularly the DN15 corridor, influences the localization of tourism facilities. A composite Tourism Accessibility Index was developed by integrating several spatial variables, including distance to major roads, proximity

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to the lake shoreline, terrain slope, and distance to settlements. These variables were standardized and combined using a weighted overlay method in order to identify areas with higher accessibility and tourism development potential. The results indicate a clear spatial concentration of tourism facilities in areas with high accessibility scores, especially along the main transportation corridor. This pattern highlights the decisive role of infrastructure in shaping tourism development in mountain lake environments and provides a useful framework for spatial planning and sustainable tourism management in similar regions.

Slope Dynamics in the Provita Depression Area. Case Study: Proximity of Provita de Sus and Provita de Jos Settlements, Prahova County

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Landslides represent one of the most frequent current geomorphological processes encountered in the Subcarpathian area. This dynamic process has a significant impact on territorial organization and planning. The purpose of our study is to identify and map slope susceptibility to landslides, as well as the vulnerability of exposed elements under current conditions in the proximity of Provita de Sus and Provita de Jos settlements, Prahova County. The workflow, based on GIS techniques, includes three main stages: 1) analysis of potential and triggering factors, 2) identification of susceptibility through multi-criteria analysis under various current conditions, 3) identification of exposed elements and their vulnerability. The methodological approach consisted of scientific documentation, field research, and the creation of a database for the study, followed by a series of GIS practices, including data processing and multi-criteria analysis. According to the analyses performed, 65% of the analyzed territory comprises areas with high and very high susceptibility to landslides under current conditions, while only 7% of the area shows low instability, being located mainly in the low-lying floodplain sectors. From this perspective, an analysis was carried out on a vulnerable anthropogenic element in the face of land instability: the road network. The result of this evaluation concluded that over 50% of the total length exhibits high and very high susceptibility. In conclusion, the paper demonstrated the practical utility of landslide modeling through geomatic techniques in the Provita Depression area for spatial planning and organization, while also offering a series of prevention and management measures for the pronounced geomorphodynamic character. In this way, it also has methodological and practical utility for local authorities in territorial management.

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Georeferencing the 1:20 000 Lambert-Cholesky Romanian topographic map and a critical analysis of its accuracy

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The Lambert-Cholesky Romanian topographic map, at 1:20 000 scale is the first cartographic dataset that provides national coverage for Romania and Republic of Moldova. The usability of this dataset for change detection approaches in geosciences is questioned here regarding georeferencing and its precision. Previous approaches used corner coordinates, but analysis of this data reveals variable shifts that hinder their use in changing detection approaches. By creating a kilometric grid based on several measurement of church locations recognized on the Lambert-Cholesky Romanian topographic map and the two editions of the 1:5 000 topographic map, we georeferenced the dataset for the Prut River border. Investigating the resulted dataset in terms of accuracy regarding forest, river, lake, road and building data we found that in general the positional horizontal accuracy is around 10 m, but there are areas with differences that can be ten times more than that. Nonetheless, by using the kilometer grid as a reference, these inaccuracies can be controlled and if needed can be corrected for vectorisation purposes.

GIS-based analysis of the relationship between morphometric parameters and landslides: a case study of the Ialpug hydrographic basin

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Landslides are one of the most important factors contributing to land degradation, affecting land productivity and the stability of ecosystems. The morphometry significantly influences the susceptibility of the land to landslides occurrence, and identifying the most vulnerable surfaces is essential for developing effective management measures. The aim of this study is to analyze the correlations between morphometric parameters and landslides in the Ialpug River

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Basin, using ArcGIS software calculations and landslide susceptibility assessment methods. The study allows for the identification of areas according to their degree of landslide susceptibility and the prioritization of zones for land management and hazard mitigation interventions. The study highlights a clear relationship between morphometry and the occurrence of landslides, providing a scientific basis for effective landslide risk reduction and land management measures.

Integrated data and GeoAI usage in smart city strategies implementation for sustainable urban mobility

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Urban mobility strategies contribute to pollution and road congestion reduction in the urban environment, representing an essential aspect of urban development. As there are multiple factors that influence the level of congestion and in the context of improvement in data collection, accuracy and availability, the use of this data not only became possible, but also became mandatory for efficient and economical decision making. When large datasets are involved, that are permanently expanding, workflow automatization and geospatial artificial intelligence (GeoAI) ensure superior speed of complex datasets interpretation, pattern identification and adaptive model creation. This study aims to develop a methodology for processing and correlating multidisciplinary integrated data with the scope of using the results in urban mobility applications. The case study used for the methodology development and testing is focusing on the public transport network in the city of Cluj-Napoca, Romania, for the period between September 2023 and August 2025 (24 months). To conduct this study, data from multiple sources must be used. Public transport data, containing the ticket and card validations and fleet vehicles' position, is structured in AVL (automatic vehicle location) files, provided by the public transport local company (CTP Cluj-Napoca). Weather data is procured from online source Meteomanz.com, providing hourly information about the main meteorological parameters such as air temperature, precipitation quantity, wind speed and atmospheric pressure. Data about the school and university holidays is obtained from relevant authorities' and universities' websites, while the schedule of major public events is extracted from media agencies. Finaly, the road network used for visualization is built on the OpenStreetMap open-source data. The study is structured in four methodological stages, each providing a relevant result. The first stage is the workflow that feeds on the meteorological data, events and holidays data and AVL databases and returns aggregated

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datasets characterized by small dimensions and easy maintenance. Next is the evaluation of relative impact that meteorological conditions, local events and holidays had on the ridership and travel times based on historical data. Statistical reports and map visualizations are provided to facilitate a better understanding of data. In these two stages tools like SQL and Python languages, DBeaver and PyCharm environments, ArcPy library and QGIS are used. The third stage is the creation, validation and calibration of the predictive model using GeoAI, that can forecast with high probability the expected travel conditions and ridership levels in relation to the variables involved. In the end, the study proposes a set of recommendations and strategies for improving the efficiency of public transport service in Cluj-Napoca.

