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Changing sodic lakes under the threat of antropogenic and climate impacts in the Southern Great Plain, Hungary

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Wetlands, preserving a significant ecological value in the matrix of arable land in the Carpathian Basin, are threatened by anthropogenic processes and the effects of climate change, and their maintenance and restoration is therefore a priority for the conservation of the surrounding wildlife. There are many ecological wise management success stories in the Great Plain to restore more favourable water and salt regime, but there are examples of former wetlands located at higher altitudes where irreversible processes occur due to the lack of available groundwater resources. This study examines sodic lakes and their environments in the Southern Great Plain through snapshots of land use, habitat and soil where the well-known and documented groundwater level decline is not advanced, thus less effort has been and should be put into restoration, and where the degradation is mainly caused by anthropogenic activities. Results to date have confirmed that changing habitat patterns are determined by the spatial location and background factors. Habitat pattern monitoring is the most cost-effective method to monitor the changing condition, but soil and groundwater level should also be monitored to identify appropriate management options.

Grazing disturbance can override habitat effects in karst doline microrefugia

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Microrefugia are relatively small areas that are protected from climate-related disturbances, such as rising temperatures and severe drought. Several species can survive adverse climatic periods in these areas. The potential microrefugial role of karst dolines compared to the surrounding plateau areas has been demonstrated not only for vegetation but also for arthropod communities. However, anthropogenic disturbances, such as grazing by domestic animals, can affect their biodiversity. We aimed to determine how grazing affects the relationships between habitat conditions (i.e. topographic-driven differences in microclimate and plant species composition between doline vs. plateau), vegetation characteristics (structure and diversity) and arthropod communities (abundance and species richness) using structural equation modelling (SEM). We analysed the data from a grazed and a non-grazed year separately. In the non-grazed year, habitat (doline vs. plateau) influenced arthropods both directly and indirectly via vegetation structure. In the grazed year, grazing could also influence arthropod abundance and richness directly and indirectly via vegetation structure, overriding the effects of habitat. However, the pathways were particularly different for arthropod groups (true bugs, spiders, and ants). Understanding the mechanisms that influence the refugial capacity of dolines is essential for determining the appropriate management practices.

Natural Water Retention Measures contribution to flood risk management

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With observed and projected frequency and magnitude changes in hydrological and other water-related extreme events the great challenge is how to manage their risk. The most frequent hydrological hazards are floods (riverine-fluvial, pluvial, coastal, mountain torrents, urban. etc) and their occurrence depends on river basin retention capacity, precipitation, land use and cover etc. In recent decades flood risk management approach based on quickly water convey is shifted to approach that balance and integrate the restoration of natural features and processes with existing land uses to minimise loss of life and maximize benefits from nature (Natural Flood Management, Floodplain management, Integrated Flood Management, etc). The function and significance of drainage area retention capacity for water adverse effects mitigation is manifold and acknowledged in different concepts that slow runoff at source by mimicking natural processes. Natural Water Retention Measures (NWRM) as a multi-functional approach are recognized as a concept for flood risk management that provide synergy with environmental objectives of the EU Water Framework Directive and reduce trade-offs with other policies (Biodiversity, Habitat, Climate Change Adaptation, etc). Due to significant number of benefits (water storage and purification, sediment balance, groundwater recharge, etc) NWRM are incorporated in the Danube Flood Risk Management Plan (DFRMP) 2021. As presented in following, NWRM integration in DFRMP 2021 is elaborated and their implementation effects on synthetic unit hydrographs (SUH) and peak discharge rate for ungauged basin are presented in more details as a function of land cover, natural features and selected short-term heavy rainfall event.

Geospatial analysis of beaver built ecosystem dynamics in the High-Resolution Aerial Monitoring Network System

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The study presents a geoinformatic analysis of Eurasian beaver (*Castor fiber*) dam-building activities in Hungary, focusing on their role as ecosystem engineers. Following their reintroduction in the 1990s, beavers have significantly altered riparian habitats, resulting in both ecological benefits and human-wildlife conflicts. Since 2018, the High Resolution Aerial Monitoring Network (HRAMN) has been investigating areas significantly affected by beavers. Using photogrammetric methods, the research analyzes beaver-modified landscapes across diverse Hungarian terrains and habitats. The primary aim is to record the state of the studied territory with the multifaceted impacts of beaver activity on different ecosystems and to model water bodies dammed by their structures. Furthermore, to generate sample data from these case studies that can later be used in the High Resolution Aerial Monitoring Network project for training its AI-supported, partially automated evaluation procedures in monitoring. The study proposes an assessment tool and decision-support framework for stakeholders that recommends nature-based solutions – such as regulated modifications of dams (e.g., flow devices) instead of complete removal – to manage the risks of assets and infrastructure. At the same time, it must reliably demonstrate situations where existing beaver dams do not pose any risk to human life or the built environment. By synthesizing geospatial data, ecological monitoring, and legal perspectives, this study aims to demonstrate the role of beavers in water management and ecosystem restoration as a key tool for enhancing landscape resilience, while contributing to more evidence-based and sustainable conservation practices in Hungary.

Human disturbances and refugial capacity: biodiversity in doline microrefugia

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Microrefugia are small areas that support the long-term survival of species during climate changes. Topographic depressions in karst landscapes (dolines) have the capacity to decouple their microclimate from regional climate changes, making them important 'safe havens' or microrefugia for biodiversity. Here we provide examples from European karst areas, where different types of anthropogenic disturbances have been shaping the vegetation for centuries, to illustrate the various effects of human activities on biodiversity in dolines. For instance, construction, lime burning, forestry activity, and biological invasion may significantly alter the capacity of dolines to support climate change vulnerable species, generally reducing the number of these species in doline microhabitats. However, in some cases, anthropogenic disturbances can also have positive consequences for biodiversity, supporting the populations of rare and endangered species in dolines. Therefore, the effects of various disturbances on biodiversity patterns in doline microrefugia must be carefully considered to determine the best management strategies.

Application of the hydrogeomorphological index (IHG) and morphological quality index (MQI) in rivers of Timiș county and Romanian Banat region to assess their fluvial quality

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The hydrogeomorphological quality of European river watercourses has been regulated by the Water Framework Directive (EU) since 2000. Several methodologies have been developed to implement the Directive, as well as scientific works applied in Europe. In this work, two methodologies with a long history of application have been used: The Spanish hydrogeomorphological index (IHG) (Ollero et al., 2011) and the Italian morphological quality index (MQI) (Rinaldi et al., 2013b). Both methods have been compared in several rivers with a wide variety of river typologies of the Banat region, in the territory of Romania. The results of the application of both methodologies show a good correlation between the methods of analysis, correctly assessing the current state of the rivers. The hydrogeomorphological assessment makes it possible to establish a framework for action in the conservation and restoration policies of the most degraded watercourses, being able to act on them to improve their condition. In the current context of climate change, hydrogeomorphological status is closely related to flood risks, as a poorly assessed river can increase the risk by not functioning properly.

Keywords: hydrogeomorphological quality, Banat region, IHG, MQI