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NATIONAL RESEARCH AUTHORITY
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DELTAS AND WETLANDS

(Book of Abstracts)

Vol. 11

2025

Tulcea

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Recommended citation of the present volume:
Author / authors, 2025– title of abstract, p. … *IN*: Deltas and Wetlands (Book of Abstract), vol. 11, ___pp, Tulcea, Romania. ISSN 2344-3766.

Ready for print: 04.2025
Print run: 200 copies / Printed version: ISSN: 2344-3766; ISSN-L: 2344-3766

Preliminary Programme

„Deltas & Wetlands" DDNI Scientific Events Community, 32nd edition

Deltas & Wetlands International Symposium

Tulcea, May 12 - 17, 2025

- **May 12, 2025 (Monday)** - Arrival of participants
  - 14.30 - 16.30 - Consultation Meeting (Internal debate regarding the reorganization of DDNI Tulcea in the context of Law 183/2024)

- **May 13, 2025 (Tuesday)**

  Venue: **„Mihail Kogălniceanu" City Hall**, 20 Păcii Street, Tulcea

  - 09.30 - 10.00 - Registration of participants *(Romanian time)*
  - 10.00 - 11.30 - **Opening ceremony** - Dr. Biol. **Marian TUDOR**, General Director of DDNI, event host
    - Guest of honor: Dr. **Andrei ALEXANDRU**, President of the National Research Authority
  - 11.30 - 11.45 - The awarding of the honorary plaques: "Researchers Emeritus" for Dr. **Andrei ALEXANDRU**, Prof. Dr. **Adrian CURAJ**, Dr. Eng. **Mircea STARAȘ** and Dr. **Janos Botond KISS**, honorary hydrotechnical engineer for Eng. **Romulus ȘTIUCĂ**
  - 11.45 - 12.30 - ***Keynote Speakers***
    - Mrs. **Magdalena-Andreea STRACHINESCU-OLTEANU**, Head of Unit, DG MARE, EC - *From Green Deal to Ocean Pact*
    - Mr. **Stavros KALOGNOMOS**, Executive Secretary of the Balkan & Black Sea Commission (BBSC) - *Conference of Peripheral Maritime Regions (CPMR)*
  - 12.30 - 14.00 - *Lunch & Networking*
  - 14.00 - 15.00 - **Roundtable debate**
    - ***UN Mega Deltas Programme: Climate Change Adaptation and Enhancing Ecosystems Services for a Resilient Future***
    - Panelists: Prof. Dr. **Nadia PINARDI** *, Prof. Dr. **Liviu GIOSAN**, Prof. Dr. **Qing HE**, Prof. Dr. **Katrin TEUBNER**
  - 15.00 - 16.00 - **Symposium interview**
    - Prof. Dr. **Adrian STĂNICĂ**, Prof. Dr. **ZHU Hui**, Prof. Dr. **QING He**, Prof. Dr. **Hamada Mohamed MAHMOUD**
  - 16.00 - 16.15 - *Coffee break & Networking*
  - 16.15 - 17.00 - **Green Deal Challenges** - **Oceans Pact:** *3D (Decarbonising Danube Delta) Cluster*
    - Dr. **Delia DIMITRIU**, Smarter Mobility Solutions LTD, Prof. Dr. **Eduardo LEITE**, University of Madeira, Guest Adjunct Professor **Ricardo GOUVEIA**, University of Madeira, Dr. **Raluca Ioana NICOLAE**, GEOSTUD: *Cross-basin cooperation on wetlands restoration: key points for success & challenges*
    - Dr. **Delia DIMITRIU**, Dr. **Raluca NICOLAE**, **Vlad SANDU** - GEOSTUD, **Mihai PONDEA** - SMS. Ltd: *The Challenge of Baseline Data on Wetlands Restoration to further Develop Business Models*

- 17.00 - 17.30 - **PICO - Innovative business approaches**
  - Mr. **Sorin BOGDAN**, MDS Electric SRL: *Equipment and solutions for water and environment*
  - Mrs. **Cătălina BAROȘ**, Verder Romania: *Preparation of laboratory samples for the analysis of soils and sediments of aquatic ecosystems*

Venue: **Avramide HOUSE**, 32 Progresului Street, Tulcea

- 17.30 - 18.30 - **Posters presentations** & *Coffee*
- 19.00 - *Festive dinner*

- **May 14, 2025 (Wednesday)**

***Venue*: „Mihail Kogălniceanu" City Hall**, 20 Păcii Street, Tulcea

- 09.00 - 10.00 - ***Keynote Speakers***
  - Dr. **Gabriel LUPU**, Danube Delta National Institute for R&D: *Status of biodiversity, reed habitats, sustainable exploitation of natural re-sources, invasive species, and socio-economic implications in Danube Delta Biosphere Reserve in 2024*
  - Prof. Dr. **XIUZHEN Li**, East China Normal University, China: *Restoration of Coastal wetlands in China: Chances and Challenges*
  - Prof. Dr. **Enikő Anna TAMÁS**, Ludovika University of Public Service: *Floodplain management under changing conditions*
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  - *Convener: Prof. Dr.* ***Katrin TEUBNER****, Co-convener: Dr.* ***Gabriel LUPU***

Hamada-Mohamed MAHMOUD, Raluca - Ioana NICOLAE, Abdel-Rahman RAGAB, Ştefan-Cătalin POPESCU	Bridging wetlands: Ecological lessons from the Danube and Nile Deltas
Chunfu TONG	Biodiversity of Wetlands in the Yangtze Estuary and Regional Sustainable Development
David TSISKARIDZE, Irakli MIKELADZE	Distribution and invasiveness of some invasive alien species (IAS) of plants in ecosystems of Colchis lowland (W Georgia / Sakartvelo)
Siniša OZIMEC, Tihomir FLORIJANČIĆ, Denis DEŽE, Dragan PRLIĆ, Ivan DAMJANOVIĆ	The LIFE RESTORE for MDD project and biotic monitoring at Bjelobrdska Oxbow Lake (Croatia)
Carmen MATEESCU	A nature-based approach for bioresource recovery harvested from the inland and coastal eutrophicated waters to produce bioenergy and byproducts
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Liliana ENE, Mihai DOROFTEI, Gabriel LUPU, Aurel NĂSTASE, Mihai MARINOV, Vasile ALEXE, Marian MIERLĂ	Research on the Natural, Touristic, Cultural, and Spiritual Heritage of the Danube Delta Biosphere Reserve in the Context of Sustainable Development and Global Changes. Issues, Challenges, Perspectives
Katrin TEUBNER, Dragoș BALAICAN	Empowering Future Environmental Leaders: Short- and Long-Term Benefits of the IAD Summer School
Markus G. WEINBAUER	Viruses and flagellates: competitors for bacteria prey?
Bogdan DRUGĂ, Charlotte L. BRIDDON, Maria NICOARĂ, Adriana HEGEDŰS, Mridul K. THOMAS	Evolution in Action: *Skeletonema marinoi*'s Adaptive Growth to Climate Extremes

Simon RACÉ, Anatolie RÎȘINĂ	The importance of Nature-based Solutions education in biodiversity conservation, the case study of Moldova within NBS EduWORLD
Silvia CARDASCIA	Challenges and Opportunities in Protecting and Conserving Global Inland Waters: A systematic Literature Review and Research Directions
Ovidiu ILIESCU, Cătălin PETRIȚAN, Constantin NEȚOIU	The role of entomopathogenic microorganisms over the evolution of *Lymantria dispar* (Linnaeus, 1758) (Lepidoptera: Erebidae) populations in Euramerican Poplar Hybrids (*Populus* spp.) crops of the Danube Delta
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Alexandru DOROȘENCU, Lucian BOLBOACĂ, Vasile ALEXE, Mihai MARINOV, Andreas SMITH, Jenny DAVENPORT	The Radar Method: A Scalable Approach to Aeroecological Research in the Danube Delta

- 13.00 - 14.30 - *Lunch & Networking*
- 14.30 - 16.00 - ***Keynote Speakers***
  - Prof. Dr. **Mirna HABUDA-STANIĆ**, University of Osijek: *The Climate Change and Water Cycle - Current Situation and Future Predictions*
  - Prof. Dr. **Jurica JUG-DUJAKOVIĆ**, University of Dubrovnik: *Preservation of biological diversity, reduction of water and land use by applying new technologies in aquaculture*
  - Prof. Dr. **Liviu GIOSAN**, Woods Hole Oceanographic Institution, USA: *Mesopotamian Megadelta Morphodynamics: Key to Understanding the Cradle of Western Civilization*
- 16.00 - 16.15 - *Coffee break & Networking*
- 16.15 - 18.00 - **Section II**, **Environmental factors. Ecological restoration and Anthropic Impact**
  - *Convener: Prof. Dr. **Jurica JUG-DUJAKOVIĆ**, Co-convener: Dr. **Adrian BURADA***

ZHU Hui, JIANG Ming	Wetland Restoration Benefits Biodiversity Conservation
Ana GAVRILOVIĆ *	How innovative monitoring and prediction models for sediment spillage can improve the Danube Delta and the Black Sea in Romania
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Natalia CANDU, Iunia PODOLEAN, Magdi El FERGANI, Simona M. COMAN	From marine sulfated polysaccharide ulvan to 2,5 -furandicarboxylic acid (FDCA): a catalytic approach toward bio-polymers production
Tudor RACOVICEANU, Mihai ADAMESCU, Constantin CAZACU, Sorin CHEVAL, Vasile CRĂCIUNESCU, Alexandru DUMITRESCU	Integrated platform for wetland restoration and decision -making
Andreea ARDELEAN *, Bianca-Denisa CHEREJI, Florentina-Daniela MUNTEANU	Cadmium: a possible pollutant of the Mureș river
Maria NICOARĂ, Alexia PRIPON, Adina BAIU, Bogdan DRUGĂ	Acclimation vs adaptation: a study on the thermal tolerance of cyanobacterium *Microcystis aeruginosa*
Enrique MURCIANO, Lorena JUSTE, Juan Pablo DÍAZ, Ernesto ÁLVAREZ	PIGARGO´s project: reintroduction project of the white-tailed eagle *Haliaeetus albicilla* in Spain. Releasing technique

- **May 15, 2025 (Thursday)**

***Venue*: „Mihail Kogălniceanu" City Hall**, 20 Păcii Street, Tulcea

  - 09.00 - 09.30 - ***Keynote Speaker***
    - Prof. Dato' Dr. **Aileen TAN SHAU HWAI, FASc**, Universiti Sains Malaysia (USM) - *Translating Marine Science Findings to Actionable Solutions*
  - 09.30 - 12.30 - **Section III**, **Mission Ocean. New Research approaches**
    - *Convener: Dr.* ***Delia DIMITRIU****, Co-convener: Dr.* ***Iulian NICHERSU***

    - Dr. Hugo FARIA, Maria JOSÉ DURÃO, Lara SOUSA: *Impact assessment framework: building a mindset*
    - **Decarbonising Danube Delta - *3D Cluster*** unlocking:
      - Panel discussion on what to expect from 3D: from initial Vision & Strategy to present commitment - Dr. **Iulian NICHERSU**, DDNI, Dr. **Raluca NICOLAE**, GEOSTUD, Dr. **Delia DIMITRIU**, SMS. Ltd., 3D partners
    - **Danube Delta and Nile Delta & Valley**: potential for cooperation and roundtable on existing partnership - Dr. **Iulian NICHERSU**, DDNI, **Vlad SANDU**, GEOSTUD, Prof. Dr. **Hamada - Mohamed MAHMOUD**, Beni Suef University
    - **Innovations in upscaling for a Blue Future**: existing opportunities & challenges in implementing the Mission Ocean objectives - Dr. **Iulian NICHERSU**, DDNI, Prof. Dr. **Eduardo LEITE**, University of Madeira, Dr. **Delia DIMITRIU**, SMS. Ltd, 3D partners
  - 12.30 - 14.00 - *Lunch & Networking*
  - 14:00 - 15:30 - **Carbon-Neutral Construction Strategy Roundtable** (ReBorn project, funded by EUKI Programme)

    The event aims to explore the role of individual behaviors, public policies, and local innovation in the transition towards zero-emission buildings (ZEB). The discussion will focus on the potential of natural materials as sustainable solutions and on ways to generate meaningful change through effective policies, education, and cross-sector collaboration.
  - 15.30 - 16.00 - ***Keynote Speaker***
    - Prof. Dr. Eng. Habil. **Mihai DATCU**, National University of Science and Technology Politehnica Bucharest, visiting professor ESA Φ-lab: *Digital Twin Earth systems: Satelite Remote Sensing for assessement of environmental impacts*
  - 16.00 - 16.15 - *Coffee break & Networking*
  - 16.15 - 17.30 - **Section IV**, **Geographical Information System and Application System Modeling**
    - *Convener: Mr.* ***Hans Marius SCHUSTER****, Co-convener: Dr.* ***Marian MIERLĂ***

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Hans Marius SCHUSTER	H2 METAVERSE & GreenH2Danube
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Marian MIERLĂ, Mihai DOROFTEI, Simona Dumitrița CHIRILĂ, Cristian TRIFANOV, Silviu COVALIOV, Florentina SICRIERU	Using GIS in assessing vegetation vulnerability to climate changes in the Danube Delta Biosphere Reserve
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Răzvan MATEESCU, Liliana RUSU, Elena VLĂSCEANU, Robert NENIȚĂ, Dragoș NICULESCU	The influence of the coastal current dynamics on the development of barrier islands at Danube river mouths

- 17.30 - 18.00 - **Conclusions & Awards**

- **May 16, 2025 (Friday)**

Venue: **Danube promenade, Delta Hotel**

- 09.00 - 19.00 - Field trip in the Danube Delta Biosphere Reserve

✓ **May 17, 2025 (Saturday)** - Departure of participants

**** - online participation***

Posters:

Section I, Biodiversity & nature conservation, natural resources & Socio-economic aspects

Alexandru Cătălin DOROȘENCU	The Radar Method: A Scalable Approach to Aeroecological Research in the Danube Delta
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Simona Dumitrița CHIRILĂ, Mihai DOROFTEI, Kiril VASSILEV, Stoyan NIKOLOV	*Centaurea jankae* in Romania and Bulgaria: ecology, distribution and phytocoenology
Simona Dumitrița CHIRILĂ, Mihai DOROFTEI, Cristian TRIFANOV, Alexandru BĂNESCU, Gabriel LUPU, Vasile ALEXE, Alexandru Petre NAUM, Oliver LIVANOV, Ana Mariana CHIRILĂ, Marian MIERLĂ, Matei SIMIONOV, Silviu COVALIOV, Mihai MARINOV	Biodiversity analysis in some natural islands in the Danube Delta
Simona Dumitrița CHIRILĂ, Ștefan RĂILEANU, Nikolay VELEV, Livia Oana DAVID	Plant palatability and its correlations with environmental factors in some pastures of the Danube Delta
Simona Dumitrița CHIRILĂ, Ioana Cătălina PAICA, Cristian BANCIU, GABRIEl Mihai MARIA, Anca MANOLE, Mihnea VLADIMIRESCU	Preliminary analysis of the genetic structure of *Crambe tataria* populations in Romania using ISSR markers
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Simona Dumitrița CHIRILĂ, Mihai DOROFTEI, Marian MIERLĂ	Phytocoenological preferences, distribution, and conservation status of *Gymnospermium odessanum* in Romania
Simona Dumitrița CHIRILĂ, Mihai DOROFTEI, Mátis ATTILA, Adrian OPREA, Culiță SÎRBU	Population characteristics and habitat preferences of the threatened species *Trachomitum venetum* in Romania
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Lucian BOLBOACĂ, Mihai DOROFTEI, Vasile ALEXE, Alexandru Cătălin DOROȘENCU, Mihai MARINOV, Silviu COVALIOV, Marian MIERLĂ, Gabriel LUPU	Temporal Analysis of Burned Areas in the Danube Delta Biosphere Reserve Using EFFIS Data
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ABSTRACTS

Section I - Biodiversity and nature conservation, natural resources & socio-economic aspects

1. Assessing eDNA metabarcoding primers for studying freshwater macroinvertebrates in the Danube Delta

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Environmental DNA (eDNA) methods have emerged as a powerful tool for detecting species and assessing biodiversity in various ecosystems, including freshwater. The Danube Delta hosts a wide variety of aquatic macroinvertebrates, which are valuable ecological indicators used to assess water quality. The use of eDNA-based methods in regulatory quality assessment programs is currently being evaluated. A key factor influencing the success of eDNA analysis is the choice of primers, which determine taxonomic coverage and detection sensitivity. While many universal primer sets exist, it is essential to evaluate them for effective application in the studied ecosystems. In this study, we aimed in vitro evaluation of the performance of primers fwhF2 and EPTDr2n, designed to amplify mitochondrial cytochrome c oxidase I (COI) gene in macroinvertebrates. All sampled insect taxa of the *Coleoptera* and *Diptera* orders were consistently amplified using fwhF2/EPTDr2, aligning with its expected taxonomic coverage. In the case of gastropod taxa, different results were obtained for the two families analysed, showing a greater taxonomic coverage for *Lymnaeidae* spp. compared to *Planorbidae* spp. These results support the use of fwhF2/EPTDr2 for amplifying DNA from specific groups of aquatic insects, and highlight its limited effectiveness outside these target groups.

2. First results following the implementation of appropriate reproductive technologies for endangered or declining fish species in the Danube Delta Biosphere Reserve

Adrian Burada, Cristina Despina, Nicoleta Cioceanu, Petre-Bogdan Gheorghe, Daniela Seceleanu, Mihaela Țigănuș, Iasemin Suliman, Orhan Ibram, Iuliana-Mihaela Tudor, Aurel Nastase, Marian Tudor
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In the Danube Delta Biosphere Reserve there are at least 15 species of conservation interest, and species such as *Carassius carassius* - in numerical decline and included in the Red List and *Tinca tinca* need revitalization and conservation measures. In this context, starting from the examples of good practices used in the reproduction of endangered/declining fish species, of which 2 artificial reproduction methods were adjusted and adapted to the specific conditions in the Danube Delta Biosphere Reserve. During this time, natural directed reproduction was tested and adjusted for the 2 targeted species.
The preparation of the breeding specimens was carried out in 1.5m3 tanks, which allowed the gradual increase of the water temperature by approximately 1ºC/day to value of 20 - 21ºC.
In the case of artificial reproduction, synthetic hormone injections were used, after which the cyprinid reproduction method was applied. For naturally directed reproduction, egg incubation was carried out in the 2 tanks with artificial substrate and willow fascicle roots at a water temperature of 20-21°C, at a water recirculation flow rate in the pools of approximately 10 liters / minute.
The final results showed that the administration of micronized starter type feeds and frozen chironomids resulted in a reduced growth rate and a mortality of approximately 2%, while the administration of natural food led to the selection of vigorous specimens with a growth rate double that of those fed with feeds.