In conclusion, modern geospatial techniques allow the processing and correlation of large datasets, improving the understanding of urban mobility tendencies and supporting more informed and efficient decision making.

Multi-scenario flood vulnerability analysis using GIS techniques in Tecuci Municipality

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Floods are a more common phenomena, especially in the context of climate change. Considering the placement of inhabited areas along major and minor river courses, case studies of flood modeling are increasing in relevance for local communities. The research was conducted using GIS spatial analysis techniques to analyze the study area. Vector data regarding buildings, road network, land use, and points of interest in the Municipality of Tecuci, Romania were used. The vulnerability exposure of the vector data was analyzed according to the probability of flooding, based on flood hazard curves. Results highlight the spatial distribution of vulnerable buildings, road networks, land use types, and points of interest within the municipality, as well as their classification, according to three different theoretical flooding scenarios. The analysis allows the identification of areas with a much higher degree of vulnerability exposure, where the majority of constructions, road networks, and exposed land use types are concentrated. The aim of this analysis is to highlight vulnerable areas and to support the implementation of several, potential prevention methods.

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Validation of flood risk maps in the area of Glăvănești-Noi locality, Andrieșeni commune, using the interview method

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The present study examines the assessment of flood risk along the middle course of the Jijia River. Its purpose is to provide support to the population susceptible to such events, while also offering an alternative perspective and a deeper understanding of flood risk and the manner in which this phenomenon manifests. The study evaluated the potential impact that floods could have on nine localities situated between Pogorăști and Buhăeni, located along the middle course of the Jijia River, while also highlighting the potential damages that these settlements could incur. Through the analysis of flood risk maps, it is possible to observe and identify the potential damages that may occur as a result of such events. According to the 5% flood probability band, the estimated potential damages are relatively limited. In the scenario based on the 1% flood probability band, a significant increase in the potential damages caused by a larger-scale flood event can be observed. In the third scenario, developed using the 0.1% flood probability band, an increase in damages is also noticeable; however, compared to the scenario based on the 1% probability band, the increase is not significantly greater.

Theoretical analysis of beekeeping potential of Iași county using Geographic Information Systems and remote sensing

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Beekeeping activity represents an essential component in maintaining biodiversity and supporting ecological balance, due to the crucial role that bees play in the pollination process. In the context of environmental changes and increasingly pronounced anthropogenic pressures, the evaluation of territory becomes necessary in order to identify the most suitable areas for the development of apiaries. Thus, the present study aims to analyze the apicultural

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potential of Iași County by using modern tools from the field of geography.

The main objective of the study was to identify and classify areas with high, medium, and low potential for apicultural activities within Iași County through the use of Geographic Information Systems (GIS) and remote sensing techniques. In order to achieve this objective, the methodology included the following steps: the selection of the parameters considered in the analysis (multiannual mean temperature, multiannual mean precipitation, relief, slope, slope aspect, distance from roads, and distance from water bodies); the establishment of reference intervals for suitability classification for these parameters; the reclassification of the layers corresponding to the analyzed variables; and the determination of the suitability level through the combination of these layers. The results obtained from this study indicate that within Iași County there are areas with high suitability for apicultural activities, particularly distributed in zones characterized by diversified vegetation and consistent melliferous resources, while regions heavily transformed by human activities or with limited accessibility displayed a lower potential.

The conclusions of the study confirm that GIS and remote sensing represent essential tools for evaluating apicultural potential at the territorial level, providing a solid basis for the strategic planning of apicultural activities. The most suitable areas are concentrated in regions characterized by high floristic diversity, high accessibility, and stable climatic conditions.

Assessing Storm-Induced Damage in Fruit-Growing Areas of North-Eastern Romania Using Remote Sensing and GIS Techniques

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Extreme weather events such as hailstorms and strong winds represent major hazards for agricultural systems, particularly for perennial crops such as orchards and vineyards. These phenomena can cause significant damage depending on the phenological stage of the crops, with effects that may persist over several growing seasons. In the summer of 2021, a series of intense storm events affected fruit-growing areas in northeastern Romania, producing strong winds and hail that caused substantial damage to more than 400 hectares of orchards. The events occurred during the fruit ripening period, approximately one month before harvest, leading not only to fruit damage but also to injuries to young trees, including trunk and branch damage. This study aims to identify and

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map the areas affected by these extreme events using remote sensing and geospatial analysis. Meteorological conditions associated with the storms were analyzed using gridded climate datasets (ERA5) and indicators related to storm intensity. Satellite imagery and vegetation indices were used to monitor changes in vegetation condition before and after the events. By integrating satellite data with GIS-based spatial analysis, the research highlights the spatial distribution of damage and the potential of remote sensing techniques for rapid assessment of extreme weather impacts on orchard systems. The results contribute to improving monitoring approaches for agricultural risk assessment and support the development of adaptation strategies for fruit-growing regions exposed to increasing climate variability.

Forest Composition and Structural Diversity in the Putna-Vrancea Natural Park (Romania): Insights from Forest Management Data and GIS Analysis

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The Putna-Vrancea Natural Park (PVNP), situated in the Eastern Romanian Carpathians, represents one of the most structurally diverse and ecologically preserved forest landscapes in the region. This study aims to evaluate the spatial composition and structural diversity of PVNP forests using detailed parcel-level data from forest management plans (2012–2014) integrated into a Geographic Information System (GIS). Spatial boundaries of compartments and subcompartments were obtained from forest district archives and enriched with manually entered descriptive data on tree species composition, stand age, and site productivity to build a unified geospatial database. Compositional and structural metrics were derived to characterize dominant species and age-class distribution, while forest diversity was quantified using Simpson's diversity index (1–D) and Pielou's evenness index (J'). The results indicate a heterogeneous but structurally balanced forest matrix dominated by Fagus sylvatica (36%), Picea abies (34%), and Abies alba (18%). Moderate diversity (1–D = 0.3–0.6 over 46% of the area) and high evenness (J' > 0.7 over 69%) suggest stable, resilient forest systems typical of near-natural Carpathian ecosystems. The integration of forest

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management data with GIS-based analysis provides a reliable framework for assessing forest structure and supports data-informed governance and sustainable management within protected mountain landscapes.