3. Challenges and Opportunities in Protecting and Conserving Global Inland Waters: A systematic Literature Review and Research Directions

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The study presents a systematic review of governance and policy mechanisms currently used to conserve and protect inland waters, including rivers, lakes, and wetlands. Drawing on selected peer-reviewed articles grey literature published between 2020 and 2025, it provides a comprehensive overview of existing top-down instruments—such as global designations (IUCN, Ramsar, UNESCO sites), EU directives, and national laws—alongside bottom-up and hybrid governance models, including "Rights of Rivers," community-based initiatives, and multi-level frameworks.
The review reveals significant variation in the design and implementation of these mechanisms, ranging from strictly protective legal frameworks to models focused on sustainable development. Key challenges include fragmented policy landscapes, uneven enforcement, overlapping multi-designated areas, and insufficient integration between terrestrial and freshwater biodiversity governance.
Emerging recommendations stress the need for greater policy coherence, basin-scale planning, improved management and monitoring, and the adoption of socio-ecological approaches that balance conservation goals with local development needs. Finally, the study highlights major research gaps, particularly in spatial analyses of overlapping designations and in comparative governance studies, which are essential for understanding how multi-layered frameworks can better support the effective conservation and sustainable use of inland water ecosystems worldwide.

4. Tancat de la Pipa Wetland as a natural filter: microplastic dynamics and control mechanisms

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Wetlands play a crucial role in regulating water quality by acting as natural filters for pollutants. They facilitate the removal of contaminants through sedimentation, plant uptake, and microbial degradation. Among emerging pollutants, microplastics pose a significant environmental threat due to their persistence and potential toxicity. Understanding the dynamics of microplastic retention and transformation is essential for optimizing wetland management and enhancing their efficiency in water treatment. This study aims to assess the capacity of wetlands in mitigating microplastic pollution and to evaluate the key mechanisms involved in their removal, including sedimentation, biofilm formation, and plant-root interactions.
A case study of Tancat de la Pipa Wetland is presented to illustrate these mechanisms in action. Field sampling and laboratory analysis were conducted across Tancat de la Pipa, a restored wetland within the Albufera de Valencia Natural Park. The vegetation in Tancat de la Pipa consists of a mix of aquatic (like Common reed, Bulrushes, Water lilies, and Hornwort), riparian (Rushes and sedges), and marshland plant species, which support a wide variety of wildlife. Water samples were analyzed for microplastic presence, from feb 2024 to may 2024. Water samples were collected from 6 points on the surface of the wetland and filtered through 0.425 mm, 0.075 mm and 0.040 mm sieves.
The retained particles were analyzed using microscopy and Raman spectroscopy to identify and quantify microplastics. Findings from Tancat de la Pipa Wetland indicate that it effectively reduces microplastic loads, with retention rates reaching up to 38%.
Microplastic particles were predominantly trapped within sediments, while wetland vegetation contributed to their entrapment through root systems and biofilm formation. The integration of sedimentation ponds and vegetated filters in Tancat de la Pipa enhanced the overall retention of microplastics, showcasing the potential of engineered wetlands in pollution control.
The study highlights the efficiency of wetlands, particularly Tancat de la Pipa, in microplastic control and underscores the importance of sedimentation dynamics, plant-microplastic interactions, and microbial communities in determining their effectiveness. The results suggest that wetland restoration and management strategies should prioritize sediment stabilization, plant diversity, and water flow optimization to enhance microplastic removal.
Tancat de la Pipa serves as a model system, demonstrating how managed wetlands can be integrated into broader water treatment strategies. Wetlands serve as vital ecological buffers, mitigating the impact of microplastic pollution on aquatic ecosystems. The case study of Tancat de la Pipa highlights the effectiveness of restored wetlands in pollutant retention, reinforcing their role in water quality improvement, biodiversity conservation, and pollution control. Further research is recommended to

refine wetland designs for enhanced microplastic removal efficiency and to explore the long-term fate of retained microplastics.
Keywords: wetlands, water quality, microplastics, pollutant removal, sedimentation, Tancat de la Pipa, ecosystem services

5. Preliminary analysis of the genetic structure of *Crambe tataria* populations in Romania using ISSR markers

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Crambe tataria is a threatened species in the flora of Romania, characterized by a limited number of populations. For the populations in Romania, information about their genetic structure and its correlation with the geographical distribution is lacking. In this context, the aim of the study was to conduct a preliminary investigation of the genetic affinities between the populations of *C. tataria* from the main distribution area in Romania using ISSR markers. Samples were collected from 15 representative populations across the entire distribution area in Romania. These populations were located in different regions, including the counties of Brașov, Buzău, Iași, Mureș, Sibiu, and Vaslui. A total of 50 samples were collected for genetic analysis.
The results showed that the average value of Nei's genetic distance was 0.196, indicating low to moderate genetic differentiation among the sampled populations. Analysis of molecular variance (AMOVA) indicated that 79% of the total genetic variation occurred within populations, 20% occurred among populations, and only 1% was due to variation between regions. These results suggest the presence of gene flow between populations or a low level of genetic differentiation between them. UPGMA clustering revealed five distinct clusters that show close genetic relationships among individuals from all three regions, while Bayesian clustering revealed four clusters that are represented in all individuals, indicating ongoing admixture in all populations. The analysis revealed substantial genetic admixture in all populations, with weak clustering based on geographic origin. Populations from Moldova, in particular, show extensive genetic admixture, both among themselves and with populations from Transylvania.

6. Biodiversity analysis in some natural islands in the Danube Delta

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This study aimed to identify vulnerable species and establish effective protection measures in seven natural islands of the Danube Delta, located near Isaccea port, Chilia and Sf. Gheorghe Branches during 2023-2024. For the vegetation analysis, phytocoenological relevés were carried out. Transects were carried out to identify vertebrates (birds, mammals, reptiles, and amphibians), and an entomological net was used to identify invertebrate species. A GPS was used to determine the planimetric and altimetric coordinates, and the multibeam method was used for the bathymetric determinations. Suspended sediment morphology was investigated using a non-isokinetic, multi-frequency (four frequencies) automatic water sampler. This instrument allowed for the determination of both suspended sediment concentration and grain size distribution through analysis of backscatter data.
The results showed that *Salicetum albae* was the dominant association in the analyzed islands. Also, among the frequently encountered macromycete species were *Candolleomyces candolleanus*, *Lentinus tigrinus* and *Fomitopsis pinicola*. Avifauna was represented by 140 species. Regarding mammals, they were represented by 12 species, of which *Lutra lutra* and *Rattus norvegicus* are the most common. Regarding invertebrate species, the most common species of community interest was *Lycaena dispar*. In the case of reptile and amphibian species, nine species have been identified, of which *Pelophylax ridibundus* dominates with 944 individuals, followed by *Pelophylax kl. esculentus* with 588 individuals. The hydrological analysis showed significant seasonal fluctuations in water level, flow and velocity in some of the analyzed islands. The bathymetric analysis indicate that the river bed remains relatively stable throughout the year. The granulometric fraction of the sediments is mainly composed of fine sand

and coarse silt. These results can help establish effective measures for protecting and restoring habitats in the Danube Delta. In this context, continuous monitoring of species and limiting the impact of anthropogenic activities is necessary.

7. Plant palatability and its correlations with environmental factors in some pastures of the Danube Delta

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The diversity of plants in a given area contributes to the well-being of humans and animals by providing resources such as food, feed, and medicine. In this case, the use of these plants is influenced by their palatability. Palatability refers to the preference of animals for a particular plant.
The study aimed to evaluate the palatability of some pastures in the Danube Delta and to correlate palatability classes and environmental variables. In this context, investigations were carried out in April and October 2024, in 18 pastures in the Danube Delta. Thus, in each pasture, plant species were identified, and the palatability of the plants was assessed by visual observation of four groups of animals (horses, sheep, goats, and cattle) grazing. The degree of palatability of each plant was identified using the palatability index, which varies between 1 and 5: (1) non-palatable (NP), (2) highly palatable (HP), (3) moderately palatable (MP), (4) less palatable (LP), and (5) rarely palatable (RP). Information was also provided about the part of the plant consumed, the condition of the plant, and which groups of animals were the most selective. Our results showed that 41% (88 plant species) of the identified plants are non-palatable. In terms of the degree of palatability, 18% of the plant species were classified as "moderately palatable", and 17% were classified as "highly palatable". Furthermore, 11% of the analyzed plant species were included in the "less palatable" category, and 13% of the plant species were included in the "rarely palatable" category. In terms of the plant part used, 73% of the plant species were consumed as a whole plant. The other vegetative organs of the plants (leaves – 19%, fruits – 7% and inflorescence – 1%) were consumed occasionally. From the point of view of the condition of the plants at the time of consumption, most animals preferred plants in a fresh condition (67%). In the case of animal preference, cattle (30%) are the largest consumers of the analyzed plant species. The next animal groups were goats (26%), sheep (25%) and horses (19%). The regression analyzes showed a statistically significant correlation between the annual mean temperature and the number of less palatable plant species. Thus, as the temperature increases, the number of less palatable species decreases.

8. *Centaurea jankae* in Romania and Bulgaria: ecology, distribution and phytocoenology

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Centaurea jankae is an endangered species in its geographical range, being in decline due to changes in land management. The main causes of this decline are overgrazing and subsequent vegetation changes, which lead to the spread of shrubs and increase interspecific competition.
This study aims to identify the habitat and phytocoenological preferences of *C. jankae* in Romania and Bulgaria. It was conducted between June and August 2024 in three areas in Romania and three areas in Bulgaria. To determine the phytocoenological and habitat preferences, 26 relevés were analyzed. The population status assessment was carried according to the criteria in Article 17 of the Habitats Directive. The locations mentioned in the literature were checked to update the species distribution.
The results indicate that the species phytocoenoses belong to the alliances *Pimpinello-Thymion zygoidis* and *Stipion lessingianae*. In Romania, *C. jankae* was recorded in three locations in Tulcea and Constanța counties, with 7366 individuals recorded and the main threat is overgrazing. In contrast, in Bulgaria, *C. jankae* was recorded in three locations near the Nevşa, Ravna, and Venchan villages, where 5925 individuals were recorded. However, in Bulgaria, the species is primarily threatened by erosion, dirt roads, and the expansion of bushes and trees.
To prevent further population decline, it is important to develop conservation measures such as monitoring existing populations, increasing the number of *C. jankae* individuals, and controlling bushes and the number of grazing animals.

9. Ecology, distribution and phytocoenology of *Pontechium maculatum* in Romania

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Pontechium maculatum is a western Palearctic forest-steppe element recorded throughout Romania. Due to anthropogenic impact, the size and number of *P. maculatum* populations have decreased in Romania. The study aimed to analyze ecological conditions, as well as to update the distribution and identify habitat and phytocoenological preferences. The study was conducted during 2017–2024. Topographic, bioclimatic and soil chemical data were presented for each recorded population. To update the data on the distribution of the *P. maculatum* species in Romania, management plans, websites, specialized databases, scientific articles, specialized books, herbaria and personal observations were consulted. For vegetation analysis, 218 relevés were analyzed. Relevés were analyzed using Agglomerative Hierarchical Clustering. The relationship between vegetation and environmental variables was assessed by Detrended Correspondence Analysis (DCA) and Canonical Correspondence Analysis (CCA). The results showed that *P. maculatum* was recorded at elevation ranging from 56 to 725 m a.s.l. in areas with moderate annual precipitation and temperatures. In general, *P. maculatum* was identified on gentle slopes (from 3 to 10°) and moderate slopes (from 11 to 20°), with south-west, south and west aspects. The soils are moderately acidic to weakly alkaline, and rich in nutrients. Regarding species distribution, 80 populations of *P. maculatum* were recorded out of the 210 populations in the literature, which included new observations. These populations were distributed in Banat, Bucovina, Crișana, Dobrogea, Moldova, Muntenia, Oltenia, and Transylvania. The total number of individuals from all studied sites is approximately 6461. Vegetation analysis indicated that *P. maculatum* was recorded most frequently in the associations *Taraxaco serotinae-Festucetum valesiacae*, *Jurineo arachnoideae-Stipetum lessingianae*, *Festuco rupicolae-Brachypodietum pinnati*, and *Carici humilis-Brachypodietum pinnati*. According to CCA, BIO12 (annual precipitation) explained most of the variation in floristic composition. The main threats to the species are overgrazing, intensive agriculture, and succession of forest vegetation of grasslands. In this context, it is necessary for *P. maculatum* populations to be monitored and for nature reserves to be created and expanded.

10. Phytocoenological preferences, distribution, and conservation status of *Gymnospermium odessanum* in Romania

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Gymnospermium odessanum is an endangered plant species, being present only in the Dobrogea region of Romania. The study aimed to present the ecological conditions, identify the phytocoenological preferences and update the species distribution. Thus, for the species distribution, the populations mentioned in the literature and other potential locations were checked. For the analysis of phytocoenological preferences, relevés were carried out in all locations where the species is present. The Agglomerative Hierarchical Clustering method was applied to the vegetation classification groups. Also, for each cluster (plant community) the ecological conditions were compared. The cluster analysis indicated five vegetation units, identified with five associations. *G. odessanum* occurs most abundant in the associations *Artemisio austriacae-Poetum bulbosae* and *Gymnospermio odessani-Celtetum glabratae*. The total number of individuals recorded is 1107. Currently, the number of *G. odessanum* individuals has decreased compared to 2007 data, when 2135 individuals were recorded. The area occupied by the populations is decreasing. The conservation status of the population and the changes in the distribution pattern of the habitat type are unfavourable-inadequate. Due to habitat fragmentation and anthropogenic impact, the areas occupied by *G. odessanum* in the previously mentioned associations have been significantly reduced. In this context, it is necessary to monitor populations continuously.

11. Population characteristics and habitat preferences of the threatened species *Trachomitum venetum* in Romania

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Trachomitum venetum s. l. is a plant species highly threatened with extinction in Romania, being affected by anthropogenic impact. This species has an extremely restricted range in Romania, being present only on the Perișor sandbank in the Danube Delta. The taxonomic and nomenclatural situation of the analyzed taxon is complicated. There is major disagreement between different authors regarding the correct name and delimitation of the genera *Poacynum*, *Apocynum*, and *Trachomitum*. A general lack of consensus also concerns the taxonomic ranking of several taxa from this group. At present, the taxon is listed as *Trachomitum venetum* (L.) Woodson in the Romanian literature. The nomenclatural treatment of the taxon and its presence in Romania varies greatly, depending on the different international taxonomic databases. According to World Plants, *Trachomitum venetum* subsp. *armenum* is synonymized with *P. armenum*, the species being reported in the flora of Romania. Euro+Med Plantbase maintains the name *T. venetum* as being accepted, with the infrataxon *T. venetum* subsp. *armenum* is present only in Turkey. GBIF has synonymized *T. venetum* subsp. *armenum* with the accepted taxon *P. armenum*, and the WFO Plant List treats *T. venetum* subsp. *armenum* as a synonym of *A. venetum* subsp. *armenum*. According to POWO, *P. armenum* is treated as a synonym for *A. venetum* subsp. *armenum*, but this taxon is not reported for Romania. Hopefully, future genetic analysis will elucidate the exact nature of the taxon present in Romania. Although the analyzed species resembles *P. armenum*, their morphology does not match the description of the latter species (e.g. lateral nerves hardly visible). It is related to both *P*. *armenum* and *P. venetum*, but differs morphologically. In addition, this species is morphologically different from *Apocynum sibiricum* var. *angustifolium*, which occurs in southeastern European Russia and northwestern Kazakhstan. The study aimed to evaluate the species *T. venetum* in Romania by analyzing the ecological conditions, plant associations, and demographic parameters. To identify the plant associations, 23 relevés were carried out. The results showed that *T. venetum* was recorded most frequently in the *Artemisio santonici-Juncetum maritimi* association, but also in *Secali sylvestris-Brometum tectori*, *Teucrio scordioidis-Schoenetum nigricantis*, and *Salsolo ruthenicae-Xanthietum strumarii*. The total number of individuals recorded was 1410, and the average population density was 75 individuals/100 m^2. The highest number of individuals was recorded in the *Artemisio santonici-Juncetum maritimi* association. The plants height varied between 54 and 85 cm, but most individuals had a height between 20 and 25 cm due to overgrazing. In lower areas, when water disappears during the summer, salinization can become a problem, affecting ecological conditions. From the point of view of ecological indices, *T. venetum* is a heliophilous and mesothermic species, adapted to moderate temperature conditions.
Regarding humidity and soil reaction, the species prefers mesophilic soils with neutral pH. In terms of nutrient requirements, *T. venetum* is a mesotrophic species. Tolerance to salinity is medium. To conserve the only known population of this species in Romania, it is necessary for the activities carried out by farmers to be controlled, especially grazing.

12. Ecology, chorology, and phytocoenology of *Viola jooi* in Romania, Ukraine and Serbia

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Viola jooi is an endemic species from the South-Eastern Carpathians with a scarce distribution in habitats characterized by calcareous substrate and mesoxeric to mesic conditions. This species is distributed in southeastern Europe, mainly in Romania with isolated populations in NE Serbia and SW Ukraine. In this context, this study presents the environmental conditions, phytocoenological preferences and updates the chorology of the species *V. jooi*.
Topographic data were recorded in situ, while bioclimatic data were extracted from the WorldClim climate model based on the locations of the populations. Distribution was assessed based on species records retrieved from botanical literature and personal field surveys carried by the authors. For the phytocoenological analysis, relevés were carried out, using the Braun-Blanquet method.
V. jooi has its main area of distribution in Romania, linked mainly to the Carpathian region (South-Eastern Carpathians, including the Transylvanian Basin), with 123 recorded occurrences. In Ukraine, the species was found in three locations from the Ivano-Frankivsk region, while in Serbia, the species

occurs in the northeastern region, in the Mt. Homoljske Planine, part of the Transdanubian Carpathians. The species occurs in a large spectrum of ecological conditions, along an ample altitudinal gradient, that varies among the three countries: from 381 to 1772 m a.s.l. in Romania, to 170 to 400 m a.s.l. in Ukraine, and 780 to 820 m a.s.l. in Serbia. The species is frequently found on very steep south-facing slopes. Based on climate model data retrieved for the recorded populations, the species occurs in areas with mean precipitation values of 682 mm in Romania, 650 mm in Ukraine, and 735 mm in Serbia. The annual mean temperature for the same locations is 6.5 °C in Romania, 8.5 °C in Ukraine, and 8.3 °C in Serbia. Population size and extent vary greatly between the three countries, with most of the areal (>95% of the total populations and individuals of the species) located in the Romanian part of the Carpathians, covering most probably vast areas (>1000 ha) of mid-elevation mountain calcareous substrate. In Serbia, a total number of approximately 500 individuals distributed over 3.5 ha has been estimated, while in Ukraine, approximately 5400 individuals distributed over an area of 1.16 ha have been estimated.
From a phytocoenological perspective, *V. jooi* occurs in the alliance *Seslerion rigidae* (*Asperulo capitatae-Seslerietum rigidae*, *Helictotrichetum decori*, *Cephalario-Seslerietum rigidae*), *Bromo pannonici-Festucion csikhegyensis* (*Viola jooi-Stipetum eriocaulis*, *Phleo montani-Seslerietum heuflerianae, Asplenio rutae-murariae-Melicetum ciliatae*) and *Cirsio-Brachypodion pinnati* (*Thymio comosi-Caricetum humilis*) in Romania and Serbia and in the allaince *Galio campanulati-Poion versicoloris* (*Schivereckio podolicae-Seslerietum heuflerianae* and *Ranunculo zapalowiczii-Helictotrichetum desertori* associations) in Ukraine.