Evolution of Environmental Information Systems in the Republic of Moldova in the Context of the Implementation of the INDS

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The paper analyzes the process of transformation in environmental data management in the Republic of Moldova under the impact of the implementation of the National Spatial Data Infrastructure (NSDI) and the alignment with the INSPIRE Directive. The research examines the transition from managing data in analog formats or isolated databases toward interoperable Web-GIS architectures capable of supporting complex spatial analyses for environmental monitoring. The study explores three fundamental stages of this evolution: (1) the establishment of the legislative framework and primary state registers, (2) sectoral specialization (water, waste, emissions), and (3) technological maturation through Web-GIS services and interoperability platforms. The conclusions highlight the importance of using open standards (OSGEO) and harmonized metadata in order to improve the efficiency of environmental spatial data management.

Evolution trends of soil rill and interrill erosion in Romania during 2000-2018

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Our study investigates the evolution of soil rill and interrill erosion in Romania for 2000-2018 period. We used the Revised Soil Loss Equation (RUSLE) model to compute erosion maps for each year of the period. The RUSLE model included 5 factors: 3 temporal static factors (slope length and steepness, soil erodibility) and 2 temporal dynamic factors (rainfall erosivity and crop-management factor). Linear evolution trends were computed for each pixel, characterized by Pearson correlation coefficients, slope coefficients and statistical significance. The results show that most of the country (84.2 %) presents increasing soil erosion trends. However, these trends are statistically significant on 27 % of the territory

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(about 58600 sq km), of which 18.1 % (38600 sq km) present moderate (p value < 0.05) and high (p value < 0.05) significance. These areas are located mostly in the Transylvanian Depression, southern and central Wester Hills, the Curvature Subcarpathains, central Western Plain, north-eastern Romanian Plain and parts of the Carpathians. The main driver these erosion trends is rainfall erosivity temporal dynamics, which also displays increasing trends in the analyzed period. Locally, crop-management factors become the main driver, being however subordinated to rainfall erosivity.

Monitoring drought and dryness phenomena in the deciduous forests of North-Eastern Romania using satellite remote sensing methods

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This paper addresses one of the most pressing environmental challenges of the 21st century: the profound impact of drought and aridity phenomena on terrestrial ecosystems, with a specific focus on deciduous forest ecosystems, in the context of accelerating global climate change. In recent decades, these extreme weather events have become increasingly frequent, severe, and prolonged, reaching a remarkable global scale. They are particularly significant and alarming in light of the severe drought periods experienced in recent years in Romania, which have severely threatened regional biodiversity, ecological stability, and forest resilience. Forest ecosystems act as critical carbon sinks and biodiversity reservoirs, making their health essential for mitigating broader climate impacts. However, prolonged water deficits induce severe physiological stress on trees, leading to defoliation, decreased primary productivity, and increased vulnerability to secondary disturbances such as pest outbreaks and wildfires. To comprehensively understand these dynamics, this study monitored the evolution of vegetation health and canopy moisture stress during the critical summer seasons spanning an eight-year period, from 2017 to 2024. The research focuses on the Natura 2000 protected site ROSCI0076 Dealul Mare-Hârlău, located in North-Eastern Romania, an area highly representative of the region's deciduous forest ecosystems and increasingly susceptible to aridification. The methodological approach relies on advanced satellite remote sensing techniques, which provide a highly efficient, non-invasive, and continuous means of observing large-scale ecological changes over time.

Vegetation health and water stress were quantitatively assessed using three

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widely recognized spectral indices: the Normalized Difference Vegetation Index (NDVI) to evaluate overall greenness and photosynthetic capacity, the Vegetation Condition Index (VCI) to contextualize current vegetation health against historical extremes, and the Browning Reflectance Index (BRI) to detect early signs of canopy drying and senescence. These indices were calculated and analyzed utilizing the powerful geospatial processing capabilities of the Google Earth Engine platform, based on high-resolution multispectral data provided by the European Space Agency's Sentinel-2 satellite constellation.

The primary aim of this paper is to contribute to a nuanced understanding of the role played by drought and aridity phenomena in the degradation of forest ecosystem health over time. By correlating spectral signatures with ground-level climate anomalies, the research highlights the immense usefulness of satellite remote sensing methods in monitoring environmental risks. Ultimately, these methods offer a vital macroscopic perspective, extending far beyond the limitations of human perception, to detect the early and often invisible stages of forest degradation under drought conditions. The findings underscore the urgent need for adaptive forest management strategies and provide a robust framework for future monitoring of climate change impacts on vulnerable protected areas.

Preliminary geospatial analysis regarding physical and anthropic parameters, applied in identifying optimum campsite locations

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As more tourists look for genuine outdoor experiences and a more immersive engagement with the natural environment, nature-based tourism has grown in popularity in the recent years. One of the most accessible and environmentally friendly type of travel is camping, which gives guests the change to experience natural settings with a minimal impact on the environment. However, careful spatial planning is needed when developing camping sites to guarantee visitor safety, accessibility and environmental preservation. The purpose of this study is to use Geographic Information Systems (GIS) to determine the best sites for the development of camping tourism in Călimani Mountains. This study blends a number of spatial factors that are important for campground quality, such as accessibility, distance from hiking paths, proximity to springs or any other water sources and terrain features. To identify regions with more potential for camping development, these criteria are examined and categorized using GIS-based spatial analysis. The study results demonstrate the usefulness of GIS as a

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decision and support tool in tourism planning by highlighting a number of areas with ideal circumstances for campsite creation. This study offers an organized strategy for locating appropriate camping spots while promoting the growth of sustainable tourism and the cautious use of natural resources by utilizing spatial analysis techniques.