13. *Salvia nutans*: ecology, biogeography, and phytocoenology in Romania

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Salvia nutans is a steppe and forest-steppe element of the Western Palearctic, which is vulnerable to overgrazing and the conversion of grasslands into arable land. Due to anthropogenic impact, the species is on the verge of extinction in some locations in Romania. In this context, the study aims to investigate the habitat preferences and plant associations in which the species occurs as well as the environmental factors that explain the floristic composition.
A total of 870 relevés were used for vegetation analysis. The data were processed using the JUICE software, applying the modified TWINSPAN algorithm for hierarchical classification. The floristic composition and environmental variables were analyzed using multivariate statistical methods.
Salvia nutans was recorded predominantly in grasslands communities belonging to the class *Festuco-Brometea*, the order *Festucetalia valesiacae,* and alliances *Stipion lessingianae*, *Festucion valesiacae* and *Cirsio-Brachypodion pinnati*. At the association level, *S. nutans* occurs most frequently in *Jurineo transylvanicae-Stipetum pulcherrimae*, *Allio albidi-Stipetum lessingianae* and *Festucetum rupicolae*. *Salvia nutans* is distributed on steep and very steep slopes, with southwest to south aspects. The species also prefers grasslands at low to medium-low elevation (100–600 m a.s.l.). It is found in a wide range of EUNIS habitat types, predominantly in dry grasslands (R1). Canonical Correlation Analysis (CCA) revealed that annual precipitation explained most of the variation in the floristic composition of *S. nutans* phytocoenoses.
In conclusion, *S. nutans* is influenced by certain topographic and edaphic conditions, thus indicating its role as an indicator species for xerophilic grasslands. Given the current trend of habitat degradation, it is necessary for *S. nutans* to be monitored in the long term to assess population dynamics.

14. Molecular confirmation and phylogenetic analysis of Macrobrachium nipponense in the Danube Delta

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The objective of this research is to ascertain the origin of the invasive freshwater shrimp Macrobrachium nipponense, recently identified within the Romanian Danube Delta. Its presence is hypothesized to result from an accidental introduction, potentially via dispersal from established populations in adjacent countries, a scenario possibly distinct from introduction routes documented in other invaded regions. Confirmation of the species' taxonomic placement within the Macrobrachium genus is provided by

macromorphological features, notably the pronounced enlargement of the second pereiopod pair in mature males. Determination of the geographic source population utilized both morphological comparisons and DNA sequence analysis. Phylogenetic examination of 18 specimens collected in the southern Danube Delta (preserved in absolute ethanol) suggests that the source population likely resides in Henan Province, China. This inference is corroborated by the high degree of genetic similarity observed between the Danube Delta samples and variants known from Henan.
Recent favorable environmental conditions within the Danube Delta may account for the successful establishment of this non-native species.

15. Evaluating the health indicators of Phoxinus phoxinus in a mountain stream ecosystem

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This study evaluates the health status of the freshwater fish species Phoxinus phoxinus, commonly known as the minnow, within the Furu River ecosystem.
The Furu River, located in the Vrancea Mountains of Romania, is a tributary that plays a significant role in feeding the Râmnicu Sărat River and contributes to the ecological complexity and biodiversity of the region.
Understanding the biological responses of key aquatic species in such habitats is essential for assessing the ecological health of mountain rivers.
To achieve this objective, a total of 334 individual minnows were sampled and subjected to morphometric analysis. Specifically, the weight and total length of each specimen were recorded to investigate patterns of physical development and health. These measurements provided the necessary data to calculate Fulton's condition factor (K), a widely used index that reflects the nutritional status and general physiological condition of fish. The condition factor is particularly valuable in ecological studies, as it can serve as a proxy for environmental stress, food availability, and overall ecosystem quality.
The study examined the variability of weight, length, and condition factor across the collected specimens to identify biologically meaningful trends. The observed fluctuations in these parameters revealed insights into the growth dynamics of the species in its natural habitat. For instance, variations in body length and weight may indicate the influence of external factors such as water temperature, flow rate, or pollutant levels on fish development. Similarly, changes in Fulton's condition factor may point to spatial or temporal differences in food resource availability, or other environmental pressures that impact the vitality of the population.
The outcomes of this investigation offer a comprehensive view of the current health status of Phoxinus phoxinus in the Furu River, serving as a valuable benchmark for future monitoring activities. By providing quantitative data on a sentinel species, the study contributes to a broader understanding of the region's ecological integrity. Moreover, the findings can support the formulation of conservation measures and sustainable management strategies aimed at preserving aquatic biodiversity and maintaining ecological balance.

16. Sustainable Beekeeping and Biodiversity in the Danube Delta Biosphere Reserve: Contributions to Research and Resource Valorization

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Beekeeping is a traditional practice that simultaneously supports biodiversity conservation and contributes to the socio-economic development of local communities in the Danube Delta Biosphere Reserve. Since 2004, our research has focused on identifying plant species utilized by bees and other pollinators throughout their life cycles. Over time, we have expanded our understanding of both the diversity of forage plants and the dynamic practices of local and itinerant beekeepers in adapting to and utilizing the region's natural resources.
Building on previous studies, this paper presents updated findings regarding the floral species frequented by pollinators and the optimal routes for beekeepers to sustainably harness nectar and pollen resources. We also propose a series of new measures aimed at improving the conservation of natural habitats while enhancing the sustainable capitalization of beekeeping resources in the Danube Delta Biosphere Reserve and its adjacent areas.

17. Observations on the species Bucephala clangula in Northern Dobrogea

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The presence and nesting of the Common Goldeneye in Dobrogea, and in Northern Dobrogea in particular, is a very good indicator of climate change but also of the health of the deltaic habitats preferred by this species. The common gannet is one of the few diving duck species that nests in tree hollows, sometimes at heights of over 10 meters. The species also plays a significant role in maintaining the balance of aquatic ecosystems, by feeding on aquatic insects, mollusks and crustaceans, contributing to the control of their populations. Its frequent diving also helps to oxygenate the water, which supports the life of other aquatic species.
The observations focused on the meda areas of Northern Dobrogea, predominantly on the areas of the Danube Delta and the important lakes in the northern half of Dobrogea, occasionally also on the lakes in South-West Dobrogea. The purpose of these observations was to identify and update the existing observations in Northern Dobrogea, to estimate the nesting population, however, with a predilection for the population that winters in the mentioned areas.
Bucephala clangula (Common Goldeneye) is a northern, holarctic, carnivorous species, a winter and passage guest, rarely nesting in the Danube Delta. Sometimes a few specimens remain in summer and winter near the inland waters of the country.

18. Bird fauna of the Special Ornithological Reserve "Podpanj" in Croatia within the Mura-Drava-Danube transboundary Biosphere Reserve

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The Special Ornithological Reserve "Podpanj" because of its exceptional ornithological values has been protected since 1997. With wetland and forest habitats on area of 90.22 ha, it belongs to Drava River floodplain. It is part of the Natura 2000 Ecological Network and the Mura-Drava-Danube transboundary Biosphere Reserve. Field surveys began in the nesting season in May 2024, and ended with a winter bird count in January 2025. The presence of a total of 58 bird species was recorded, of which 20 (35%) are Natura 2000 species, 38 strictly protected and 6 endangered species. Nesting populations of different species were recorded; *Acrocephalus arundinaceus*, *Acrocephalus scirpaceus*, *Ciconia ciconia*, *Circus aeruginosus*, *Circus pygargus*, *Dryocopus martius*, *Egretta garzetta*, *Haliaeetus albicilla*, *Fulica atra*, *Leiopicus medius*, *Locustella luscinioides*, *Merops apiaster*, *Oriolus oriolus*, *Tachybaptus ruficollis* and others. Migratory and wintering populations were recorded as well: *Anser anser*, *Buteo lagopus*, *Falco columbarius*, *Pandion haliaetus* and *Remiz pendulinus*.
According to the population status, 52 species (90%) are nesting, 25 (43%) are residents (43%), 27 (47%) are nesting migratory species and 7 (12%) are wintering. The results confirm that a large number of Natura 2000 species, strictly protected and endangered species use the area for nesting, resting during migrations and wintering. Obtained results of this research additionally confirm the importance of the SOR "Podpanj" and its significance for bird fauna at the national and international level.
Keywords: biological monitoring, bird fauna, Natura 2000, SOR Podpanj, strictly protected species, river Drava

19. The Radar Method: A Scalable Approach to Aeroecological Research in the Danube Delta

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Radar technology provides a scalable, non-invasive approach for monitoring aerial fauna, particularly birds, enabling continuous high-resolution quantification and verification of flight activity across diverse habitats. Consequently, radar is a valuable tool for studying both migration patterns and local flight behaviors providing a consistent and rigorous measurement of aerial movement across a wide range of ecosystems throughout the world. Compared to traditional migration study techniques such as visual observation, trapping, and banding, radar offers several advantages. Its capacity to operate effectively at high altitudes and over extended distances, coupled with its independence from ambient light and relative insensitivity to weather conditions, radar enables the acquisition of data regarding the timing, direction, altitude and patterns of migratory flight. Various 2D and 3D radar systems are employed to monitor avian migration, flight behavior over different ecosystems and flight responses to human-made structures and activities. Radar provides a real-time situational map where additional remote sensors such as infrared cameras, bioacoustics, geo-tagging and other techniques enable us to observe fauna in our natural and man-made environment. As a result, radar has become a key tool in research of animal ecosystems and their relation to human activities including aircraft navigation (including unmanned aircraft systems), ship navigation, agricultural production, and environmental health (monitoring of infectious diseases such as bird flu). Exploration of these large diverse datasets using AI and machine learning techniques will further enhance and accelerate our insights into aero ecology like never before.
In the context of the Danube Delta — a globally significant ecosystem where radar technology will help us advance conservation and public safety while reducing environmental impacts. The Radar Method thus emerges not only as a robust observational tool but as a node in an interconnected network of modern aero ecological methodologies to help us better coexist in our global ecosystem.

20. Preservation of biological diversity, reduction of water and land use by applying new technologies in aquaculture

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The main reasons for the development of water recirculation systems (RAS) in aquaculture were the reduction of water consumption and land use and the possibility of creating the desired environment in the cultivation area. They have been developed and tested for several decades. The optimal temperature and water quality is maintained in the RAS throughout the production cycle, creating a stress-free environment that maintains health and accelerates the growth of the breeding organism. In addition, RAS releases a relatively small volume of concentrated wastewater, which is easily transported to the plant for possible treatment. Despite numerous failed designs and unrealistic capital costs, breeding projects that include RAS, from industrial megaprojects to so-called "boutique production systems", have become an inevitable response to climate change, water shortages, limited land and water surface use, and increasingly strict laws on the conservation and use of natural resources. In addition, the RAS is ideally suited to the circular economy and sustainable agricultural production, and its closedness enables the cultivation of economically profitable foreign species. After successful initial research, the primary focus was on the creation, development and commercialization of technology capable of producing fish and other aquatic organisms on an economically competitive basis. The basic economic problem was the fact that the individual technological processes of water purification include sophisticated mechanical, electrical, electronic and biological components that enable the continuous reuse of breeding water. The high market price of these components developed in the last few decades and the fact that it is a closed system that requires a solid facility required capital costs that made most recirculation aquaculture projects unprofitable. In the last ten years, the components of recirculation systems have become cheaper thanks to mass production and simplified constructions, and with the help of competent experts, complete systems have been adapted to the cultivation of various types of aquatic organisms, i.e. their developmental stages, while the accumulated experience has enabled the development of new creative, simplified, custom designed and more financially justified designs. The presentation introduces several designs adapted to the cultivation of different types of fish or their developmental stages that can find their application in our areas.

21. Research on the Natural, Touristic, Cultural, and Spiritual Heritage of the Danube Delta Biosphere Reserve in the Context of Sustainable Development and Global Changes. Issues, Challenges, Perspectives

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This paper presents the results of the first research phases of the project, carried out between 2023-2024, on the natural, tourist and cultural heritage of the Danube Delta Biosphere Reserve (DDBR). The great global changes, economic, social, health, environmental, armed conflicts, wars, terrorism, etc., which have affected the whole of humanity in recent decades, have caused unimaginable damage, including on an essential component of the elements that contribute to the construction of human identity: world heritage. Through a multidisciplinary approach, the research aims to revitalize by promoting the tourist, natural, cultural and spiritual heritage of the Danube Delta Biosphere Reserve (DDBR). Wetland where it is imperative to promote solutions that combine biodiversity conservation practices and methods with the sustainable development and exploitation of resources in the context of sustainable development and new global changes.
The research is funded by Ministry of Education and Research within the framework of Nucleus Programme „Danube Delta 2030" PN 23 13, 2023-2026 – Nucleus Project: This study was carried out within the framework of the project *–„Research on the Natural, Touristic, Cultural, and Spiritual Heritage of the Danube Delta Biosphere Reserve in the Context of Sustainable Development and Global Changes. Issues, Challenges, Perspectives".* NUCLEUS Program - Danube Delta 2030, Contract 35N/2023/MCID, Project PN 23 13 03 03 (coordinator: Liliana Ene) executed by DDNI, Tulcea, Romania.

22. Culinary heritage a resource for sustainable tourism. The role of local gastronomic points in the Danube Delta Biosphere Reserve (Tradition, Diversity and Tourist Value)

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This paper presents the results from the research conducted in 2024 regarding the culinary heritage in Danube Delta Biosphere Reserve (DDBR). The research investigates the role of local gastronomic points in the Danube Delta Biosphere Reserve in promoting cultural identity, preserving culinary traditions, supporting the local economy and strengthening a sustainable tourism model. The local gastronomic points (LGP) are structures that contribute not only to the valorization of the culinary traditions specific to the area, but also to the preservation of the balance between human activities and biodiversity conservation, by integrating the principles of sustainable development into the regional tourism offer. The research used qualitative methods, field observation and literature review to highlight the value of these gastronomic points as elements of intangible cultural heritage and sustainable tourism resources. The research also followed the customs and culinary diversity of the dishes specific to the investigated areas, cultural influences and economic impact on local communities.
The research is funded by Ministry of Education and Research within the framework of Nucleus Programme „Danube Delta 2030" PN 23 13, 2023-2026 – Nucleus Project: This study was carried out within the framework of the project *–„Research on the Natural, Touristic, Cultural, and Spiritual Heritage of the Danube Delta Biosphere Reserve in the Context of Sustainable Development and Global Changes. Issues, Challenges, Perspectives".* NUCLEUS Program - Danube Delta 2030, Contract 35N/2023/MCID, Project PN 23 13 03 03 (coordinator: Liliana Ene) executed by DDNI, Tulcea, Romania.

23. The role of entomopathogenic microorganisms over the evolution of *Lymantria dispar* (Linnaeus, 1758) (Lepidoptera: Erebidae) populations in Euramerican Poplar Hybrids (*Populus* spp.) crops of the Danube Delta

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The increase in the frequency of extreme weather phenomena and climate aridization have led to the increase of forests areas affected by diseases and pests. Because of these conditions, forests are affected by biotic and abiotic factors, especially those of Euramerican Poplar Hybrids (*Populus* spp.). The effect of these phenomena is aggravated in the Danube Delta by the fact that Euramerican poplar monocultures are located in dammed enclosures, with alluvial soils, lacking water, which makes them vulnerable to destabilizing factors. Among these factors with destructive effect, an important share is made by the defoliating insects, *Lymantria dispar* (Linnaeus, 1758), being distinguished by the affected surface as well as by the extent of the damages**.** Currently, integrated pest management is applied in forestry practice, which brings together forestry measures with methods of mechanical, chemical, biological control, with a special emphasis on the parasite, predatory and entomopathogenic microorganisms, natural factors of regulating the pest populations. Among these entomopathogenic microorganisms, over time, the *Lymantria dispar* multicapsid nuclear polyhedrosis virus, *Alphabaculovirus lydisparis* produced hight mortalities in the outbreaks developed by *Lymantria dispar*. In the last two decades, the presence in Romania of the entomophagous fungus species *Enthomophaga maimaiga* (Humber, Shimazu et Soper, 1988), a species native to Japan, has been reported, a species that causes epizootics to *Lymantria dispar* populations. This paper aims to evaluate the role of some entomopathogenic microorganisms during *Lymantria dispar* outbreaks in Euramerican Poplar stands in the Danube Delta.
Keywords: *Lymantria dispar*, biological control, entomopathogenic, epizootic, *Enthomophaga maimaiga*.

24. Status of biodiversity, reed habitats, sustainable exploitation of natural re-sources, invasive species, and socio-economic implications in Danube Delta Biosphere Reserve in 2024

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The Danube Delta Biosphere Reserve is naturally associated with research aimed at biodiversity and nature conservation, natural resources & socio-economic aspects. As a consequence, this paper presents the results of research conducted in 2024 in Danube Delta Biosphere Reserve (DDBR) regarding the mapping of the reed beds and characterizing their typologies to implement actions to regulate firefighting activities based on elements of fire ecology, assessment of the sustainable exploitation of vegetal resources, conservation status of invertebrate species of community interest, research on the evaluation of the conservation status of ichthyofauna species of community interest, fisheries research for the sustainable exploitation and conservation of biodiversity, reptiles and amphibians of community interest, colonial waterfowl species, mammal species of community interest, evaluation of the invasiveness degree of some species (using the latest methodologies) in the context of climate change, research regarding the quality of life of the human population and study on the practice of ecotourism, in the context of sustainable development.
The research is funded by Ministry of Education and Research within the framework of Nucleus Programme „Danube Delta 2030” PN 23 13, 2023-2026 – Nucleus Project: „Research on the conservation of biodiversity, habitats, non-native invasive species, sustainable exploitation of natural resources, and socio-economic implications in the Danube Delta Biosphere Reserve, in the context of climate change - PN 23 13 01 03”

25. Integrated Assessment of Biodiversity, Reed Habitats, Sustainable Resource Use, Invasive Species, and Socio-Economic Dynamics in the Danube Delta Biosphere Reserve (2024)

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The Danube Delta Biosphere Reserve (DDBR) represents a unique ecological and socio-economic system, serving as a natural laboratory for research in biodiversity conservation, sustainable use of natural resources, and human-nature interactions. This study presents a synthesis of multidisciplinary research conducted in 2024 within the DDBR, focusing on key components relevant to conservation and sustainable development. The research encompassed: spatial mapping and typological classification of reed beds to support fire management strategies grounded in fire ecology principles; assessment of the sustainable harvesting potential of vegetal resources; evaluation of the conservation status of invertebrate and ichthyofauna species of community interest; fisheries research aimed at balancing resource exploitation with biodiversity protection; monitoring of reptile, amphibian, mammal, and colonial waterbird populations; and the analysis of invasive species dynamics using state-of-the-art methodologies in the context of climate change. Additionally, the study included socio-economic investigations addressing the quality of life of local communities and the role of ecotourism as a tool for sustainable regional development.
The research is funded by Ministry of Education and Research within the framework of Nucleus Programme „Danube Delta 2030" PN 23 13, 2023-2026 – Nucleus Project: „Research on the conservation of biodiversity, habitats, non-native invasive species, sustainable exploitation of natural resources, and socio-economic implications in the Danube Delta Biosphere Reserve, in the context of climate change - PN 23 13 01 03"

26. Bridging wetlands: Ecological lessons from the Danube and Nile Deltas

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River deltas are critical biodiversity hotspots and providers of essential ecosystem services, such as water filtration and flood regulation. This study compares avian biodiversity in the Danube Delta (Romania) and the Nile Delta (Egypt), focusing on ecosystem functions, conservation strategies, and socio-environmental pressures. The Danube Delta, a UNESCO Biosphere Reserve since 1990, spans over 5,700 km² and hosts more than 300 bird species. It features the world's largest compact reed bed, 30 protected habitats, and unique ecosystems. Despite its ecological importance, it remains vulnerable to pollution, invasive species, and unsustainable land use. In contrast, the Nile Delta covers only 2% of Egypt's territory but supports over 40% of the population and 63% of its agriculture. It faces growing challenges from climate change, salinization, wetland degradation, and rising greenhouse gas emissions, threatening both biodiversity and livelihoods. Using existing records spanning nearly a quarter century, we analyzed bird species richness, diversity indices, and beta diversity. The Danube Delta recorded higher diversity values, suggesting more intact habitats. Beta diversity in the Nile Delta showed shifts in bird communities, likely due to habitat loss and degradation. These results highlight the need for tracking of migratory birds, habitat restoration, and enhanced cross-delta collaboration. We recommend joint research and pilot projects focused on sustainable resource use, biodiversity monitoring, and wetland resilience. Long-term monitoring and cooperation can help assess the ecological carrying capacity of deltaic ecosystems, providing a foundation for advancing decarbonization, renewable energy integration, and circular economy development, backed by improved ecosystem data and evidence-based strategies.