Light pollution in the context of the current conflict between the Russian Federation and Ukraine

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The ongoing conflict between the Russian Federation and Ukraine has generated profound social, economic, and environmental consequences, affecting both urban infrastructure and the daily lives of millions of people. Among the less explored aspects of this conflict is the impact on artificial nighttime lighting and the dynamics of light pollution in urban environments. This study aims to analyze the evolution of light pollution levels in several Ukrainian cities during the war, using satellite-derived nighttime light data as an indirect indicator of urban activity, infrastructure functionality, and the broader environmental implications of armed conflict. Light pollution represents a widespread phenomenon in contemporary urban areas, resulting from the excessive or inefficient use of artificial lighting. Although it is often overshadowed by other forms of environmental degradation such as air or water pollution, the study of nighttime light emissions provides valuable insights into patterns of human activity, electricity consumption, and urban development. In the context of military conflicts, changes in nighttime lighting patterns can reveal disruptions in energy infrastructure, population displacement, or the gradual recovery of urban systems following periods of destruction. The research focuses on several major Ukrainian cities significantly affected by the conflict, including Kyiv, Dnipro, Kharkiv, Mariupol, and Vinnytsia. The analysis examines variations in nighttime light intensity across three key temporal stages: the period preceding the full-scale invasion, the phase characterized by large-scale attacks on energy infrastructure, and the subsequent recovery period marked by efforts to restore essential services. Satellite data obtained from the Visible Infrared Imaging Radiometer Suite (VIIRS) Day/Night Band were processed using the Google Earth Engine platform, which allows efficient spatial and temporal analysis of large satellite datasets. The processed data were subsequently analyzed and visually represented through thematic maps and graphical

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interpretations created in QGIS, facilitating a clearer understanding of spatial patterns and temporal changes in artificial light emissions. In order to enhance the reliability of the analysis, satellite observations were correlated with additional information sources, including press reports, official statistics, and documented timelines of military attacks targeting energy and urban infrastructure. This integrated methodological approach made it possible to identify strong correlations between decreases in nighttime light intensity and specific episodes of infrastructure damage or electricity supply disruptions. The results reveal significant reductions in nighttime light emissions in several cities during periods of intense military activity, reflecting widespread power outages and severe disruptions in urban functionality. In some cases, particularly in heavily affected cities such as Mariupol, the decrease in light intensity persisted for extended periods, indicating long-term infrastructural damage. In contrast, other cities, including Kyiv, exhibited gradual recovery trends as electricity networks and urban services were partially restored. Overall, the study demonstrates that satellite-based nighttime light data represent a valuable tool for assessing the spatial and temporal impacts of armed conflict on urban environments. By monitoring changes in artificial lighting, it becomes possible to better understand both the immediate disruptions caused by warfare and the resilience of affected cities during the recovery process.

Jijia river channel dynamics: erosion and flood risks

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Rivers represent dynamic systems which are in constant evolution. Understanding the mechanisms of channel modeling is essential for anticipating the hydro-morphological hazards associated with this natural process. The analysis this dynamic character allows us to reduce vulnerability to risks and responsibly manage the impact of evolutionary processes on endangered habitats. Our study aims to analyze the channel evolution of the upper course of the Jijia River (Romania) by specifically focusing on the sector located upstream of Larga Jijia. The study area is morphologically challenging, characterized by a wide floodplain and a sinuous path, where the interaction between water flow and alluvial banks produces constant changes in the terrain's configuration.

To conduct this study satellite imagery from different periods from 1970 to 2025 were used to analyze the differences between riverbanks and quantify the transformations occurred over time. The workflow was based on surface analysis and multi-temporal change detection techniques, overlaying historical

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documents with recent imagery. Through this multi-temporal mapping approach, areas of lateral erosion were identified. Additionally, a digital elevation model (DEM) was used to simulate water propagation in the major riverbed, allowing the visualization of flood-prone areas across various time steps. The results indicate active dynamics, particularly in areas with pronounced meandering, where water pressure causes a constant retreat of the shoreline. The comparative analysis reveals that the river channel "migrates" toward terraces previously considered safe. Predictive scenarios suggest that, erosion processes could expand deeper into the settlement and create a new vulnerable area. This paper analyzes the dynamic evolution of the Jijia riverbed, highlighting how sinuosity and active erosion reshape the channel. Monitoring these temporal transformations enables the assessment of hydro-morphological risk, emphasizing the major danger posed to civil constructions by the combined processes of flooding and continuous riverbank modeling.

Workflow for automated extraction and processing of web data for the analysis of educational performance in Romania

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Access to comprehensive spatial and statistical data often represents a barrier in geographical research. Although public institutions in Romania publish educational results annually, these datasets are frequently fragmented, lack complete download options, and, most importantly, do not include a spatial component (geographical coordinates). This paper proposes a practical methodology for automating the process of collecting, cleaning, and geocoding web-based data, applied to the results of national examinations (the National Assessment and the Baccalaureate). Using the Python programming language, scripts were developed to extract JSON files hidden within the architecture of official platforms, as well as web scraping algorithms that navigated and structured information from more than 33,000 HTML pages. In order to provide the database with a spatial dimension, an automated geocoding process was implemented through Google Plus Codes for more than 18,000 educational institutions, using multiple queries for each institution in order to optimize location accuracy. The resulting dataset was used to analyze the spatial distribution of educational performance at the national level, enabling the detailed observation of patterns and disparities through the use of a comprehensive dataset. In addition to analyzing the distribution of performance,

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educational flows were also created and examined, representing the pathways followed by students from lower secondary schools to high schools after completing the National Assessment examination. Distances within this educational mobility network were replaced with real travel times obtained through the TomTom routing API and data extracted from Google Maps. Thus, the study demonstrates how modern web scraping and data wrangling techniques can be integrated into the generation of geospatial databases.

Environmental characteristics in the vicinity of sheepfolds assessed based on satellite imagery

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Pastoral activity represents one of the oldest traditional practices in Romania and plays an important role in maintaining the rural landscape and ecological balance. The study focuses on analyzing the environmental conditions around sheepfolds and understanding the impact of grazing activities using satellite imagery and spatial analysis methods. The study area is located in the eastern part of Romania and belongs to the geographical unit of the Moldavian Plateau. It overlaps with administrative-territorial units from the North-East and South-East development regions and is also part of the historical region of Moldova. The analyzed samples include several localities from four counties: Botoșani (Albești, Bogdănești, Rânghilești, Stăuceni), Iași (Cotu Morii, Hoișești, Plugari, Rădeni, Sticlăria, Valea Oilor), Vaslui (Bârzești, Brăhășoaia, Chițcani, Popești, Stroiești), and Galați (Ghindești, Ireasca, Piscu, Tudor Vladimirescu). These localities are characterized by diverse environmental conditions favorable to traditional pastoral practices. The motivation for choosing this topic originated from an initial interest in evaluating soil erosion on agricultural lands. However, this topic proved to be too broad and widely studied at a global scale. Following discussions with the supervising professor, the research focus shifted toward analyzing environmental characteristics in the vicinity of sheepfolds using satellite imagery. This approach allows the identification of soil conditions, degradation processes, and the impact of grazing on vegetation and landscape.

The research methodology combines field observations with satellite image analysis and the consultation of specialized literature. Field research played an essential role in understanding the environmental characteristics of representative samples, especially in areas close to my place of residence. For the other locations, satellite images available through platforms such as Google

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Maps were used. The research process was structured in three main stages. The first stage involved identifying and classifying types of traditional pastoralism, including local grazing, pastoral grazing, and meadow grazing, while also highlighting the gradual replacement of these practices with modern livestock management methods. The second stage consisted of selecting representative samples and identifying the spatial footprint of sheepfolds, which is influenced by soil type and relief. The results showed that the sheepfold footprint is less visible in areas with alluvial soils, such as Brăhășoaia and Piscu, while it becomes more pronounced in areas characterized by regosols, luvisols, and chernozems, such as Bogdănești, Sticlăria, and Stăuceni. The third stage focused on interpreting the results by analyzing the relationship between soil, relief, and sheepfold footprints using the NDVI vegetation index. The analysis revealed several environmental impacts associated with grazing activities, including vegetation degradation caused by overgrazing, soil compaction resulting from sheep movement along contour lines when the soil is wet (forming sheep trails), and soil salinization in floodplain areas, as observed in the Chicani sample. Overall, the study highlights that grazing activities have visible effects on the environment. At the same time, spatial analysis based on satellite imagery represents an effective tool for understanding environmental transformations and the interaction between natural and anthropogenic factors in rural landscapes.

Analysis of the variation of water surfaces in the Bârlad Plateau using satellite imagery: case study of the Solești and Pușcași Reservoirs

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In the current context of climate change, characterized by an increase in the frequency and intensity of extreme events, drought represents one of the primary factors affecting water resource availability at both regional and global scales. This phenomenon significantly influences the balance of the hydrological cycle, with important consequences for natural ecosystems, agriculture, and the water supply for human populations. In this context, monitoring water bodies has become essential for the effective and sustainable management of water resources. Satellite remote sensing currently provides modern and efficient tools for observing and analyzing the dynamics of water surfaces, allowing for the assessment of their evolution over long periods and at regional scales. The present

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study, entitled “Monitoring of Water Surfaces in the Bârlad Plateau Using Satellite Remote Sensing: Case Study of the Solești and Pușcași Reservoirs”, aims to analyze the temporal evolution of the surface areas of these two reservoirs over the period 2015–2024 using Sentinel-1 satellite imagery. The selection of this time frame allows the observation of significant variations in water surfaces, driven both by climatic factors—particularly frequent drought episodes—and by anthropogenic influences, such as water withdrawals for the supply of the city of Vaslui. The use of radar data from the Sentinel-1 missions, based on Synthetic Aperture Radar (SAR) technology, enables the monitoring of water surfaces regardless of weather conditions or time of day, providing an effective tool for analyzing hydrological processes. The study also analyzes and correlates climatic data, including air temperature and precipitation recorded at the Vaslui and Bârlad meteorological stations during the analyzed period. Additionally, data on water volumes extracted from the Solești and Pușcași reservoirs, provided by the regional water operator, are used to highlight the impact of anthropogenic activities on the evolution of the reservoir surfaces. By integrating satellite imagery with climatic and hydrological information, the study seeks to identify the main factors driving variations in water surfaces and to highlight their evolution trends over the last decade. The results of the research underscore the important role of satellite remote sensing in water resource monitoring, demonstrating the utility of Sentinel-1 imagery in detecting and analyzing changes in reservoir surface areas. Furthermore, the study contributes to a better understanding of the impacts of climate change and anthropogenic pressures on the hydrological systems of the Bârlad Plateau, providing relevant information for the sustainable management of water resources and for the development of effective strategies to adapt to current climatic conditions.