27. Habitat Preference for Nesting and Foraging of Eurasian Spoonbill (Platalea leucorodia) in Breeding Season

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Wetlands are valuable because they support considerable ecological functions and play a crucial role in maintaining and sustaining bird communities by supplying an abundance of resources. Wetlands are ecosystems with high biodiversity and a hotspot of research that allows their inhabiting species to carry out their basic vital activities such as feeding, sheltering, and breeding. Due to the sensitivity and rapid reduction of wetlands, biodiversity, especially waterbirds, will also be affected by these changes. Binary logistic regression (BLR) is one of the techniques that is widely used in habitat modeling based on the presence and non-presence data, and it applies maximum likelihood estimation after transforming the dependent variable into the logit variable. Eurasian Spoonbill (Platalea leucorodia) is a waterbird species in the Gadaman Wetland and the presence of the species in this wetland is only limited to the breeding season. Wetland succession can impact various wetland-dependent birds, especially during the breeding season. Therefore, the modeling done to determine the habitat suitability is only limited to this season. The overall classification accuracy and receiver operating characteristic (ROC) were assessed to know the sensitivity and accuracy of the model. The model performance assessed by the area under the receiver operating characteristic (ROC) curve was found to be 0.993 ± 0.008 implying that the present model is effective. According to the results and data obtained based on the table of water depth and vegetation of Carex-Juncus spp. for foraging and Cladium-Cyperus spp. and Blysmus-Phragmites spp. for nesting.

28. Population updates and comparative assessment of Ligularia glauca (L.) O. Hoffm. in the north of Romania

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This study aimed to assess the population size of Ligularia glauca in two distinct areas in northern part of Romania and to compare specific quantitative parameters to identify potential ecological and morphological differences between them. Ligularia glauca (L.) O. Hoffm., a glacial relict rare in Romania, has a primary distribution in Asia and scattered populations across Europe, classifying it as a Euro-Siberian species. Accurate conservation assessment requires detailed population data and ecological metrics, which are vital for tracking trends and guiding targeted management efforts.
Given the conservation significance, this study presents updated population data collected during May–July 2024 across two distinct sites: the protected area "Fânațele seculare de la Calafindești" (Suceava County) and a second location near Higheș Peak, at the Neamț-Harghita county border. A comprehensive population census was conducted in Calafindești, involving systematic mapping of all individual clusters to assess spatial distribution. In contrast, the Higheș Peak population was evaluated through an extrapolated abundance estimate based on the same standardized sampling protocol. The methodology employed 25 m² plots, with recorded individuals classified by developmental stage (vegetative vs. fertile adults). For reproductive specimens, quantitative parameters were measured, including flowering stem and inflorescence length and capitulum count.
The complete population inventory at Calafindești recorded a total of 2,502 individuals, representing a significant decline compared to previous surveys (4,487 individuals), likely attributable to anthropogenic pressures. At Higheș, partial inventory data suggest a population estimate ranging between 1,001-5,000 individuals. Statistical analyses revealed distinct patterns in trait relationships between the two populations. Pearson correlations demonstrated consistent parameter associations within each site, indicating stable intraspecific trait covariation. However, inter-population comparison of these correlation structures revealed significant divergence between Calafindești and Higheș. This was further supported by Mann-Whitney tests, which identified measurable differences in the investigated morphological parameters between sites. The observed differentiation likely reflects site-specific ecological conditions, though the exact drivers require further investigation.

29. Current Water Crisis in Ukraine: Non-Random Scenario

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The high probability of acute water shortages in Ukraine this year will aggravate the energy, agriculture, and household consumption crisis. Minimal snow cover significantly reduces groundwater reserves, threatening a summer hydrological drought. The most vulnerable sectors of the economy are: i) Hydroelectric power plants, since the water level in the rivers feeding the hydroelectric power plants is below normal, and the situation may worsen by summer. It means a decrease in electricity generation, which, in the conditions of war and a destroyed energy system, is fraught with additional power outages and an increase in electricity prices; ii) Cooling of nuclear reactors using river water. Its deficit or increase in temperature can lead to a decrease in the efficiency of reactors, a reduction in generation volumes, or even a temporary shutdown of individual power units. And given that nuclear energy covers about 55% of the country's energy consumption, such a scenario would lead to serious risks to energy system sustainability; iii) Agriculture, which is already experiencing difficulties due to the war and the loss of significant territories. The lack of water will affect the crop and vegetable harvest, which will reduce exports and increase food prices within the country. For example, current internal prices of vegetables and fruits are higher than those in Europe.

30. The LIFE RESTORE for MDD project and biotic monitoring at Bjelobrdska Oxbow Lake (Croatia)

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The LIFE RESTORE for MDD project is jointly implement by 17 partners from Austria, Slovenia, Croatia, Hungary and Serbia, aimed at the preservation and restoration of wetlands and flooded forest habitats in the UNESCO's Transboundary Biosphere Reserve "Mura-Drava-Danube". The Bjelobrdska Oxbow Lake is a former meander of the Drava River, cut-off by regulation works in 1805 year. The restoration aims to restore 65 ha of the water body and improve the hydrological connection and structure of floodplain forest habitats on 193 ha. Activities in monitoring of habitats, flora, invasive alien plants, and wild fauna were carried out from March 2024 to February 2025. Habitat types of floodplain forests 91E0*, with two associations from the Salicion albae alliance, and various aquatic and wetland habitats, had been recorded. The vascular flora consists of 110 species, of which 13 invasive alien plants. For the fauna diversity, members of the following taxonomic groups were recorded: freshwater and terrestrial snails, bivalves, leaches, arachnids, insects, amphibians (5 species), reptiles (7), birds (59), and mammals (10). For the bird fauna, 18 species are Natura 2000 target species, while 40 (including 5 of Woodpecker family), confirms good quality of floodplain forest habitats for birds. Among mammal fauna, an otter (Lutra lutra) is Natura 2000 target species, and valuable record is of the beaver (Castor fiber). Most of the species, like: red deer (Cervus elaphus), wild boar (Sus scrofa), pine marten (Martes martes), golden jackal (Canis aureus) and badger (Meles meles), prefers floodplain forest habitats.

31. A contribution to amphibious, aquatic and marshland habitat distribution in Nature park Lonjsko polje, Croatia

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Nature park Lonjsko polje is located in central Croatia along the left bank of the Sava river, spreading across 50650 ha and consisting of diverse and valuable habitats as part of the Natura 2000 ecological network. During the months of July and August in 2024, a comprehensive field reseach was undertaken across the whole area of Lonjsko polje with an aim to improve knowledge on habitat distribution and floristic diversity of habitats 3130 Isoëto-Nanojuncetea and 3150 Magnopotamion or Hydrocharition. Research on two plant communities, namely Spirodelo-Salvinietum natantis Slavnić 1956 and Caricetum vesicariae Chouard 1924, was also included. Areas of interest were defined by using remote

sensing techniques which consequently produced 221 locations to be physically visited and analyzed. Relevees were created for all sites, photo-documentation included, and notes were taken on various ecological parameters (where applicable) such as depth and transparency of water, type of sediment, condition of the surrounding area, habitat threats etc. In regards to the total habitat area, the results are as follows: 108,18 ha for 3130 Isoëto-Nanojuncetea, 411,97 ha for 3150 Magnopotamion or Hydrocharition, 121,45 for Spirodelo-Salvinietum natantis and 254,1 ha for Caricetum vesicariae. Some of the recorded noteworthy plant species are: Carex vesicaria, Cyperus fuscus, Cyperus michelianus, Eleocharis acicularis, Ludwigia palustris, Ludwigia peploides, Marsilea quadrifolia and Salvinia natans. Current results may serve as an upgrade to the habitat maps of both Lonjsko polje and Croatia in general, but can also provide valuable ecological data upon which standard field monitorings can be conducted in the future.

32. The influence of parasitic populations on the health of domestic animals on pastures near some localities in the Danube Delta

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The influence of parasite populations on the health of wild and domestic animals in the Danube Delta makes it necessary to study the parasite distribution in deltaic ecosystems. Based on field research and laboratory parasitological determinations, parasite species were identified from several grazing regions in the Danube Delta, this area providing a favorable environment for the development of parasite eggs and larvae. High vegetation and the potential for flooding of some grazing regions are factors that contribute to the development of parasite populations. The biological cycles of parasites can include various intermediate hosts, which can lead to a complex epidemiological situation. Studies on this issue, as well as the identification of parasite species in grazing areas, provide the opportunity to develop plans for the prevention and control of parasitic diseases, thus contributing to maintaining the health of animal and human populations, but also to avoiding affecting the economic potential of the various delta areas, here referring to tourism and regional agrotourism. It is also particularly important to avoid affecting human populations in transit by zoonotic parasitic diseases. Therefore, the most effective way would be to add prevention and control measures to the administrative practices of each administrative-territorial unit in particular, but also in the surroundings, as well as adapting these measures according to the specifics of each ecosystem and the interactions within it. During the study, 1450 fecal samples were collected from 3 animal species, from pastures in 3 localities located along the Sf. Gheorghe arm. 463 samples were positive for various species of parasite.

33. The importance of Nature-based Solutions education in biodiversity conservation, the case study of Moldova within NBS EduWORLD

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Enhance knowledge on NBS at all education levels: formal, informal, and non-formal. In formal education, different age groups of learners (e.g., primary school, high school, university students), are made aware of, and supported in understanding the importance and potential of nature in urban, rural, and coastal areas. Utilize the digitalization of education as a tool to disseminate knowledge on nature while creating space and opportunities for all people to engage in valuing nature by taking incremental steps in understanding the role of nature in their lives.
Make communities more cohesive, participatory, respectful, and inclusive of a variety of voices when engaging with nature and equipping them with the knowledge, attitudes, and skills on the benefits of nature for health and wellbeing in local contexts. Create synergies between educational professionals, NBS practitioners, communities, and policymakers to embed NBS in the sustainable development and wellbeing of European rural, coastal, and urban communities.

34. Feeding selectivity and trophic links of a dominant cyclopoid copepod

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As a key link between producers and fish, zooplankton grazing regulates the transfer of energy and nutrients. Cyclopoid copepods often dominate the zooplankton of freshwater ecosystems and are considered omnivores. Yet, we know little about their diets or prey selection, and even less so for different life stages. Most work focuses on large bodied Cladocera, while large bodied copepods – often equally or more abundant – remain less understood. Macrocyclpos is a common and abundant genera of large bodied cyclopoid copepod in Northern temperate freshwater lakes and often dominates zooplankton biomass in colder months. We aimed to quantify prey specific clearance rates and selectivity of Macrocyclops albidus adults and nauplii via short term grazing micro assays with unicellular alga including cyanobacteria and chlorophytes, and heterotrophic ciliates (Paramecium). We evaluated grazing rates on single prey and paired mixed prey diets using 5mL well plates by comparing prey abundance in no-grazer controls and grazer present treatments over a period of 3 hours. Algal abundance was measured via pigment specific chlorophyll concentrations (PHYTO-PAM) and ciliate abundance was counted with microscopy. Prey abundance was standardized to 0.5 mgC/L equivalent biomass, which is the optimal density for most zooplankton. Initial results suggest that adult copepods strongly select for ciliates while nauplii graze more on phytoplankton. The ontogenic diet shift has implications for trophic dynamics and subsequent ecosystem functions.

35. The Evolution of Demographic Structure in the Danube Delta between 1992 and 2021

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The Danube Delta, an integral part of the Danube Delta Biosphere Reserve, represents an area of exceptional ecological, cultural and economic value. This territory has significantly influenced, and continues to influence, both the population structure and the development of local communities. Although the Danube Delta enjoys international recognition, there is a limited number of in-depth studies documenting the evolution of the population in this region since 1990, when it was designated as a Biosphere Reserve, particularly in the context of economic, social, and environmental changes. The present research aims to analyze the dynamics of the population in this distinctive region, based on official data extracted from the last four national censuses. By analyzing demographic trends between 1992 and 2021, significant patterns have been identified, such as changes in the demographic structure, population migration and demographic aging. In this analysis, both official statistical data and sources from specialized literature were used. The study contributes to a better understanding of the social and demographic transformations in the Danube Delta and provides a useful framework for developing public policies that support the sustainable development of the region.
Keywords: Danube Delta, population evolution, demographic analysis, local communities

36. Tracking Genetic Diversity and Structure in a Declining Giant: Beluga Sturgeon in the Lower Danube River

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The Lower Danube River represents the last natural spawning ground for the beluga sturgeon (Huso huso) in Europe, a critically endangered species facing severe decline in the region. In this study, 167 young-of-the-year individuals born in 2015, 2016, and 2019 in the river were analyzed using mitochondrial DNA control region sequencing to evaluate the genetic diversity and population structure of this species. A number of 48 haplotypes were identified. The results from neutrality tests (Tajima's D and Fu's Fs) and haplotype network analysis, suggest a recent expansion after population bottleneck. Moderate to high genetic differentiation between cohorts (FST = 0.20815) was highlighted by this study. Our results indicate that the *Huso huso* population in the Lower Danube River has not undergone major genetic changes. Urgent conservation actions are needed to contribute to the recovery of this Critically Endangered species in the region. They have to address habitat restoration, longitudinal connectivity in the river, and strict enforcement of anti-poaching regulations to ensure the long-term survival of *Huso huso* in the wild.
Keywords: Huso huso, sturgeon conservation, mitochondrial DNA, genetic diversity, Lower Danube, population structure, demographic bottleneck, habitat restoration.

37. Evaluation of contamination by heavy metals through bioaccumulation and biomagnification in the avifauna of the Fălticeni area

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Heavy metals are environmental pollutants originating from both anthropogenic activities and natural processes, present in varying concentrations. They can bioaccumulate and biomagnify along the food chain, ultimately affecting biodiversity. Avifauna, with their unique ecological and physiological traits, can serve as effective bioindicators for these pollutants. This study aims to detect the presence and concentration of 3 heavy metals: Pb, Fe and Cd in the feathers of three avifauna species: *Pica pica*, *Garrulus glandarius*, and *Buteo buteo,* from the Fălticeni town area. The sampling area is characterized by various sources of heavy metals, including urban environments, industrial zones and intensive agricultural practices. To achieve this purpose, the following objectives were pursued: Inventorying the avifauna by identifying species based on feathers and assigning their specific geolocation; Conducting a spatial analysis of the area by determining the percentage of land use classes and industrial sources and highlighting the potential for bird contamination; Performing Graphite furnace atomic absorption spectrometry analysis of the samples. Finally, interpreting and correlating the laboratory analyses with the presence and concentration of the pollutant and the type of species. Based on the results, this study seeks to underscore the importance of monitoring heavy metals to understand their impact on biodiversity.
Keywords: heavy metals, biodiversity, bioindicators, anthropogenic activities, avifauna.

38. Assessment of carbon sequestration and hazardous chemical storage in reed habitats of the Danube Delta Biosphere Reserve's fluvio-marine sector

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The Danube Delta, a dynamic alluvial plain, serves as a substantial carbon sink due to its extensive stands of reeds, specifically *Phragmites australis*. This study quantifies carbon storage across five distinct reedbed types based on substrate characteristics, using biomass assessment, soil carbon analysis, and GIS-based spatial mapping. Results showed that reeds on salinized organic soils (S-Pa) demonstrate the highest carbon storage capacity (8.595 t/ha C). Furthermore, an analysis of heavy metal contamination (Cr, Ni, Pb, Zn) over five years revealed concentrations below regulatory thresholds, with a declining trend. The analysis indicates that reeds demonstrate notable potential for pollutant sequestration, particularly in aquatic vegetation and soil. These findings highlight the crucial role of deltaic wetland ecosystems in carbon sequestration and contaminant retention, underscoring the need for the implementation of sustainable management strategies.

39. Floodplain management under changing conditions

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Floodplains are facing challenges in the 21st century. Anthropic changes have affected them for centuries worldwide. For thousands of years humans used river floodplains for hunting, fishing, agriculture and settlement. While these use somewhat altered floodplain ecological communities, they did only moderately affect the basic hydrological and morphological processes that sustain floodplain ecosystems. Following the industrial revolution major engineering projects transformed the river ecosystems and their processes. These interventions also facilitated the disconnection and conversion of river floodplains, directly by the construction of flood control levees, and indirectly by the alteration of the hydrology and hydraulics of the river itself. These anthropic changes of the riverine and floodplain landscape have been identified as a significant cause of the decline of key ecological functions: a recent study found that over 80% of the original floodplain area in the Danube River Basin alone has been lost since the turn of the 19th – 20th centuries.
Now, it is generally recognised that wetlands are fragile ecosystems and sustainable conservation and management has not yet been achieved in many countries due to various reasons. But the loss of floodplains is not only important because of the loss of biodiversity. Floodplains serve important functions in nature, ecosystem services such as purification of water, storage of flood volumes and groundwater recharge. Floodplains must be approached with a complex and comprehensive attitude to ensure ecosystem services evaluation and improvement, as well as adaption and mitigation measures for sound floodplain wetland management plans, facing, in addition to the negative effects they have suffered in the past decades, a changing climate and an accelerating hydrological cycle as well.

40. Empowering Future Environmental Leaders: Short- and Long-Term Benefits of the IAD Summer School

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The IAD Summer School, held in the Danube Delta in August 2024, brought together over 20 international students and 13 expert lecturers. Covering microbiology, biota surveys, reed management, wetland planning, and climate research, the program focused on plastic pollution, biodiversity, and conservation within climate change mitigation. Participants from Romania, Austria, Bulgaria, Hungary, Serbia, Ukraine, and Slovakia engaged in hands-on ecological research and interdisciplinary learning. Short-term benefits included practical training in environmental assessment methods, such as butterfly trapping, botanical, and landscape management surveys. A student presentation on AI applications for plastic waste cleanup aligned with Black Sea beach initiatives for plastic waste collection during the summer school. Collaboration with international lecturers exposed students to diverse scientific approaches, enhancing problem-solving skills and deepening their understanding of environmental challenges. Some students are now co-authoring scientific publications under supervision of lecturers and advanced students. Long-term impact extends beyond academic training. The program fostered professional networks that encourage future research and policy collaborations. Exposure to varied scientific methodologies promoted adaptability, critical thinking, and cross-disciplinary cooperation - key for addressing global environmental issues. The summer school also strengthens international cooperation and knowledge exchange, contributing to scientific innovation and sustainable solutions, not only among students but also among lecturers, and between students and lecturers. Expanding such initiatives across the Danube River Basin is crucial for cultivating future environmental leaders, raising global awareness, and fostering long-term collaborations in ecological research and conservation on a broader scale.

41. Biodiversity of Wetlands in the Yangtze Estuary and Regional Sustainable Development

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The Yangtze Estuary is an extra-large mudflat estuary and also an ecological transition zone where land, river and sea meet, with a spatial distribution pattern of three-level branching and four entrances to the sea. The huge amount of sediment carried by the Yangtze River accumulates in the estuary area, providing a rich material basis for the development of the estuarine wetlands. The land area of the Yangtze delta is basically developed on the foundation of nearly 6,000 years of sediment accumulation from the river. The estuarine wetlands are important stopovers on the migratory route of the birds and also serve as spawning, breeding, feeding grounds and migration corridors for the aquatic organisms, boasting rich biodiversity. However, at the same time, the Yangtze Estuary is also a densely populated region with rapid economic development. How to promote the coordination of biodiversity conservation and social-economic development to achieve regional sustainability has been the goal which we have been striving for the past decades. Many practices we have carried out in the Yangtze Estuary have appeared to be the successful cases, including those on Chongming Island, Hengsha New Island, Jiuduansha Shoals and Qingcaosha Reservoir, etc. It has been proved that the regional sustainable development is achievable as the win-win strategy between the social-economic development and biodiversity conservation can be fulfilled in the area.

42. Distribution and invasiveness of some invasive alien species (IAS) of plants in ecosystems of Colchis lowland (W Georgia / Sakartvelo)

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The spread of foreign plants in Georgia began in ancient times and continues today. Species of foreign origin are particularly widespread in western Georgia, which, along with its physical geographical location, is facilitated by relatively mild climatic conditions.
The paper presents the results of research carried out in western Georgia, in particular on the Colchis lowland. On the basis of botanical expeditions, field studies and laboratory processing of collected materials 6 foreign origin species (IAS) were identified: Canadian goldenrod (Solidago canadensis L.), Honey locust (Gleditsia triacanthos L.), False indigo-bush (Amorpha fruticosa L.) Common ragweed (Ambrosia artemisiifolia L.), Brazilian vervain (Verbena brasiliensis Vell.), Bur cucumber (Sicyos angulatus L.).
In order to study their distribution characteristics, surveys were carried out on the basis of Broun-Blanquet squares and Releve methods in the administrative boundaries of the Kolkheti National Park and in the Chorochi Delta. The frequency, coverage and density of the target species were studied. The characteristics of their distribution in ecosystems and their invasive potential were determined.

43. Microhabitat selection of the threatened Moldavian viper (Vipera ursinii moldavica)

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Microhabitat selection is a critical aspect of reptilian ecology and a key focus in ecological research, as it significantly influences survival, reproduction, and overall fitness. Reptiles rely on specific environmental cues to choose optimal microhabitats that offer essential resources such as thermoregulation, protection from predators, and access to prey. This selection process, shaped by a variety of environmental factors, carries important implications for biodiversity, conservation efforts, and species management strategies. Understanding microhabitat preferences is crucial for effective conservation, as maintaining landscape heterogeneity and preserving specific ground cover features can help support the survival of reptile species that rely on specialized microhabitats. Temperature and humidity are fundamental factor affecting reptile biology, influencing development,

behavior, and survival. Reptiles employ a range of adaptive strategies, such as thermoregulation and phenotypic plasticity, to manage temperature fluctuations. Understanding these responses is crucial for predicting the effects of climate change on reptile populations and their ecosystems. Meadow vipers (Vipera ursinii) are a group of small-sized, insectivorous snakes found in various parts of central and southern Europe. The meadow viper is one of the most threatened snakes in Europe, primarily due to its patchy distribution and habitat loss, being labeled as vulnerable in the IUCN Red List. In Romania, the meadow viper is represented by two subspecies: V.u. rakosiensis and V.u. moldavica, both subspecies facing threats from habitat loss and human activities, necessitating conservation efforts. The Moldavian meadow viper (V.u. moldavica) is endemic in Eastern Romania, where it is considered as Critically Endangered by the IUCN Red List and by the Romanian Red Data Book of Vertebrates.
The aim of this study is to analyze microhabitat selection in V.u. moldavica in the "Fânețele seculare Valea lui David" nature reserve. Six 1-hectare plots were selected, and transects were conducted covering three activity seasons from April 2024 to October 2024. For each observation, the following variables were recorded: soil temperature, soil humidity, vegetation cover percentage, and vegetation height. These variables were also measured for randomly selected points within the species' habitat.
As a result of the analysis, using mixed linear models, the percentage of vegetation cover positively influences the presence of Vipera ursinii moldavica.

44. Viruses and flagellates: competitors for bacteria prey?

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Viruses (bacteriophages) and flagellates share the same prey, i.e., bacterioplankton. Logically and intuitively, they should thus be competitors. However, science is not (only) about speculation but about measuring and testing. In conducting complex and complicated experiments in the Římov Reservoir (Czech Republic) and Hong Kong coastal systems, it turned out that ecological systems are more diverse and complex than anticipated. Flagellate grazing on bacterioplankton can foster phage infection, probably by grazing-induced feedback loops in nutrient cycling that stimulate bacterial growth and thus viral infection. In addition, grazing and viral infections have a mutually enhancing rather than a competitive effect on bacterial diversity, hence stabilizing ecosystem functions and diversity.

Section II - Environmental factors, Ecological Restoration & Anthropic Impact

45. Mortality of vertebrate species on the roads within the Natura 2000 sites (ROSPA0031, ROSCI0065) and the areas adjacent to the territory of the Danube Delta Biosphere Reserve in eastern Dobrogea (Romania)

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The study focuses on mortality caused by vehicles on the roads within and near the Natura 2000 sites (ROSPA0031 Danube Delta and Razim-Sinoe Complex and ROSCI0065 Danube Delta). The aim of our study was to identify the road segments intersecting ROSPA0031 and ROSCI0065 and assess their impact on vertebrates, as well as to find solutions to reduce this impact. The data collected about vertebrates killed on the roads is essential for evaluating the impact of roads on biodiversity and identifying locations where ecoducts or other protective measures are needed. It is important to note that the roads in the study serve both the local population and intensive tourism, especially during the warm months. In this study, we present the results of a year-long observation of vertebrates run over on the the roads from within or near ROSPA0031 and ROSCI0065. Roads that intersect wetlands generate significantly higher mortality rates compared to other areas. Covering a total route distance of 157.7 km, 46 species were recorded, totaling 652 carcasses, of which 45% were amphibians, 35% birds, 11% reptiles, and 9% mammals. Most accidents occurred during the warm period of the year, especially in

the case of amphibians and reptiles migrating to or returning from their breeding sites. Specific organizational and administrative measures are recommended to reduce roadkill mortality.

46. Dose-dependent effects following exposure of zebrafish larvae to an antibiotic cephalosporin

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Pharmaceuticals for medical and veterinary applications are discharged into aquatic ecosystems, presenting a growing issue due to their bioactive properties and potential environmental repercussions. Cephalosporins, a prominent class, constitute 50-70% of antibiotic utilization in the treatment of humans and animals throughout several countries. Ceftriaxone is a third-generation cephalosporin that offers enhanced and extensive coverage against gram-negative bacteria. It is supplied parenterally and is utilized to treat bacterial infections in the respiratory system, skin, soft tissues, and urinary tract. Research has shown that pharmaceutical residues in aquatic ecosystems pose a significant threat to aquatic life, being found in water bodies in concentrations ranging from ng to µg/L. Zebrafish serves as a model organism for toxicological research and biomonitoring pharmaceutic substances potential environmental side effects. Zebrafish early stages (72 hours post fertilization larvae) are widely utilized for examining the toxicological impact of certain contaminants, because of their transparency, rapid development, and maintenance simplicity. The light/dark assay is the most used method for studying larvae's behavior due to its cost, time-effectiveness, and high predictivity. Moreover, using the environmental relevant concentrations of ceftriaxone (10 µg/L and 1000 µg/L), our study can fill the gaps in literature regarding the behavior of larvae in different light stages (light/dark). The light/dark test assesses the behavioral response of free-swimming of zebrafish larvae towards a visual stimulus, tracking changes in activity with an automated video tracking system. Normal behavior is characterized by low basal activity in light and a substantial increase of activity upon the switch to darkness. The tested concentrations of ceftriaxone did not cause lethal effects. The data reflects the increased mobility and anxious behavior of larvae treated with higher doses of Ceftriaxone in light exposure. The antibiotic may have a potential neurological effect on the larvae's ability to recognize the environment in the light or dark period. Evaluating relevant environmental concentrations is crucial to addressing gaps in the research on the toxic effects and behavior of early-stage fish and to leading us towards the development of new technologies for the destruction of pharmaceutical waste or even the design of new, more environmentally friendly medications.

47. CADMIUM: A possible pollutant of the Mures river

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Due to the development of heavy industries, macro- and nanoparticles resulting from specific heavy manufacturing industry processes have started to deposit in aquatic ecosystems, resulting in large ecological imbalances [1, 2].
Heavy metals are defined as any metal with a density 5 times that of water. This characteristic allows these particles to settle to the bottom of the water body [1, 2]. Studies have shown in recent years that contamination of a body of water affects animal organisms (through the accumulation of heavy metals in muscle, liver, and brain).The impact of heavy metals on algae can be summarized in the following effects: acute toxicity (interferes with photosynthesis, nutrient uptake and growth processes), reduction of algal diversity, biomagnification, influence on the chemical characteristics of the water (influence on pH and reduction of oxygen present) and decrease in the purification capacity of algae, which leads to the accumulation of pollutants in the contaminated water body, ultimately leading to the death of the entire ecosystem [1, 2, 3, 4].
This scientific study aims to determine the amount of cadmium in samples taken from the Mures River, located in Arad, Romania.
Keywords: cadmium, water body, pollution, fuels.
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48. Biological implications on *Lumbricus terrestris* communities in heavy metals polluted soils

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Soil is highly vulnerable to degradation through pollution, erosion, and anthropization. By heavy metals, represents one of the most persistent and harmful environmental issues due to it is long-lasting effects and low decontamination potential, as it takes thousands of years for the soil to regain its fertility. Living organisms interact closely with soil, making them highly susceptible to pollution. These interactions are essential in regulating how pollutants spread, accumulate, or break down within ecosystems. This experiment aims to observe the effects of heavy metal pollution on soil using *Lumbricus terrestris* as a bioindicator species. This species is particularly suitable for such studies due to its direct contact with the soil and his role in soil aeration and nutrient cycling. The experiment evaluates how different concentrations of heavy metals—specifically lead (Pb) and zinc (Zn)—affect the biometric parameters and mobility of earthworms. Thus, the controlled administration of heavy metals solutions (lead and zinc) on the substrate consisting of an unpolluted soil in specific doses to simulate varying levels of pollution. After a short period of acclimatization were introduced *Lumbricus terrestris* earthworms into the contaminated soil, serving as test species. The experiment was carried out during 30 days. Biometric parameters and mobility aspects were monitored and after this the ability of the earthworms to bioaccumulate heavy metal ions was quantified. High levels of lead and zinc were associated with reduced survival rates, impaired mobility and curling of the body. Earthworms exposed to higher pollutant concentrations also exhibited visible signs of physiological stress, such as discoloration and lethargy.
Keywords: heavy metal ions, toxicity, earthworms, chronic exposure, bioaccumulation.

49. Temporal analysis of burned areas in the danube delta biosphere reserve using EFFIS data

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The Danube Delta Biosphere Reserve (DDBR) is a critical wetland ecosystem of global significance, providing vital biodiversity, carbon sequestration, and hydrological services. Human-induced fires and their frequency have specific impacts on these processes.
This study presents a temporal analysis of burned area surfaces in the DDBR from European Forest Fire Information System (EFFIS) data, spanning multiple years. By examining the spatial-temporal distribution of fire events across different months and years, we aim to identify patterns, peak fire seasons, and potential drivers behind wildfire occurrences in the region.
Our dataset includes annual and monthly burned surface data (hectares) from 2015 onward, allowing us to evaluate inter- and intra-annual fire dynamics. Preliminary results indicate substantial variability between months and years regarding burned surfaces, with significant fire events concentrated in late winter and early spring. For example, large-scale fire events in February and March 2029, 2020, and 2022 suggest that seasonal dry conditions and anthropogenic activities may exacerbate fire risk. Over all years, March was the month with the highest burning activity, while in June, no significant (larger than 1 ha) fire was recorded. 2022 was a record year in the Danube Delta Biosphere Reserve, with more

than 85000 ha of vegetation burned. Most fires were located in the eastern part of the Danube Delta Biosphere Reserve, an area characterized by substantial expansions of reedbeds.
Understanding the seasonal and annual trends in fire occurrences is crucial for enhancing fire management strategies in the DDBR. Our results underscore the need for improved real-time monitoring of fire impacts in this ecologically sensitive region. Future research should incorporate remote sensing techniques and climatic and ecological modeling to refine risk assessments and reveal the influence of fire on the ecosystem.

50. Interactive effects of rising CO2 levels and drought stress on photosynthesis and metabolic profiles in Raphanus sativus

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Atmospheric CO2 concentrations have risen dramatically in recent years and were projected to reach a climax by 2010 of about 800 ppm. Other viewpoints go a step further, predicting that concentrations will ascend even higher, up to 1200 ppm in the near future. Elevated carbon dioxide (eCO2) contributes to both drive and accelerate abrupt changes in our Earth's climate system; these changes involve temperature, changes in the quantity and intensity of precipitation, and more significant variability in climate. Global warming also comes with suppressing the atmospheric vapor pressure deficit, which worsens drought stress for plants. To investigate the synergistic effects of eCO2 and drought stress on plant physiology, we used Raphanus sativus, cultivated under three atmospheric CO2 concentrations: 400 ppm (ambient), 800 ppm, and 1200 ppm. Drought stress was applied for seven days. Drought conditions affected several physiological traits of the plants. However, exposure to elevated CO2 generally enhanced leaf gas exchange parameters, water use efficiency, and photosystem II (PSII) activity compared to ambient CO2 conditions. These improvements likely contributed to maintaining a higher leaf water potential, thereby supporting a better water status in drought-stressed plants grown under elevated CO2. Consequently, plants exposed to high CO2 concentrations exhibited increased net photosynthetic rates. When combined with reduced stomatal closure and lower transpiration rates, this led to a marked improvement in water use efficiency. The leaves' primary and secondary metabolite concentrations also decreased in response to increasing stress intensity.

51. Preliminary assessment of heavy metals accumulation in sediments of two lakes located in the predeltaic area of the Danube Delta

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Because of their toxicity, persistence, mobility, and biomagnification potential, the pollution of sediments with heavy metals (like Cd, As, Hg, Ni, Pb, Zn, Cu etc.) is regarded as a global problem, which may pose a serious risk to aquatic ecosystems. Considering the variety of anthropogenic activities carried out in the vicinity of the areas crossed by the Danube River, these may contribute to the input of various chemical pollutants and may affect the quality deltaic ecosystems. In the present study, it was assessed the presence of heavy metals in several bottom sediments sampled, during summer season 2023, from two lakes (Câșla and Căzănele) located in Somova - Parcheș aquatic complex lakes, West of Tulcea (Romania). The study area was selected considering the possible impact associated with the anthropogenic activities carried out in the area, such as the production of ferroalloys and alumina. The content of Mn, Ni and Cd was slightly higher in the sediments sampled from Câșla lake, while the level of Zn and Cu was higher in Căzănele lake. Sediments content of zinc (60.3 – 98.1 mg/kg) was within the limit imposed by the national legislation, while for some samples, the content of Ni, Cu and Cd exceeded the limits required by national law (Ministerial Order no.161/2006). The results were similar with those reported in studies performed in other lakes from the same aquatic complex. To differentiate between the natural and anthropogenic origins of heavy metals in sediments, the enrichment factor (EF) was calculated based on the metals concentration in sediments and their abundance in the upper crust (background), using Fe as reference metal. For some of the analyzed sediments, the EF values indicated a possible anthropic contribution for Cd, Ni and Cu content. In the case of Mn and Zn, the EF values indicated no enrichment, their presence being mainly associated with natural sources. In the present study, the geo-accumulation index (Igeo) was used to assess the heavy metals pollution in sediments. The Igeo_Cd was within 1 – 2, indicating moderately polluted status, while Igeo_Ni and Igeo_Cu (for Căzănele lake) was within 0 – 1, corresponding to lowly polluted status. Based

on the Igeo values for Mn, Cu (for Câșla lake) and Zn, the sediments can be considered unpolluted with these metals. This work was financially supported by the Romanian Ministry of Research, Innovation and Digitalization, within the project PNRR-III-C9-2022-I5-18_ResPonSE (contract 760010/2022).

52. The potential toxic effects of two types of pharmaceuticals on the early stages of Danio rerio, using environmentally relevant concentrations

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Pharmaceutical pollution has become more common in recent years, mostly because of concerns about its possible effects on human health and aquatic life.
The existence of elevated concentrations of pharmaceutical chemicals in groundwater, rivers, oceans, and even drinking water has given this issue international attention. Nevertheless, pharmaceutical pollutants cannot be completely removed from wastewater-by-wastewater treatment facilities. The current study's goal was to evaluate the potential effects of two distinct medications on zebrafish embryo and larvae at their early developmental stages, considering environmental concentrations (valproic acid= 3µg/L, meropenem= 1 µg/L). The zebrafish's sensitivity to pollution exposure, dynamic development, transparency, and ability to propose a broad range of physiological and behavioral factors make it an extremely valuable animal model in such research. Therefore, in this study, changes in heartbeats, alterations in interocular distance, and in the diameter of the ocular lens were evaluated in the exposure of embryos and larvae. Moreover, the embryos showed more pronounced effects compared to the larvae, because they are in continuous development and the substances (both simple and in mixtures administration) affected their normal growth. Regarding the behavior of the larvae, it was observed that there are significant differences between the light periods during which the organisms were tested, as well as between the administrations of simple substances and mixtures, as a result of which the earlier stages of zebrafish (embryos) were more susceptible than the larvae. The zebrafish is a useful research tool that helps define new and existing boundaries and advances our understanding of possible effects on aquatic life. The examination of these effects on aquatic life may result in a stronger emphasis on creating novel techniques for getting rid of these substances.