Current state of research on urban vegetation monitoring based on LiDAR data and the development of low-cost mobile scanning systems

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Urban vegetation plays a crucial role in maintaining ecological balance in cities by mitigating the urban heat island effect, improving air quality, supporting biodiversity, and enhancing environmental comfort for urban populations. As urbanization continues to intensify, the need for efficient and scalable monitoring methods for urban green infrastructure has become increasingly

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important. Traditional approaches to vegetation inventory, based on manual field measurements, are time-consuming, resource-intensive, and difficult to update frequently over large urban areas. In this context, LiDAR (Light Detection and Ranging) technology and modern geospatial methods provide new opportunities for detailed and efficient monitoring of vegetation structure. The main hypothesis of this study is that recent developments in LiDAR technology, particularly the emergence of low-cost mobile laser scanning systems, can provide reliable and cost-effective solutions for monitoring urban vegetation while maintaining an acceptable level of accuracy for operational applications. To investigate this hypothesis, the study conducts a systematic review and comparative analysis of existing scientific literature on LiDAR-based vegetation monitoring. The research examines multiple LiDAR data acquisition platforms, including airborne laser scanning (ALS), unmanned aerial system laser scanning (ULS), terrestrial laser scanning (TLS), and handheld mobile laser scanning systems (HMLS). Special attention is given to the architecture and performance of mobile LiDAR systems, including experimental, commercial, and consumer-grade devices. The analysis focuses on sensor integration (LiDAR, GNSS, IMU), data acquisition strategies, and processing techniques used to extract dendrometric parameters such as tree height, canopy structure, and diameter at breast height (DBH). A comparative evaluation of system performance is also performed based on reported accuracy metrics, particularly the root mean square error (RMSE) associated with DBH estimation. The results indicate that LiDAR technologies provide highly detailed three-dimensional information about vegetation structure, enabling the generation of derived products such as Digital Terrain Models (DTM), Digital Surface Models (DSM), normalized Digital Surface Models (nDSM), and Canopy Height Models (CHM). These products are widely used for identifying individual trees, estimating biomass, and analyzing the spatial distribution of urban green infrastructure. Among the analyzed technologies, mobile LiDAR systems show significant potential for urban applications due to their operational flexibility and ability to collect data at pedestrian scale. Furthermore, recent studies demonstrate that low-cost mobile systems, including consumer-grade devices equipped with LiDAR sensors, can achieve DBH estimation errors of only a few centimeters, making them suitable for urban tree inventory and monitoring tasks. However, challenges remain regarding data georeferencing, point cloud density, and trajectory stability, particularly in environments with limited GNSS signal availability.

In conclusion, the study highlights the growing importance of mobile and low-cost LiDAR technologies for urban vegetation monitoring. The findings suggest that the integration of compact LiDAR sensors, multi-constellation GNSS, and advanced SLAM algorithms can significantly improve the cost–performance ratio

of monitoring systems. These advancements support the development of efficient and scalable solutions for the sustainable management of urban green infrastructure and provide a solid foundation for the future development of low-cost mobile scanning systems.

Drought Monitoring at 10-Day Intervals in the Republic of Moldova Using SPEI, Python, and QGIS

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Drought monitoring at sub-monthly resolution is increasingly important for identifying the onset, intensification, and spatial propagation of dry conditions, particularly in regions where rapid hydroclimatic shifts affect agriculture, water resources, and ecosystem stability. This study is based on the hypothesis that drought assessment at 10-day intervals provides a more sensitive and operationally useful representation of drought dynamics than conventional monthly monitoring, especially for detecting short-term anomalies and transitions between drought phases. To test this hypothesis, the Standardized Precipitation Evapotranspiration Index (SPEI) was adapted and calculated, for the Republic of Moldova, for 10-day periods using precipitation totals and mean air temperature as the main climatic inputs. The methodological framework combines automated climate-data processing in Python with spatial analysis and cartographic visualization in QGIS. A Python-based tool was adapted to compute SPEI for 10-days periods. The workflow includes data preprocessing, aggregation of precipitation and mean temperature by 10-day periods, calculation of the climatic water balance, standardization of the resulting series, and generation of drought classes for subsequent spatial interpretation. The resulting outputs were then integrated into a GIS environment, where drought severity, temporal evolution, and spatial patterns were mapped and analysed using QGIS. The results indicate that the 10-days SPEI approach captures short-term drought fluctuations and onset signals that may remain partially obscured in coarser temporal analyses. The Python-based automation considerably improves the reproducibility and efficiency of index calculation, while QGIS ensures clear spatial representation of drought extent, severity, and evolution. The combination of temporal detail and geospatial visualization makes it possible to identify not only when drought conditions

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emerge, but also how they expand, persist, or recover across space.

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Analysis of thermal inversion phenomena in urban areas using modern analysis methods and climatic modelling in ENVI-Met

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This study investigates the phenomenon of thermal inversions in the municipality of Iași, with a focus on the ski slope area in the Copou district, using modern methods that highlight the physico-geographical and climatic features favorable to their occurrence. Thermal inversions represent complex atmospheric processes, frequently observed in depression landforms, which modify the vertical structure of air temperature and lead to the development of a negative thermal gradient. The manifestation of this phenomenon is primarily conditioned by altitude, the degree of terrain fragmentation, and slope orientation, in addition to radiative cooling processes and the advection of cold air masses. The research adopts a multidisciplinary approach, integrating statistical analysis of the frequency of thermal inversions at the level of Iași municipality with geomorphoclimatic classification methods applied to the study area, according to the typology proposed by Octavia Bogdan (1999). Furthermore, numerical modeling performed in the ENVI-met environment was used to simulate the topoclimatic and microclimatic conditions specific to the analyzed area, aiming to highlight ground-level thermal inversions characterized by the confinement of cold air in low-lying areas. The model allows for a detailed definition of controlling factors such as altitude, slope, active surface characteristics, vegetation, and geographical position. Preliminary results demonstrate both the capacity of the ENVI-met environment to simulate negative temperature conditions and certain limitations related to the size of the modeled domain, the conditions required for snow layer generation, and the influence of the active surface on simulated processes. At the same time, the analysis confirms the role of the geographical position and physico-geographical characteristics of Iași in the formation of a local topoclimate favorable to cold air

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accumulation and the occurrence of thermal inversions, as supported by significant temperature differences identified between valley and slope areas.