53. The effects of cephalosporin drugs and polypropylene microplastics in environmental concentrations on Danio rerio behavior

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Currently, antibiotics and microplastics are two prevalent emerging contaminants found in aquatic environments. The interaction of antibiotics with microplastics creates combined pollution, which may have detrimental consequences on organisms. Cephalosporins are one of the largest groups of antibiotics. Ceftriaxone (Cef) is a cephalosporin found in different concentrations: 0.334 mg/L in wastewater and 0.059 mg/L in groundwater. Polypropylene (PP) is a plastic polymer found in the environment at concentrations of 11.821 µg/L and 35.35 µg/L.
The study aims to assess the impact of the single and combined effects of ceftriaxone (50 µg/L) and polypropylene (2 mg/L) on adult zebrafish behavior using the novel tank test. Before the experiment, the zebrafish were accommodated for two weeks in a large aquarium (92 L) and for another period of 3 days in 10 L aquariums filled with 5 L of tap water. Experimental conditions were a water temperature of 26°C, a light/dark period of 14/10 hours, and conductivity of 500 µS. After the accommodation period and 24 hours after the administration of substances, the twenty fish were individually placed in a transparent tank containing 6 L of water. Behavioral activity was studied using EthoVision XT 17 software for 5

minutes. Different parameters were analyzed after the treatment period (96h), such as time spent on the upper and bottom sides of the tank, thigmotaxis, rot clockwise frequency, and rot counterclockwise frequency.
After analyzing these parameters using the ANOVA analysis, the results indicate that exposure to Cef, PP, and the mixture affected the exploratory behavior of zebrafish, decreasing swimming activity in the upper part of the aquarium. Zebrafish showed a preference for swimming near the walls of the aquarium, called in literature thigmotaxis, compared to the control group, indicating a level of anxiety following exposure to the treatments. The presence of polypropylene microplastics can facilitate the transport and persistence of ceftriaxone in the aquatic environment.

54. Analysis of polycyclic aromatic hydrocarbons from water to fish

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The Black Sea ecosystem is of particular importance, but due to anthropogenic activities it can be polluted with polycyclic aromatic hydrocarbons (PAHs) by the discharge into seawater, their sedimentation and their accumulation in marine organisms. During 2021-2023, water, sediments and a commercially important fish species, the turbot, were sampled from the Romanian Black Sea coast. The PAHs concentrations obtained in water, sediment and turbot were compared with the maximum permissible limits and threshold values existing in the legislation.
The aim of this work is to compare the PAHs concentrations obtained in water, sediments and turbot with the maximum permissible limits and threshold values existing in the legislation from the point of view of the ecological state of the environment and for human consumption.
Keywords: polycyclic aromatic hydrocarbons, turbot, Black Sea, sediments, seawater.

55. Restored vs. natural wetlands: A Comparative study of physico-chemical dynamics in the Danube Delta

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Wetlands are dynamic ecological systems where physico-chemical parameters critically influence biodiversity, water quality, and various processes. Restoration projects often aim to recreate natural wetlands' structural and functional characteristics, yet the extent to which these efforts succeed remains a key question. This study seeks to compare a range of physico-chemical parameters—including pH, dissolved oxygen, conductivity, nutrient concentrations, and turbidity — across a selection of restored and natural wetlands from the Danube Delta. Sampling was conducted at multiple sites across different seasons, with physico-chemical variables and nutrient levels measured using standardized methods (YSI-EXO2 multiparameter probe and a FluoroProbe). Preliminary observations suggest potential differences in several parameters between restored and natural systems, although full data analysis is ongoing. This comparative approach is expected to give insight into the successes and the limitations of current restoration practices. Our findings will contribute to a better understanding of ecosystem recovery processes and inform future restoration strategies.

56. Cross-basin cooperation on wetlands restoration: *key points for success & challenges*

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The paper presents what is a cross-basin cooperation on wetlands restoration, explaining why such a cooperation is necessary. The importance of *hydrological connectivity*, *shared ecosystem services*, *pollution & water management*, as well as *climate resilience* are underlined.
Reference to key components of a successful cooperation will include:
- joint governance structures, harmonized policies, data and knowledge sharing;
- integrated water resource management (IWRM) and funding mechanisms.

Examples of Cross-Basin Wetland Cooperation are given, starting with Danube River Basin:

- multiple countries coordinate restoration of floodplains and wetlands to improve biodiversity and reduce flood risks;
- *Ramsar Convention's Regional Initiatives* often support cross-border collaboration on wetland conservation.

Challenges to Cross-Basin Cooperation will include: political tensions and differing national interests; mismatched technical capacities and resources; varied legal frameworks and enforcement capabilities; unequal stakeholder power and access to decision-making.
Data availability and monitoring difficulties are important challenges in a cross-boarder cooperation.
Strategies to Strengthen Cooperation will refer to: establishing Basin-wide Wetland Restoration Plans; using Nature-based Solutions (NbS) for joint benefits; capacity-building programs and institutional support, as well as ***engaging local communities across basins***.
Such example will be given during the 3D session, illustrating hydrological and ecological linkages between the Atlantic & Arctic Basins and the Danube River Basin**,** assessing implications for *regional water governance and climate adaptation.*
The paper concludes with a summary of key linkages and implications, a call for integrated basin and cross-basin management frameworks, pointing out the importance of a multidisciplinary cooperation (hydrology, ecology, policy, infrastructure).

57. The Challenge of Baseline Data on Wetlands Restoration to further Develop Business Models

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Data is important in any project, but on wetlands restoration data is used 'to put wetlands to work'. Data allows comparison before and after restoration, enables adaptive management, builds credibility with stakeholders and funders and supports integration with *business models and economic valuation***.**
Danube Delta is a wetland which is carbon-sinking, water-purifying, flood-busting, nature-reviving, attitude-lifting ecosystems. How to unlock its value, and assess the 'millions' € in potential benefits? Good Data are needed and it seems to be a real challenge across several interventions.
The paper is presenting an approach to data challenges in wetlands restoration, underlining the importance of baseline studies, important in monitoring ecosystem changes as they provide a reference for future comparisons and assessments. Baseline studies represent the initial set of data collected about an ecosystem before any interventions are made.
Data challenge is one important outcome and lesson learned from existing projects GEOS is engaged with, as part of the Mission Ocean Calls. Conducting baseline or impacts assessments on wetlands faces data challenges due to: *limited data availability, data ownership, lack of assistance & guidance in data collection* (methods and engagement of major stakeholders), as well as difficulties in analysing data. The lack of appropriate tools and models represent another challenge. Data refers to hydrology, soil, biodiversity, and ecosystem functions, to serve as a reference point for measuring the success of restoration efforts.
The paper identifies the data challenges and assesses their importance, opening room for discussion on how to tackle gaps and barriers. Reference to DaWetRest and EcoDaLLi projects will be given.

58. How innovative monitoring and prediction models for sediment spillage can improve the Danube Delta and the Black Sea in Romania

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Environmental monitoring and assessment are key to mitigating negative impacts on surrounding ecosystems and communities. Changes of the "natural" sediment fluxes as well as sediment quality in the last centuries have resulted in changes in fluvial morphology and may have far-reaching consequences for life of rivers and seas. Sediments originate in river basins mainly through land and channel erosion processes and are transported in river systems in the direction of the coast, with the oceans being the final sink. River mouths thus present a dynamic system that can respond rapidly to

both fluxes in fluvial water and sediment discharge. On semi-arid wave-exposed coasts, the morphosedimentary behavior of river mouths is particularly sensitive to variations in water discharge, which can be significantly influenced by climate variations, in addition to anthropogenic actions such as the construction of dams for water resource needs. In this recent setting, an increasingly common consequence of decreasing river water discharge is the more or less prolonged closure of river mouths. Thus, river sedimentation presents an important indicator for ecological and geomorphological assessments of soil erosion within any watershed region. In Danube Basin, riverbed straightening, hydropower dams and dikes have led to significant changes in the sediment load, resulting in an increasing discrepancy between the surplus of sediment (e.g. reservoir sedimentation) and the deficit of sediment (e.g. river bed and coastal erosion). This sediment imbalance contributes to flood risks, reduces navigation possibilities and hydropower production, and deteriorates the ecological conditions of the river leading to the loss of biodiversity within the basin, and moreover, can influence Danube Basin and Black Sea biodiversity. In order to improve understanding of sediment transport related problems in the Danube River, it is crucial to have a clear picture of the spatial and temporal variation of the sediment amount being transported in the river and based on this data, to create models that would predict changes and potential risks. Predicting sediment transport and quality in a river basin requires a multidisciplinary approach including innovative types of monitoring using all technological advances. Most studies have addressed these issues using analytical, parametric, numerical, or statistical models that are characterized by high stochasticity, non-linearity, non-stationarity, and feature redundancy. Within the last decade, numerous innovative models and monitoring tools, including the use of artificial intelligence were proposed, and they are discussed in this review.

59. Woods Hole Oceanographic Institution, USA: Mesopotamian Megadelta Morphodynamics: Key to Understanding the Cradle of Western Civilization

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Deltas and ancient civilizations have developed in concert. Nowhere this symbiosis was tighter than in Mesopotamia. The rise of Sumer, a crucible for ancient urban culture, has been traditionally tied to the development of large-scale irrigation networks. Using paleoenvironmental reconstructions and satellite-acquired topography, we show that northern Persian Gulf became increasingly restricted during Sumer's history (c. 6,000–4,000 y ago) as multiple rivers built a fast-evolving delta complex under enhanced erosion in the Fertile Crescent. We revisit the origins of Sumer's prosperity to suggest that ocean tides were an important ingredient for jumpstarting intensive agriculture. Tidewater farming along deltaic riverbanks initially supported a diversified high-yield agriculture. Later, the decline of tides as the delta closed the access to sea provided a push for adopting labor-intensive river irrigation. This agroecological transformation was mirrored by innovative effervescence and increasing social complexity.

60. Using Cluey Data Collector for Mapping and Identifying Human-Wildlife Conflict Hotspots in the Danube Delta Biosphere Reserve

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At the end of a journey spanning over 2,840 kilometers, the Danube River, after collecting waters from an impressive river basin covering more than 8% of Europe's surface, creates one of the world's most special wetland areas at its confluence with the Black Sea. Danube Delta comprises three main branches: the Chilia Branch in the north, the Sulina Branch in the center, and the Sfântu Gheorghe Branch in the south. These branches are critical migration pathways for three endangered anadromous sturgeon species: the Beluga sturgeon (*Huso huso*), the Stellate sturgeon (*Acipenser stellatus*), and the Russian sturgeon (*Acipenser gueldenstaedtii*). Adult sturgeons use the Danube Delta's branches as entry points for upstream migration to their spawning grounds. Despite legal prohibitions introduced in 2006 on sturgeon fishing, these species—highly valued for their caviar production—remain under continuous anthropogenic pressures, particularly poaching, which poses a persistent challenge. To support wild populations of endangered species, specialized tools have been developed to facilitate field data collection and analysis, enabling the identification of potential Human-Wildlife Conflict Hotspots. Data collected using the Cluey Data Collector application, combined with a "Sturgeon Agent-Based

Model," can be utilized to pinpoint high-risk areas and periods for poaching activities. This approach is integral to designing effective conservation strategies and mitigating threats to wild endangered species.

61. The Climate change and water cycle- current situation and future predictions

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Water is an integral part of all components of the climate system—atmosphere, hydrosphere, lithosphere, and biosphere. Consequently, the effects of climate change are most prominently reflected in changes to the global hydrological cycle, particularly in the quality and availability of water. Over the past two decades, significant disruptions to once-balanced natural water cycles have been observed, primarily driven by various anthropogenic activities. Storms, floods, droughts, wildfires, and prolonged periods of above-average temperatures have become increasingly frequent across nearly all regions of the world. Leading climatologists and ecologists at international conferences have voiced growing concern over the current concentrations of greenhouse gases—which are unprecedented in human history—warning that they are causing permanent and irreversible environmental damage, degrading quality of life and human health, and contributing to the decline of numerous plant and animal populations. Scientists further highlight that climate projections point toward unavoidable changes in the global hydrological cycle in the coming decades unless significant changes are made in how modern society operates. A continued rise in global average temperatures is expected to lead to profound shifts in both economic and political landscapes worldwide. Although changes in atmospheric composition and Earth's climate have occurred throughout the planet's history, previous research has never recorded a rate of change as rapid as the one observed today. As such, understanding the mechanisms behind various ongoing and future hydrological and biogeochemical processes within global water systems is essential for formulating effective measures to mitigate current impacts and prevent further disruptions to water resources on a global scale.

62. Measures for improving the ecological and hydrological conditions of the wetland Câșlița from Chilia Veche village, Tulcea county

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The Câșlița Wetland, located near the commune of Chilia Veche in Tulcea County, encompasses an area of approximately 277 hectares and is an integral part of the Danube Delta Biosphere Reserve. Over the past decades, this area has undergone significant degradation due to hydrological alterations and anthropogenic pressures, leading to habitat loss and a decline in biological diversity. The proposed restoration project aims to reconnect the Pardina channel with the former wetland, in order to enhance water circulation, restore habitats, and improve ecological connectivity through targeted ecological reconstruction measures. The implementation of this project is expected to contribute to biodiversity conservation, increase ecosystem resilience to climate change, and promote ecotourism and sustainable development in the region.

63. Effects of pesticides on the development of larval amphibians in aquatic ecosystems

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Synthetic agrochemicals negatively affect many communites species and can cause biodiversity extinction with imbalances of ecosystem. That including some modification of intra-community composition in natural systems. Biodiversity is necessary trough trophic role in interrelations. For example, amphibians keep under control insects species. However, the effect of pesticides varies depending on each species. Amphibian species living in agricultural areas can be exposed to pesticides during their aquatic larval phase, as well as other organisms in the aquatic environment. Pesticides induced sublethal or chronic manifestations and lethal effects even mortality. The aim of the experiment

was to observe the effects of the pesticides deltamethrin and glyphosate on the larval development stages of the species *Rana temporaria*. We chose *Rana temporaria* because it is the most widespread anuran species in Europe. The experiment was conducted in the laboratory conditions, that was simulated a little ecosystem in two phase: for the first, larvar stages, an aquarium with water from the natural environment and for second stage, the juvenils, in a terrarium zone with the natural stones. 10 larvae of *Rana temporaria* were introduced. Thus, taking into account the following aquatic parameters: pH, temperature, total dissolved solids (TDS), and electrical conductivity. Solutions of deltamethrin and glyphosate at a 10% concentration were used, with the dose gradually increasing up to 60 ml. Observations were made throughout the experiment, from the tadpole stage to the adult stage. Chronic toxicity of glyphosate and acute toxicity of deltamethrin were tested, including a reference aquarium. Deltamethrin resulted in the death of all specimens, while glyphosate led to the bioaccumulation of the pesticide. The species showed sensitivity to deltamethrin even at a dose of 1 ml.
Keywords: pesticides, *Rana temporaria*, larval development, glyphosate, ecotoxicity, deltamethrin.

64. A nature-based approach for bioresource recovery harvested from the inland and coastal eutrophicated waters to produce bioenergy and byproducts

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Excessive use of fertilizers in agriculture more intensively in the past decades has been reflected in negative consequences on the aquatic environment, leading to eutrophication that has become a global problem; in lakes, rivers and coastal waters strongly affected by eutrophication, microalgae, fibrous macroalgae and aquatic plants may become excessively proliferating and create a hypoxic environment for fish and other species. Exploiting the aquatic bioresource as a potential biomass for producing bioenergy in various forms (e.g. biodiesel, bioethanol, biomethanol, biodimethyl ether, biomethyltetrabutyl ether, bioethyltetrabutyl ether, biomethane, biohydrogen) can bring undeniable benefits not only to managing the impact of eutrophication on the environment and ecosystems but also to provide carbon-neutral bioenergy while contribute to the circular bioeconomy. This communication aims to draw attention to the negative impact of eutrophication on the environment and economic sectors, but also to propose a solution to mitigate eutrophication by valorizing aquatic bioresources to the energy and chemical sectors, adopting appropriate treatment and biorefinery techniques. Particularly, a review will be conducted on some species of algae and aquatic plants spread in the Black Sea basin with high potential for biorefinery through anaerobic digestion. Experimental results achieved under national research programs on assessing the biogas potential of some locally harvested microalgae and macroalgae can support the need to implement this sustainable option for managing eutrophication.

65. The water quality in urban and ecologically restored aquatic ecosystems within the Danube Delta Biosphere Reserve

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The ecological status of the Danube Delta Biosphere Reserve is defined as an expression of the quality of the structure and functioning of aquatic ecosystems based on the assessment of a series of biological quality elements (phytoplankton, aquatic macrophytes, zooplankton, macroinvertebrates and fish) and supported by a set of quality chemical and hydromorphological data. Expeditions were carried out to collect data for physico-chemical, biological and hydrological measurements in the Danube - Galati city area, Danube - Tulcea city area, Tulcea urban area - Ciuperca Lake and 2 areas where ecological reconstruction works took place (Zaghen and Carasuhat). For the time assessment of the ecological state of aquatic ecosystems with urban influences, Ciuperca lake and urban segments of the Danube were chosen as representative, and Carasuhat and Zaghen Lakes were selected as ecological reconstruction areas. Through multiparametric statistical analysis, significant correlations between the investigated parameters were identified, allowing for the assessment of the pollution impact in these

areas on Danube water quality, as well as insights into the temporal evolution of these environmental indicators.

66. Review: Long-Term Trends of Pesticide Residues in the Danube River Basin

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Pesticides play an important role in boosting agricultural production by controlling pests. Pesticides can be: algicides, antimicrobials, disinfectants, herbicides, insecticides, molluscicides, pheromones, rodenticides (raticides) and biopesticides. Despite regulations, pesticide pollution remains a threat to human health, food security and the environment. Pesticides can harm the environment, affecting water quality and biodiversity and can be toxic to non-target species. This study aimed to assess the impact of pesticide residues on the surface waters of the Danube River, through concentrations determined in the period 1995-2023 in the Danube River Basin. In the present study, scientific techniques were used to collect scientific evidence, consulting academic literature databases such as Google Scholar, Science Direct, MDPI, etc. The study also looked at the quantities of pesticides used in the countries of the Danube River Basin compared to agricultural production during 2014-2022. Five compounds from the pesticides class were selected from the literature. This selection was based on the frequency of determination in surface waters from the Danube River Basin. Pesticides have a negative effect on both the aquatic ecosystem and humans, directly affecting the proper functioning of the body. Continuous monitoring of pesticide residues is essential for determining the quality of the Danube water, as well as for biodiversity.

67. Pigargo´s Project: Reintroduction Project of the White-Tailed Eagle Haliaeetus Albicilla in Spain. Releasing Technique.

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In 2021 the Pigargo´s Project started in the Iberian Peninsula. The aim of this program is to reintroduce the species (Haliaeetus albicilla) in Northern Spain. This program is developed with the collaboration of Norway's authorities, which provided 25 eagles to be released by GREFA between 2021 and 2022 on an experimental phase. This organization has been involved for over 40 years in raptor conservation: this long-term expertise has enabled it to develop an innovative release methodology for species such red kite, black vulture, Bonelli´s eagle or lesser kestrel, among others.
The methodology applied for the white-tailed sea eagle involves the traditional hacking methodology with a release aviary for a soft release. This aviary promotes full bird development and flight capabilities along with a strong socialization of the released group (which promote bonding and early pair formation in the release area).
During this experimental release, the use of GPS/GSM devices has also enabled the organization to gather first-hand information about the adaptation of the birds to their new habitat.
At the end of the experimental phase, the results reveal that, according to the survival rate and pair formation, the adaptation to their new habitat was positive. The survival rate of the eagles was 84% at the end of this phase, standing at 68% at the time of writing this article. The pair formation adds up to 3 stable pairs and one trio. Nowadays one of the pairs is incubating the first clutch of the species in Spain since it´s extinction.