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Thermal Regulation Potential of Blue-Green Corridors in Urban Areas: Assessing the Cooling Intensity of Lakes and Adjacent Green Spaces

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Urban areas face increasing thermal stress due to the urban heat island (UHI) effect, making blue-green infrastructure (BGI) essential for climate adaptation. This study investigates the thermal regulation potential of urban lakes and their integration with adjacent green spaces in Bucharest, Romania, hypothesizing that lakes embedded within green corridors (blue-green corridors) exhibit enhanced cooling effects compared to isolated water bodies. We introduce the Blue-Green Cooling Intensity Index (BCII), a novel metric quantifying the temperature differential between lake-adjacent zones (0-50 m) and background urban areas (400-500 m), to systematically evaluate the cooling capacity of 14 major urban lakes. The methodology employed a gradient-based spatial analysis using Landsat-derived Land Surface Temperature (LST) data combined with spectral indices (NDVI, NDBI, NDWI) and land cover metrics. Lakes were classified into three categories based on their spatial relationship with urban parks: Blue-Green Corridors (lakes surrounded by substantial park areas ≥1 ha), Lakes with Parks (adjacent to smaller green spaces), and Isolated Lakes (requiring 50 m buffer zones for analysis). Thermal profiles were extracted across concentric rings (0-500 m) from lake edges, and cooling distance thresholds (dT < 0.5°C) were calculated.

Results reveal substantial variability in cooling performance among Bucharest's lakes. The highest BCII values were recorded for Pârâul Valea Saulei (2.74°C), Lacul Elisabeta (2.61°C), and Lacul Văcărești (2.39°C), demonstrating significant thermal mitigation potential. Conversely, Lacul Tineretului exhibited the lowest cooling intensity (0.79°C). The mean BCII across all lakes was 2.05°C, confirming the hypothesis that urban water bodies provide measurable cooling benefits. Cooling distances varied considerably, with most lakes showing

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effective thermal influence within 100 m, while Lacul Tei extended its cooling effect to 400 m. The construction gradient analysis (difference between built-up density at 400-500 m versus 0-50 m) revealed that lakes surrounded by less urbanized peripheries (negative gradients) demonstrated stronger cooling effects, supporting the synergistic role of vegetation in enhancing water body thermal performance. The green-blue ratio (NDVI/NDWI) remained consistently negative across all sites, indicating water-dominated spectral signatures in near-lake zones. These findings provide quantitative evidence for urban planning decisions, emphasizing that integrated blue-green corridor design maximizes thermal regulation benefits. Lakes connected to extensive green networks should be prioritized in climate adaptation strategies, while isolated water bodies may require vegetative buffer enhancement to optimize their cooling potential. This research contributes to the growing body of evidence supporting nature-based solutions for urban thermal comfort and resilience.

Assessing geodiversity and geomorphosite potential in badlands using GIS: a case study from the Moldavian Plateau, Romania

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Badlands are often regarded as degraded landforms resulting from intense erosion processes acting on poorly consolidated sediments. However, these highly dissected landscapes frequently exhibit considerable geomorphological complexity and active morphodynamic processes, which may reflect significant geodiversity and geomorphosite potential. This study analyses the spatial relationship between badlands distribution, geodiversity patterns, and geomorphosite potential in selected sectors of the Moldavian Plateau (Romania) using GIS-based spatial analysis. High-resolution Digital Elevation Model (DEM) data were used to derive key morphometric parameters, including slope gradient, terrain ruggedness, drainage density, and relative relief. These parameters were subsequently integrated in order to analyse the spatial distribution of geodiversity using the Geodiversity Index. Badlands areas were identified through a combination of morphometric thresholds, drainage network analysis, and satellite imagery interpretation. The spatial distribution of geodiversity values was then compared with the extent of badlands landscapes in order to identify sectors characterized by high geomorphological complexity.

Preliminary results indicate a clear spatial association between badlands landscapes and areas with elevated geodiversity values within the Moldavian

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Plateau. These sectors are characterized by the coexistence of several active morphogenetic processes, including gully erosion, slope retreat, and mass movements. In addition, the strong landscape contrast and distinctive geomorphological features observed in these areas may enhance their scientific, educational, and geotourism significance. The results suggest that landscapes traditionally perceived as degraded environments may represent geomorphosite complexes with significant geotourism potential. The study highlights the usefulness of GIS-based approaches for identifying and evaluating geomorphosites and underlines the importance of geomorphological heritage in supporting sustainable geotourism development.

Mapping Eneolithic Landscapes: a multi-method GIS/RS approach to Cucuteni settlements from NE Romania

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This paper presents the results of some interdisciplinary investigations of Cucuteni settlements in north-eastern Romania. While Eneolithic Cucuteni sites have long been studied, recent advances in non-invasive approaches provide new opportunities to reassess settlement organization and spatial dynamics at multiple scales. The research focuses on the analysis and reinterpretation of settlement layout, internal spatial organization, and delimitation systems through a combined workflow integrating aerial datasets and geophysical measurements within a GIS environment. High-resolution aerial imagery, including both historical and recent orthophotos, has been systematically analyzed to detect cropmarks, soil marks, and microtopographic variations indicative of buried archaeological features. These observations are further refined through LiDAR and photogrammetric processing, which enables the generation of detailed digital elevation and surface models and enhances the visibility of subtle terrain anomalies. A central component of the methodology is large-scale magnetometer survey, employing both total field and vertical gradient measurements. Due to the strong magnetic contrast of burned cucutenian structures, magnetometry proves highly effective in identifying and mapping subsurface features such as dwellings, pits, kilns, ditches, and possible palisade systems. The integration of these datasets within a GIS framework allows for precise spatial correlation between surface indicators and subsurface archaeological remains. Several case studies, covering different phases of the Cucuteni culture, are analyzed to illustrate the potential of this

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multi-method approach. The results highlight significant variability in settlement organization, including differences in the size, orientation, and density of structures, as well as in the configuration of enclosure systems. In particular, magnetometer data reveal complex ditch networks, ranging from deep, likely defensive features to shallow, possibly symbolic or ritual delimitations.

Overall, the study demonstrates that the integration of remote sensing geophysical techniques significantly enhances the resolution and interpretative potential of archaeological research. These methods not only allow for non-invasive large-scale investigation, but also contribute to refining models of settlement organization and social structure within the Cucuteni culture, offering new perspectives on the development of complex Eneolithic communities in Eastern Europe.

Integrating Weather Radar Hail Kinetic Energy with Sentinel-2 and Sentinel-1 for Improved Hail Damage Detection

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Hailstorms are among the most destructive convective hazards for agriculture, yet their impacts are difficult to quantify at landscape scale due to their localized and short-lived nature. This study integrates weather radar data with Sentinel-2 multispectral imagery to evaluate vegetation damage caused by two major hail events in northeastern Romania: Rădăuți (17 July 2016) and Dolhasca (30 July 2020). Radar-derived hail kinetic energy (HKE) was used as a rapid indicator of hail occurrence, applying a threshold of 300 J m^{-2} to delineate potentially affected areas. Sentinel-2 Level-1C imagery, selected based on strict temporal proximity and minimal cloud cover, was processed to generate pre- and post-event Normalized Difference Vegetation Index (NDVI) maps. Vegetation damage was assessed through NDVI differences (ΔNDVI), using thresholds of 0.10 and 0.20 to identify moderate and severe stress, respectively.

Results show a strong spatial agreement between areas of high HKE and significant NDVI reductions. For the Rădăuți event, where only one post-event image was available, affected vegetation within the HKE > 300 J m^{-2} area ranged from 2,236 to 5,856 ha. In Dolhasca, three post-event observations (5, 8, and 15 days after the event) revealed a clear temporal pattern: affected areas decreased from 6,200–9,100 ha at 5 days to 4,800–7,200 ha at 8 days, and further

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to 3,100–5,600 ha after 15 days. This trend reflects both vegetation recovery and reduced sensitivity of ΔNDVI over time. Land use analysis indicates that arable land is most vulnerable to hail damage, followed by orchards and pastures, while forests show smaller but more persistent impacts. Overall, the integration of radar-derived HKE and Sentinel-2 NDVI proves to be an effective approach for spatio-temporal assessment of hail damage, with important applications in crop monitoring, disaster response, and risk management.

Assessment of the Spatio-Temporal Dynamics of Mangroves and Climatic Parameters in the Somone Lagoon (Senegal): Contribution of Remote Sensing and Geographic Information Systems (GIS)

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Mangrove ecosystems constitute an ecological heritage of global significance, particularly vulnerable to the impacts of climate change. The Somone Lagoon, located on the Petite Côte of Senegal, hosts a mangrove ecosystem of high ecological and socio-economic value. These coastal ecosystems play a crucial role in shoreline stabilization, carbon sequestration, and biodiversity conservation. However, they are currently subjected to significant environmental pressures resulting from climate variability and the intensification of human activities, thus requiring a precise analysis of their recent dynamics.

Integrating Climate Modelling, Digital Twins and Geospatial Data in the CARMINE Impact-Based Decision Support System

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Climate risk assessment and adaptation planning require the integration of complex modelling outputs with spatially explicit environmental and socio-economic datasets. The Horizon Europe project CARMINE addresses this challenge through the development of an Impact-Based Decision Support System (IDSS) designed to support climate-resilient development pathways in metropolitan regions.

The IDSS relies on a distributed architecture where modelling outputs, Digital

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Twin simulations and contextual datasets are accessed through a federated data management framework. Within this architecture, geospatial technologies play a central role in enabling spatial harmonization, scenario analysis and interactive visualization of climate risk indicators.

Remote Sensing for Satellite-Derived Bathymetry and Sedimentation Monitoring

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Quaesta AI

Satellite remote sensing offers a scalable alternative to conventional bathymetric and sedimentation surveys in inland reservoirs, where boat-based campaigns are expensive, episodic, and difficult to deploy. In this work, we present a hybrid Earth observation workflow for Sedimentation Phenomena Evolution Monitoring in inland basins, combining satellite-derived bathymetry (SDB), physically informed machine learning, and sediment accumulation modelling. The objective is twofold: first, to estimate water depth in shallow waters by exploiting the interaction between bottom reflectance, the water column, and multispectral radiance; second, to quantify sediment accumulation in deeper zones where optical bathymetry becomes unreliable and a reference bathymetry is available.

For shallow-water SDB, where our main observation source is Sentinel-2, we focus on regression-based models that learn the relationship between multispectral satellite features, water levels, and available bathymetric references in order to estimate depth over shallow inland waters. To make these models more robust in operational conditions, we combine them with auxiliary estimators of bottom type and of maximum observable depth. The bottom-type estimator helps distinguish different reflectance regimes at the bed, while the maximum-depth estimator identifies areas where the spectral signal is no longer informative for depth retrieval, for instance because of high water turbidity or limited light penetration. In this way, depth prediction is constrained to the optically observable domain and the risk of over-interpreting weak or saturated signals is reduced. For deeper waters, where direct optical retrieval is not feasible, we estimate sediment accumulation through a model-based workflow initialized from a reference bathymetry. The current implementation starts from a distributed RUSLE-based sediment production model, in which rainfall erosivity, soil erodibility, slope-length factors, support practices, and NDVI time series are combined to estimate catchment sediment yield. These estimates are then integrated with reservoir geometry, water levels, discharges, inlet and

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outlet conditions, to simulate capacity loss and the evolution of sediment deposition over time through a diffusion-advection model. This provides a consistent extension from shallow-water bathymetric reconstruction to deep-water sedimentation monitoring within the same remote-sensing-based framework.

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