68. Acclimation vs adaptation: a study on the thermal tolerance of cyanobacterium Microcystis aeruginosa

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Cyanobacteria represent one of the most studied, globally distributed groups of phytoplankton, characterized by their rapid growth, relatively simple cellular structure and increased adaptability to climate change conditions. However, it is still unclear when we can talk about "adaptation" and

”acclimation” in phytoplankton, as the two terms are often interchanged in literature. Both ”adaptation” and” acclimation” reflect physiological changes of organisms when tested under extreme conditions, however the difference is given by the amount of time (expressed as number of generations) the subjects were exposed to the stressor.
Our study aimed to understand whether one strain of cyanobacterium Microcystis aeruginosa, isolated from Danube Delta in 2018, could adapt to warming conditions after 5 years of exposure to higher temperatures (+4°C, IPCC scenario) and when can we describe these changes as adaptive or due to plasticity. In this regard, we also short-term exposed the strain over a gradient of time, ranging from 0 to 8 weeks, to the same warming conditions, in order to reveal whether the response of the strain to long-term warming could be mirrored by any of these intermediate versions.
Our results aim to unravel the smallest number of generations required by one of the most common, widely distributed species of cyanobacteria, to develop an adaptive potential to global change conditions.

69. Integrated platform for wetland restoration and decision-making

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Wetland restoration plays a pivotal role in advancing climate adaptation, biodiversity recovery, and sustainable land-use transitions. Yet, the lack of cross-sectoral coordination, spatially explicit data, and policy integration continues to limit the scalability and impact of restoration efforts. This paper presents an integrated digital platform for wetland restoration in the Danube Basin, developed within the Restore4Life project, and its applicability to other restoration initiatives in the Danube basin. The platform combines high-resolution Copernicus satellite imagery, hydrological data, and ecosystem service assessments to identify and prioritize restorable wetland sites across the Danube region. Core functionalities include a stakeholder and policy dashboard for tracking restoration progress, citizen science tools for public engagement, and a dynamic case study library supporting peer learning and policy innovation. While developed under Restore4Life, the platform is designed to support a wide range of restoration initiatives across Europe, acting as an active promoter of wetland reconstruction. Looking ahead, it is intended to be interoperable with long-term research infrastructures such as LifeWatch and eLTER, ensuring its sustainability, adaptability, and continued relevance for evidence-based restoration planning. The results demonstrate the potential of such tools to bridge gaps between science, policy, and practice, accelerating landscape-scale wetland restoration in support of EU environmental goals.

70. Inter-species variability in heavy metal bioaccumulation among marine mollusks from the Romanian Black Sea Sector

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This study investigates the inter-species variability in heavy metal bioaccumulation among three marine mollusk species (Mytilus galloprovincialis, Rapana venosa, and Anadara inaequivalvis) collected from the Romanian Black Sea sector in 2021. The concentrations of Cu, Cd, Pb, Ni, Cr, and Co were determined using graphite furnace atomic absorption spectrometry. The results indicate that most heavy metal concentrations were within expected natural variability ranges; however, a few cases of exceedances were observed for Cd. Lead accumulation was notably higher in Rapana from Eforie Sud, while copper concentrations were consistently elevated in Rapana samples compared to the other species. In contrast, Anadara exhibited higher Ni and Co concentration levels, suggesting species-specific bioaccumulation patterns. The findings contribute to the ongoing evaluation of heavy metal contamination in the Romanian Black Sea and its ecological and human health implications.

71. Current status of water quality in Danube Delta Biosphere Reserve lakes between 2023 – 2024

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This paper presents the seasonal evolution of physical-chemical indicators of water quality (pH, electrical conductivity, dissolved oxygen, total nitrogen, total phosphorus, cadmium, zinc, copper, lead, nickel and chromium) from the most important lakes in the Danube Delta Biosphere Reserve, Lake Erenciuc, Lake Parches, Lake Fortuna, Lake Merhei, Lake Rosu, Lake Uzlina, Lake Razim and Lake Gorgostel seasonally (spring, summer and autumn seasons) in the period 2023-2024.
Water quality assessment, an important objective in water bodies management of Danube Delta Biosphere Reserve, refers to physical, chemical and biological characteristics of the water and integrated analysis of these indicators is essential due of their role in defining the quality of the biotic and abiotic environments, establishing the ecological status of surface waters.
Depending on the surface of each studied lake, a representative number of sampling points was established (between 5 and 19 points). The surface water samples were analyzed according to European standards, using molecular spectrometric methods, inductively coupled plasma mass spectrometry methods (ICP-MS) and in situ measurements using the high-precision multiparameter YSI EXO2. The results of our study indicate that the seasonal dynamic of physical-chemical indicators in surface water samples in the envisage period 2023-2024 was correlated to variations induced by the succession of the seasons, especially with changes in temperature and implicitly of all water quality parameters. In general, the concentration determined for each indicator framed the surface waters of the investigated lakes in the first, second and third quality classes, very good, good and bad ecological status, respectively.

72. Individual and Combined Effects of Microplastics and Hexavalent Chromium at Environmentally Relevant Concentrations on Aquatic Organisms

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The production of plastic materials has grown exponentially in recent decades due to their innovative potential and unique properties. Although European plastic production reached 54 million tonnes in 2023 (PlasticsEurope, 2024), only 13.2% of post-consumer plastics were mechanically recycled, and just 1.4% were bio-based plastics. Most plastic waste ends up in landfills or the natural environment, where it degrades through physical, chemical and biological processes. Depending on the type of polymer and exposure conditions, this degradation can lead to fragmentation into microplastics (MPs) and even size reduction down to the nanoscale. Despite numerous studies demonstrating that exposure to MPs can lead to various adverse effects, there is still a significant information gap concerning the risks that MPs and the compounds that may result from degrading plastic pose to aquatic ecosystems and human health. In addition, MPs can interact with other contaminants (e.g. heavy metals, pharmaceutical compounds, etc.), potentially altering their availability and toxicity. Likewise, current research on the combined effects of MPs and heavy metals on aquatic organisms is insufficient. In this context, the present study aimed to evaluate the effects resulting from exposure to polystyrene microplastics (PS MPs) and hexavalent chromium [Cr(VI)] at environmentally relevant concentrations on two model aquatic organisms, duckweed (Lemna minor L.) and zebrafish (Danio rerio). In L. minor, physiological and biochemical responses were assessed after 7 days of exposure by measuring lipid peroxidation (MDA—malondialdehyde) levels, the activities of some oxidative stress markers (SOD—superoxide dismutase, POD - peroxidase and CAT—catalase) and the photosynthetic pigments content (like chlorophyll a, chlorophyll b and total carotenoids). In D. rerio, the changes in social and 3D swimming behaviors along with acetylcholinesterase (AChE) activity, lipid peroxidation (MDA—malondialdehyde) contents, SOD and CAT activities, were evaluated after 21 days of exposures. Our results revealed that both individual and combined exposure to PS MPs and Cr(VI) caused significant biochemical alterations in L. minor and behavioral impairments in zebrafish.

73. Evaluating and assessing the impact of physical loss on seafloor integrity in the Romanian Black Sea region within the framework of the Marin Strategy Framework Directive

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Physical loss is defined as any permanent human-induced change to the physical habitat for which recovery is impossible without further human intervention. The Marine Strategy Framework Directive (MSFD, Directive 2008/56/EC) requires member states to establish a set of characteristics for good environmental status (GES) in marine waters, based on qualitative descriptors. Annex I of the MSFD includes Descriptor 6, which states: "The sea-floor integrity is at a level that ensures that the structure and functions of ecosystems are safeguarded and that benthic ecosystems, in particular, are not adversely affected." The purpose of these criteria is related to the assessment of physical losses and disruptive pressures on the seabed in general (D6C1 and D6C2), the extent of adverse effects of pressures related to physical disturbance by habitat type (D6C3), and the extent to which good habitat status has been achieved, taking into account all relevant pressures (D6C4 and D6C5).
The physical loss of the seabed (and benthic habitats) is essentially irreversible and represents the most severe form of degradation (the seabed has lost its original quality). The habitat is lost if its substrate, morphology or topography are permanently altered. The main activities that cause such damage are offshore hydrocarbon extraction installations, port activities, dredging and disposal of dredged material, wind farms, sand or gravel extraction, seabed construction, coastal protection infrastructure, beach nourishment, etc.
To assess physical losses, in situ data were used (GPS measurements of the shoreline, topographic profiles of the emerged beach, sediment analyses, bathymetric data, aerial photographs, orthophotos and digital terrain models), modelled data from the European Marine Observation and Data Network database (EMODnet High Resolution Seabed Mapping, EMODnet Habitats and EMODnet Human Activities), as well as public data (statistical data, maps) or historical data from the NIMRD database. The methodology for assessing physical losses involved identifying human activities that impact the loss of the seabed substrate, integrating data obtained from field monitoring, satellite data, and European service programs data, producing the "footprint" of losses at the seabed level, and calculating the associated areas with physical losses.
Keywords: *seabed, physical loss, coastal works, beach nourishment, GIS, benthic habitats*

74. The second life of closed quarries: The ecological importance of natural ponds in closed quarries for aquatic birds

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However, post-mining landscapes, such as closed quarries, can develop into new habitats that enrich biodiversity. This study examines the biodiversity of two closed quarries: one with naturally formed ponds and one without aquatic habitats. Both quarries are located in the Black Sea-Mediterranean flyway route of migratory birds. We used Audiomoth v1.2.0 for acoustic recordings within the quarries, from September 2024 to April 2025. Then we identified avifauna species using the automatic bird identification program BirdNet Analyzer. Our results indicated the presence of six species of aquatic birds in the quarry with aquatic habitats, out of a total of 41 species recorded. In the quarry without aquatic habitats, we recorded only 16 non-aquatic species. Tringa glareola was recorded for three consecutive days in March and Gallinago gallinago was recorded over two days in October. The other four aquatic species (Anas platyrhynchos, Tadorna ferruginea, Chroicocephalus ridibundus and Fulica atra) were recorded for less than one day at a time. This study highlights the critical role of post-mining land management in facilitating support for bird populations and the importance of creating and maintaining diverse habitats within former mining areas. Our results highlight that quarries with diverse habitats may function as significant migratory corridors, which further emphasizes the necessity for thoughtful post-mining landscape rehabilitation strategies which prioritize biodiversity.

75. Designing with Water: Strategies for Resilient Blue Infrastructure in Râmnicu Vâlcea Metropolitan Area

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This research explores the strategic integration of blue infrastructure within the Râmnicu Vâlcea Metropolitan Area (VL-MA), grounded in a review of relevant European and national legal frameworks, sustainable development strategies, and local planning documents. Blue infrastructure considers both natural and artificial water elements—such as rivers, lakes, wetlands, drainage systems, and sustainable urban drainage solutions. It has become a central element in recent environmental and urban policy. Our study has identified key European directives, including the Water Framework Directive (2000), the Urban Wastewater Treatment Amendments (2023), and the Flood Risk Management Directive (2018), which establish strict requirements for water protection, flood prevention, and integration of nature-based solutions.
Considering our case study at the local Romanian level, our research has included an analysis of the Sustainable Development Strategies (SIDU) of the municipalities in the VL-MA. The 2021–2027 SIDU of Râmnicu Vâlcea identifies multiple interventions, from sewer and water network modernisation to the rehabilitation of riverbanks and the expansion of water infrastructure. Case studies from surrounding municipalities—such as Vlădești, Dăești, Bujoreni, and Ocnele Mari—highlight a range of approaches to water resource management, often shaped by ecological, infrastructural, and risk mitigation concerns. Our analysis has shown an uneven implementation of blue infrastructure concepts across the studied metropolitan area. Challenges remain in terms of funding, political will, and community engagement in order to fully realise the benefits of these approaches. Research and collaboration between municipalities can help address these obstacles and promote more widespread adoption of sustainable water management practices in the region.

76. Wetland restoration benefits biodiversity conservation

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Wetlands play a vital role in providing multiple ecosystem services supported by their rich biodiversity, yet they face significant degradation due to climate change and human activities. The extent to which wetland restoration can enhance biodiversity conservation and subsequently improve ecosystem functions remains insufficiently understood. This study synthesizes 3,844 data records from 203 global restoration projects to evaluate the effectiveness of wetland restoration in promoting biodiversity and ecosystem functions. The findings reveal that while wetland restoration enhances the ecological function and diversity of phytoplankton, it reduces plant diversity and associated ecological functions. Excessive inputs of organic carbon and nitrogen were identified as primary contributors to eutrophication, which diminishes wetland biodiversity. Conversely, increases in soil bulk density and base saturation were found to improve substrate stability, water quality, and overall biodiversity. Integrated restoration approaches were more effective than single-habitat methods in improving both ecological function and biodiversity, with outcomes influenced by wetland type, biotic communities, and regional conditions. Incorporating these findings into restoration frameworks can strengthen wetland resilience and biodiversity, ensuring the sustained delivery of critical ecosystem services essential for environmental health and human well-being.

77. Restoration of coastal wetlands in China: Chances and challenges

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Ecosystem restoration in China has become a national strategy since 2020, while coastal zone is one of the key zones in this event. This presentation will discuss about the chances and challenges faced during coastal wetland restoration, with special focus on the aquaculture ponds, invasive Spartina alternifora, and wise use of dredging materials. Not all restoration projects are "ecologically sound". Costs and benefits from different restoration measures should be fully considered before making decisions. Nature-based ecosystem management and restoration strategies are suggested for policy makers.

Section III - Mission Ocean. New research approaches

78. From marine sulfated polysaccharide ulvan to 2,5-furandicarboxylic acid (FDCA): a catalytic approach toward bio-polymers production

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The sulfated polysaccharides known as ulvans, a major structural component of *Ulva lactuca syn Ulva rigida* green algae cell walls, have a unique chemical composition and structural properties. These make ulvan a promising raw material for synthesizing high-value biomolecules. This study aims to promote the marine bio-economy by exploring Ulva lactuca and its polysaccharide ulvan for biochemical production. Efficient Nb@zeolite catalysts were developed and applied in transforming ulvan into rhamnose (Rha) and 5-hydroxymethylfurfural (HMF) within mono/biphasic solvent systems. Subsequently, HMF was subjected to catalytic oxidation to 2,5-furandicarboxylic acid (FDCA) with monometallic magnetic catalysts like Fe_3O_4@SiO_2-MO_x, with 1, 5, and 10wt% active phase (i.e., MO_x = MnO_x, CoO_x, and FeO_x) and bimetallic ones, combining the active phases of the monometallic magnetic catalysts. The obtained results show that at 100°C and 6h, and in the presence of monometallic catalysts the oxidation of HMF selectively proceeds to the intermediate HMFCA, with selectivities in a range of 66.0-94.5%, for HMF conversions of 41.2-85.4%. Notably, in the presence of bimetallic catalysts, significant amounts of FDCA were obtained, with different selectivities, depending on the nature of the catalytic system used. Thus, in the presence of 5Fe@5Co@MNP, FDCA was obtained with S=51% for a total conversion of HMF, demonstrating that such catalysts offer a promising strategy for enhancing marine biomass valorization and contribute to sustainable biopolymers production. Acknowledgements: The Romanian Ministry Research and Digitalization is acknowledged for funding within the grant PNRR-III-C9-2022-I5-18, *ResPonSE* - Project, No. 760010/2022.

79. Evolution in Action: Skeletonema marinoi's Adaptive Growth to Climate Extremes

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Global warming and ocean acidification are transforming marine ecosystems at an unprecedented pace, but we still lack a clear understanding of how phytoplankton - the foundation of oceanic food webs - will respond to these simultaneous changes. In this study, we explored how Skeletonema marinoi, a widespread and ecologically important marine diatom, evolves under the combined pressure of elevated temperature and CO_2.
We experimentally evolved two strains of S. marinoi under four different combinations of temperature and CO_2 levels. We then quantified how these adaptations altered their growth performance across a broad range of temperature and CO_2 conditions - generating the first complete response surfaces for this species. Surprisingly, the optimal CO_2 concentration for growth was much higher than what is expected in future oceans (~6000 ppm), and this pattern was consistent across temperatures. This suggests that temperature, rather than CO_2, will likely play a stronger role in shaping future growth rates. Interestingly, we found no clear unimodal response of optimal temperature to changing CO_2, possibly due to the species' flexible carbon-concentrating mechanisms. Both strains showed clear evolutionary changes, but in different directions - highlighting the role of genetic background in determining how phytoplankton respond to climate stress.
Understanding these strain-specific adaptive responses is crucial for predicting how key algal species will behave in a changing ocean and for improving models of future ecosystem dynamics.

80. Impact Assessment Framework: Building a Mindset

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Within the scope of the Mission Ocean, and particularly of its innovation actions, a methodology for the impact assessment is being developed to help project partners, practitioners and evaluators to establish

clear and result-oriented metrics and criteria. Building from the wide heterogeneity of activities, purposes and objectives that can be encountered across several projects, a harmonised overarching approach is aimed at, in view of fostering a wide consensus around it. Hence, a methodology is being developed that sets reference categories, nomenclature and metrics for the impact analytics in each project, allowing then its cross-analytics, benchmarking and/or cross-referencing across the Lighthouses within the Mission Ocean. In this communication, a preliminary structure for this framework is presented, including its main tools and parametric logic. The way to adapt and adopt it in different specific use cases is briefly discussed as well.

Keywords: *impact assessment, innovation action, Mission Ocean, parametric evaluation framework.*

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81. Translating Marine Science Findings to Actionable Solutions

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Coastal ecosystems are increasingly threatened by pollution, eutrophication, climate change, and unregulated development. While extensive research has been conducted, much of it remains confined to the literature, without being translated into actionable solutions for public adoption or policymaking. There is an urgent need to engage local stakeholders in developing science-based strategies to restore and protect these ecosystems, enhancing their resilience against ongoing environmental stressors for the benefit of people, nature, and livelihoods. This talk aligns with the vision of the UN Decade of Ocean Science for Sustainable Development by emphasizing an ecosystem-based approach that addresses both anthropogenic and climate-induced stressors across multiple scales. It integrates scientific research with practical solutions that can be applied locally and scaled regionally and internationally. Partnerships - such as ongoing collaborations between local authorities, marine scientists, and community stakeholders - are key, with solutions being co-designed to respond to the unique environmental challenges faced. By fostering a shared knowledge base and building capacity among local communities, we can strengthen the adaptive capacity of coastal ecosystems, contributing to a healthier and more resilient ocean. This initiative also aims to translate research findings into effective management practices by providing science-based solutions for ecosystem restoration and protection. Through promoting knowledge exchange and experience-sharing among diverse stakeholders, the initiative will build capacities, inform policy development, and support global efforts in ecosystem restoration, climate action, and partnership building. Furthermore, it emphasizes protecting marine biodiversity while enhancing the well-being of coastal communities whose livelihoods depend on healthy ecosystems.

82. Associated Regions: Scaling Wetlands Restoration

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The DaWetRest project demonstrates the critical role of Associated Regions (ARs) in advancing wetlands restoration across Europe. ARs contribute to scaling and replicating innovative solutions in their local contexts, ensuring that restoration efforts reach beyond the project's core demonstration areas. They will help transform regional challenges into opportunities for sustainable environmental restoration, aligning with EU goals and the Mission Restore Our Ocean and Waters.

Keywords: *wetlands restoration, associated regions, EU goals, Mission Restore our Ocean and Waters,*

83. The Impact of Extreme Hydrometeorological Phenomena on the Danube Delta Coastal Area

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Between 19 and 27 November 2023, the western Black Sea coast was affected by an extreme meteorological episode, characterized by a strong decrease of atmospheric pressure and wind gusts exceeding 100 km/h. Records from spotter buoys and coastal tide gauges (Constanta, Mangalia) - complemented by observations from the maritime area of the Danube Delta (Sulina - Sf. Gheorghe) - show a rapid sea level rise and waves > 4 m high. The spatio-temporal analysis of these signals highlights the propagation of a meteotsunami type disturbance, favored by the semi-enclosed and micro-tidal configuration of the Romanian shelf. The most affected areas were the sheltered bays and low-lying sectors of Constanța, Mangalia and the Danube Delta, where the sea level oscillations caused severe beach erosion, inundation of coastal infrastructure and disturbance of lagoon habitats. The integration of multi-sensor data with the synoptic diagnosis confirms that the event represents one of the most intense meteotsunamis ever documented in the western Black Sea basin, highlighting the need to expand monitoring networks and risk management strategies for the Romanian coastline and for the vulnerable maritime area of the Danube Delta.

Section IV - Geographical Information System and Application System Modeling

84. Modeling flood scenarios and the impact on the *Poacynum armenum* species in the Danube Delta

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Poacynum armenum is an endangered plant in Romania and is present only on the Perișor Sand Islet in the Danube Delta (Tulcea County). Given that hydrological factors can have an important role in the survival of this species, the purpose of this study was to create flood scenarios (at 0.85 m, 1 m, 1.2 m, 1.4 m, 1.6 m, and 1.8 m) in the dam area where this plant grows. These scenarios were based on breaches in the Perișor area's protective dikes. The flood analysis was carried out by modeling a real scenario in which 50 m openings were generated in the dikes, maintained for 24 hours at the maximum levels of the Danube. The dynamic analysis method used the specialized HEC-RAS software to evaluate this scenario. Topographic measurements were performed using the Global Navigation Satellite System to determine the planimetric and altimetric coordinates of the banks of the Perișor Canal, resulting in 104 points translated into the Stereo70 projection system. Bathymetric measurements were made with a SonTek Acoustic Doppler Current Profiler (ADCP) RiverSurveyor M9 used on a speedboat.
The results showed that the flood scenarios show progressive levels of water rise in the dike area, with variable impact on the *P. armenum* species. Thus, in scenario I (0.85 m), the floods are limited to the base of the area where the analyzed species grows. In this case, the affected area is minimal, and the habitat remains stable. In scenario II (1 m), the degree of flooding is moderate, and the vegetation at the dam's base is partially affected. In the case of scenario III (1.2 m), the floods reach the low-lying areas of the area where *P. armenum* is. In scenario IV (1.4 m), the floods cover much of the area where *P. armenum* grows. In this case, the available habitat for the species is reduced. In scenario V (1.6 m), the floods almost cover entirely the species' habitat. In scenario VI (1.8 m), the habitat is completely flooded. As such, with the increase in water level, the surface of the habitat progressively decreases. Although flood scenarios between 1.4 m and 1.8 m are rarer, they can eliminate the species from the analyzed area. In the area where *P. armenum* grows, the water depth is between 0.01 m and 1 m, and the water velocity is between 0.009 m/s and 0.240 m/s in flood scenario III. In conclusion, the most vulnerable areas are the low-lying areas on the dike, which are affected in all flood scenarios. These data indicate the vulnerability of the *P. armenum* species in these scenarios.

85. Flood Risk Assessment in the Danube Delta Using 2D Hydraulic Modeling Under Climate Change: Near-Term and High-End Projections

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This research analyzes projected changes in flood extent and depth in the Danube Delta under climate change scenarios for the near future (2031–2060) and high-end projection (2071–2100). Using climate signals from four models and eight E-HYPEcatch hydrological models ensembles under two Representative Concentration Pathways (RCP4.5 and RCP8.5). Discharge at Ceatal Ismail served as a boundary condition for a 2D hydraulic model of the Delta's main area (4,152 km²), configured in HEC-RAS 6.6 using a 2m, resolution DEM and mesh resolution from 400m to 25m along major channels. Simulations used a 1-minute time step over 30 days to capture flood propagation. Flood hazard maps were generated for different return periods (10, 100 and 100 years). For the 100-year flood, the areas increase from 2,100 km² in the reference period to 2,540 km² (RCP4.5, 2031–2060) and up to 2,788 km² in the high-impact scenario. Under RCP8.5, the flood extent ranges from 2,730 km² to 2,788 km². Events currently considered rare such as 100- or 1,000-year floods, may become frequent, with 100-year floods occurring every 10 years or less, and 1,000-year floods potentially every 50 years, indicating a significant rise in fluvial flood risk. This modeling approach offers improved accuracy over past 1D simulations, supporting more reliable risk assessment. The resulting hazard maps are essential tools for decision-makers, enabling the design of effective flood risk management strategies and adaptive planning in a vulnerable and dynamic deltaic environment increasingly impacted by climate change.

86. Assessment of negative impact of Russian aggression against Ukraine on water quality and pollution, using Web of Science information, GIS and remote sensing. A provocative review

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This review aims to present the impact of Russian aggression against Ukraine on water quality and pollution, analyzing information presented in 62 Web of Science relevant scientific articles. The papers were selected using some essential keywords for the review: water quality, water pollution, Russia, Ukraine, aggression, war, GIS, remote sensing, satellite imagery. The work focuses on the aspects of water quality and pollution highlighted in the articles, proven both by water samples' analysis, but also by GIS and remote sensing. The review emphasizes the GIS and satellite techniques used to point out the water pollution caused by the armed conflict. For this review, four war fronts were selected with dramatic consequences both on the population of the respective regions and on the environment, implicitly on the water bodies: the front in Kharkov, the one in Zaporojie, the front in Mariupol and the one in Kherson-Mykolaiv. The main elements of water quality and pollution on which this review focuses and which have been revealed through water analysis, GIS and satellite imagery are: heavy metals, ammonia, nitric acid, hydrocarbons, explosive substances, sea mines, organic substances, sunken ships, destruction of dams, infrastructures intended for water supply and water treatment and purification. Overall, all main elements of water pollution caused by the predatory war of Russia against Ukraine can be proved either through the water analysis or GIS and remote sensing techniques. Satellite imagery is a useful tool to highlight the large-scale water blooms caused by untreated spills, resulting from the bombing and shattering of sewage treatment plants or the flooding of landfills, agricultural lands, livestock farms etc., following the destruction of dams.

87. Digital Twin Earth systems: Satellite Remote Sensing for assessment of environmental impacts

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Planet Earth has changed dramatically over the past few years: rising of the sea level, increasing levels of ocean acidification, drought, or frequent and extreme floods, or heat waves. Meanwhile, the world population growth and human activity amplify the effects of climate change. There is an increasing pressure on basic resources, such as fresh water or food, an accentuated stress on land and marine

ecosystems, a dramatic explosion of environmental pollution, impacting health, and biodiversity. Climate models describe changes at a scale of thousands of kilometers and for long time periods e.g. for many decades. However, adaptation measures shall be applied at human activities scale, from 10m to 1km and periods from days to months. The presentation is addressing the basic AI models to develop future Earth information systems such as Digital Twins Earth System (DTE) for understanding, forecasting, and conjecturing the complex interconnections among Earth systems, including anthropomorphic forcings and impacts to society. As a complex integrated information system, an DTE enables continuous assessment of impacts between naturally occurring and/or human activities. It is in the scope of the tutorial to promote the opportunities offered by the availability of Big EO Data, with a broad variety of sensing modalities, global coverage, and more than 40 years of observations in synergy with the new resources of AI and Quantum computing. The digital and sensing technologies, i.e. Big Data, are revolutionary developments massively impacting the EO domains, while, AI is providing now the methods to valorize the Big Data. However, the data deluge, diversity, or the broad range of specialized applications are posing new major challenges. From the methodological side the challenges are related to, the reproducibility, the trustworthiness, physics awareness, and overall, the explainability of the methods and results, as well as continuously learning, from and with mathematical models data analytics, simulations and user interaction. The presentation covers the major developments, of hybrid, physics aware AI paradigms, at the convergence of forward modelling, inverse problem, and machine learning, to discover causalities and make prediction for maximization of the information extracted from EO and related non-EO data. For DTE applications, these AI models will facilitate raising awareness and amplifying the use of existing climate data and knowledge services, for the elaboration of local and specific adaptation. That represents a step towards a citizen driven approach with an increased societal focus, with application to the needs of multiple users at all levels of activity. These technologies will follow a systemic approach merging several cross-modalities themes and areas of innovation, implemented as an inclusive methodology to bring together public administrations, private sector, civil society, and finally the citizens in person.

88. Using image segmentation in day-to-day mapping

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More and more, a vast amount of data is flooding our society. One particular type of data is images, in general, and images resulting from satellite and airplane, or drone flights, in particular, most of the time to produce maps. This process represents the abstracting of images by representation in a horizontal plane of the earth's surface (partial), generalized and reduced according to a certain scale of proportion, and drawn up on the basis of a cartographic projection, which is time-consuming. To be more efficient, image segmentation should be considered. Through segmentation, images are divided into objects (groups of pixels), of which the boundaries cover the entire image. When applied across multiple scales, segmentation can address a wide range of mapping requirements while significantly enhancing spatial accuracy. One of these requirements is the possibility of obtaining very good spatial accuracy in the end. This paper presents a custom-built software tool designed to perform image segmentation tailored to specific mapping needs, including classification and spatial precision. This tool was designed in Python programming language with PySide6 and uses multiprocessing programming to accelerate processing time. It is available in a single-file program for Windows platform and respectively for Linux platform. The first and direct use of this application is the land surface coverage, implying that vegetation is classified as natural habitats in a natural area.

89. The Influence of the Coastal Current Dynamics on the Development of Barrier Islands at Danube River Mouths

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The measurements developed for the hydro-geo-morphological phenomena of the Danube Delta's barrier islands continuous formation involve a specific scientific approach, due to the rapid changes induced by hydrometeorological variability, including river discharges, in relation to the actual build

layout of the Danube's mouths. The multifaceted analysis of the coastal hydro-morphological variability permits better consideration of the coastal and marine processes in the coastal area of the Danube Delta, in the context of the regional importance of the influence of climate change in the last decades. The present work presents certain results at local and regional scales of the Danube coast. The evaluation-based results on in situ measurements, as well as remote sensing and modelled data reveal the influence of the coastal hydrodynamics variability as the key factor inducing sediment transport in decadal conditions of decreased river solid discharge. This approach requires several complex studies of hydro-morphological interactions, considering the short-, medium- and long-term conditions at Danube coastal areas, thus encompassing sediment dynamics and the management thereof based on certain sediment environments.

90. Preliminary work on adopting digital method for collecting habitat evaluation data

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This study explores the development of Python scripts to implement an application dedicated to streamlining monitoring and research processes. The main purpose of the application is to facilitate the entry of data from the keyboard into a spreadsheet file (.xlsx), using the Python core package and the Openpyxl library. The process starts with a pre-created, empty file, in which the application automatically generates the table header according to the required fields. The resulting digital form allows the user to fill in the programmatic fields, including complex habitat data, such as: biotope, diagnostic species, habitat codes N2K, EUNIS, EMERALD, etc. The filled-in data is stored in the application's memory and saved in an Excel file via a dedicated button, ensuring precise organization of information. The script integrates essential functionalities for collecting, saving and visualizing data in a simplified way, with the ability to prevent data overwriting. At the same time, the digital form is versatile enough to be expanded according to requirements, supporting fieldwork specialists through an automated, fast and efficient process. The utility lies in the fact that the researcher no longer has to spend time in the office to transcribe all the field notes into the computer to then perform the analyses (statistics, interpretations, etc.). The tool mentioned in this paper was compiled for the Windows platform and will also be available for the Linux platform.

91. Using GIS in assessing vegetation vulnerability to climate changes in the Danube Delta Biosphere Reserve

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The Danube Delta Biosphere Reserve covers the alluvial plain of the Danube, starting from Cotul Pisicii, ending with the coastal area (up to the 20 m isobath) and the Danube Delta with its three arms to which is added the Razim-Sinoe Lagoon Complex. The present paper presents the evolution of some meteorological parameters over a relatively long period of time (1950-2022) and its effects on the vegetation in the studied area. Thus, a significant decrease in precipitation was found, associated with an increase in general temperatures (average, minimum but especially maximum). This leads to a sharp aridification of the area and a reduction in air humidity, affecting the vegetation specific to the Danube Delta Biosphere Reserve. The decrease in precipitation is also correlated with the fragmentation of aquatic vegetation. For a more tangible quantification of fragmentation, the massiveness or compactness index was used. The compactness or massiveness index is a concept used to analyze the shape of a polygon, providing information about how uniform or dispersed it is. A compact polygon is characterized by a well-defined and balanced shape, and an index closer to 1 reflects this characteristic. In contrast, higher values of the index suggest increased dispersion, indicating a less regular or fragmented shape. This indicator is important for geometric study, helping to understand the properties and configurations of polygonal shapes in various fields of research. Information is very useful in the development of policy programs aiming for protecting biodiversity.

92. Enhanced Integration of SWOT Data for Hydrological Monitoring in the Danube Delta

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River deltas are among the most dynamic landforms and ecosystems, shaped by river discharges that periodically flood the delta plain and introduce sediments, pollutants and nutrients. Understanding deltaic wetland systems and how they have adapted to varying water levels as well as how will they respond to climate change depends on monitoring these processes. Studying river deltas and coastal waters is made easier by the Surface Water and Ocean Topography (SWOT) satellite mission, which was launched in 2023 under a CNES (French Space Agency) and NASA collaboration. SWOT offers altimetric data on surface water bodies on 120km wide swath bands, being the first satellite able to measure water surfaces on 2D maps. SWOT data are crucial for river delta monitoring, as they can detect water levels even beneath vegetation. This feature makes it possible to monitor floods in areas that were previously inaccessible due to the water's obscuration by extensive vegetation. While SWOT tools enable the investigation of water elevation globally, conventional methods of determining water levels typically rely on in-situ measurements, which have spatial limits. This work demonstrates the potential of SWOT data to transform our understanding of hydrological processes. We report on a preliminary investigation carried out in the Danube Delta with an improved SWOT raster data at 30 m that enhances the classification of land and water resolution to overcome the shortcomings of the existing SWOT products. This was achieved by using SWOT's original PIXC classes and correcting misclassifications through a statistical sampling threshold. The KNeighborsClassifier was applied to define the grid boundaries, resulting in a more precise extent product, where daily water level measurements obtained at strategic places like Sfântu Gheorghe, Tulcea, Isaccea, and Sulina were used to validate satellite data. The initial validation of SWOT data against in-situ measurements revealed a high level of accuracy ($R2 > 0.9$), demonstrating its potential for monitoring water levels and floods in the Danube Delta. However, it is necessary to correct and filter potential errors, which are often prevalent in flat, highly reflective water bodies. Preliminary analyses revealed that SWOT data can help to inform models to evaluate river-sea interactions along the Black Sea coast.

93. Analysis of soil subsidence process within the Murighiol-Dunavăț area of the Danube Delta, through remote sensing techniques

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The purpose of this paper was to analyze the evolution of the soil subsidence process within the Murighiol-Dunavăț area, based on the terrain elevation classes. These classes were obtained by vectorizing the SRTM digital elevation models, years 2000 and 2010, as well as the EuDEM from 2016-2017, in QGIS. These data were superimposed on the Danube Delta soil map and it was followed how the elevation class values evolved over time depending on the soil type. All vector data with polygon-type vectors were imported into a PostgreSQL spatial database. The choice of this object-relational database management application (free and with public source) was made for the large volume of data it supports on a database-type table and for the support it offers for geometric data. This volume is up to 32TB of data per table and a practically unlimited number of records in database tables, to which is added support for vector entities of point, line, circle and polygon type. To all this, the study, based on remote sensing data and soil types, of the subsidence process was added, identifying its cause, in the case of Murighiol-Dunavăț area, and the anticipation of the soil subsidence evolution. This study results in identifying and suggesting measures to stop it.

94. H2 METAVERSE & GreenH2Danube

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Addressing European decarbonization targets requires technologies that reduce energy consumption and emissions whilst fully harnessing the potential of renewable energies.
Fuel cells and hydrogen (FCH) technologies constitute a significant opportunity to substitute fossil fuels in transport, energy and industrial sectors in combination with AI.

These technologies are well developed in the upper Danube region like Germany and Austria, but completely missing or underdeveloped in the middle and lower Danube region.
As these technologies are now entering the market, a transnational cooperation from public and private partners in the entire Danube macro region is necessary to trigger large-scale deployment for the creation of a sustainable and green hydrogen society,
GreenH2Danube aims to foster transnational cooperation and create new synergies in all relevant sectors by means of AI technologies in the so called H2 METAVERSE.

95. Strategic and spatial solutions for integrating Marine Protected Areas into Marine Spatial Planning (MSP)

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MSP4BIO project aims to develop and demonstrate the ways in which knowledge-based MSP becomes a vehicle and a tool for the protection and restoration of biodiversity through an Integrated and modular Ecological-Socio-Economic (ESE) management framework for the protection and restoration of marine ecosystems. The Romanian – Bulgaria cross border Testing Site, from Cape Tuzla in Romania to Cape Kaliakra in Bulgaria, includes diverse coastal, onshore and offshore domains and Marine Protected Areas (MPAs) supporting huge biodiversity and ecosystem services.
The Romanian part of the Western Black Sea Test site is a developed sector with both environmental and socio-economic uses, experiencing increasing land-based and marine pressures mainly due to population growth, urbanization, tourism and leisure activities, industry, transportation, and fishing. The need for space in marine areas generates multiple conflicts, such as those between environmental protection and fishery/aquaculture, fishery/aquaculture and maritime transportation, and touristic and leisure activities and infrastructures overlapping MPAs or fishing grounds.
Following the CoP members' consultations, the specific gaps and needs for the test site were formulated, resulting in key guiding management questions concerning the compatibility of maritime uses and MPAs conservation objectives, and the need to assess cumulative impacts.
The planning solutions identified include:

- Participatory mapping (using SeaSketch and ArcGIS), and stakeholder engagement methods. These were used to collect data on marine activities, areas of interest for habitats with high ecological value and species (such as marine mammals), conflicts and synergies, and future uses of marine space.
- DSTs: Cumulative Impact (Effect) Assessments: Using the PlanWise4Blue (PW4B) CEA tool to quantitatively assess the individual and combined impacts of human activities on natural values. DST was applied for present conditions (considering selected human activities) and future conditions.

Keywords: *MSP, cumulative impacts, MPAs, participatory mapping*