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Conservation potential of abandoned sand mines

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As a result of large-scale landscape aridification, moist habitat communities and species are increasingly declining. Interestingly, sand mining — driven by the growing demand of industry — can create conditions that support the formation of wetlands. Abandoned sand mines often offer suitable environments for rare and protected plant species that thrive in open or wet habitats. In our study, we examined 38 abandoned sand mines located in the Danube–Tisza Interfluve. We assessed the size of these sites, the time passed since abandonment, the groundwater level, and various soil parameters. Furthermore, we surveyed the presence and populations of rare and protected plant species within these sites. Our analysis focused on two main questions: (i) how the soil characteristics of abandoned mines differ from those of the surrounding landscape, and (ii) how factors such as previous land use (natural or agricultural), mine size, age, and groundwater level influence the occurrence of rare and protected species. Our findings revealed that soils in the abandoned mines have higher moisture content, lower nutrient levels, and lower pH compared to the surrounding areas. The previous land use and the age of abandonment did not significantly influence the number of rare and protected species present. In contrast, both the size of the mine and the groundwater level emerged as key determinants. We found that species richness increases with mine area, following a saturation curve, while the relationship between groundwater level and species richness shows an exponential decline. These findings highlight that abandoned sand mines can serve as important refuges for plant species affected by landscape changes such as aridification and land-use transformation. Therefore, incorporating abandoned sand mines into conservation strategies is essential — particularly for the protection of water-dependent species and habitats.

The devastating impact of a landslide on a home (case study in Slovenia)

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In August 2023, Slovenia experienced catastrophic floods affecting most of the country, marking the onset of recurring extreme torrential rainfall. This abstract presents a case study from June 2024, when residents of a house located on hilly terrain underlain by shale rocks (with a slope gradient of 19° to 38°) started noticing wall cracking of a few millimetres. Each rain event had made the situation more periling, prompting the local municipality to involve geologists to assess the situation. Our investigation identified the house's location on an active landslide, evidenced by larger cracks at the front of the building, indicating rotational movement downslope. Bedrock is overlain by a variable thickness of Quaternary silty clay with pieces of gravel. A nearby stream, situated approximately 50 m east, had been previously stabilized with transverse barriers.

Comprehensive terrain research was conducted, including geological mapping, dig pits, three boreholes, and inclinometer measurements. These revealed two distinct slip surfaces. Monitoring of groundwater levels further clarified subsurface conditions. Groundwater contributed to slope instability. Visible subsidence was also observed on the driveway, with pavement sinking near the garage.

The proposed mitigation plan included improving the drainage system behind the house, constructing a pile wall, and stabilizing the structure through Uretek expansion resins injection. However, before these measures could be implemented, the property deteriorated significantly, posing a serious threat to the safety of the inhabitants. Six months after the initial assessment, cracks in the walls widened to approximately 2 cm. Given the advanced damage and ongoing risk, residents were instructed to evacuate the house.

This case highlights the challenges of managing landslide-prone terrains under increasingly extreme weather conditions and the need for timely intervention.

Introducing the first ecovoltaic parks of Hungary: a reconciliation between solar development and nature conservation

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Solar energy is the most rapidly growing renewable globally, leading, as a side effect, to vast low-nature-value areas due to the high land requirement of ground-mounted solar panels. However, there may be ways to reconcile solar development with nature conservation. Ecological aspects can be considered during the planning, construction and management of the parks, and the resulting ecovoltaic park can bring various benefits to the owners. A major step in developing ecovoltaic parks is the creation of short but species-rich grassland ecosystem. Here, we set up an experimental design in three solar parks of Hungary, and sowed a mixture of 52 native species in one half of each park in 2022, while the other halves were left as control. In 2023, we surveyed the vegetation of the parks and adjacent old-growth grasslands (as references), and found that total species richness in the sown parts equalled that of the references, but the richness of grassland specialists remained lower (albeit higher than in the control). By 2024, grassland specialists in the sown parts reached the references, and we found no statistically significant difference between them. Regarding pollinators, we found higher species richness and Shannon diversity in the sown parts then in the reference grasslands, while control parts of the parks showed intermediate values. This can be explained by spillover from the sown parts, although flying pollinators might have also taken advantage of the windshade among the panels of the control parts, irrespective of food sources. Our findings suggest a rapid improvement of plant and pollinator assemblages after sowing native seed mixtures in solar parks. The resulting higher-nature-value grassland can have many co-benefits for the owners, as it requires lower management intensity, has the potential to offer high quality food for livestock or honey-bees, and lowers the widespread “not-in-my-backyard” syndrome of local people.

From micropollutant removal to greenhouse gas monitoring: New challenges in the wastewater treatment sector

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In response to the current environmental, human health and economic problems, the amendment to the Urban Wastewater Treatment Directive (91/271/EEC) has been expanded with a number of new areas in November 2024. The wastewater treatment plants must deal with the development of treatment technology, the investigation and reduction of micropollutants and microplastics, the achievement of energy neutrality and the assessment of greenhouse gas emissions. Traditional wastewater treatment technology needs to be developed and expanded in treatment plants, which ensures compliance with increasingly stringent nitrogen and phosphorus emission limits values. One of the consequences of population growth and economic activity is the exponential growth of anthropogenic waste generation, which includes wastewater and sewage sludge generated during wastewater treatment. Most of the toxic substances in wastewater and sewage sludge are non-biodegradable and persistent compounds. Two groups of these are micropollutants (e.g. pharmaceutical active compounds, pesticides), which can have a harmful effect on human health and the ecosystem even at low concentrations (µg/L, ng/L), and microplastics, from which up to several million particles can be released with a single load of laundry. The investigation and monitoring of micropollutants and microplastics will become mandatory in treatment plants in the future, and their removal requires the installation of special technology, the so-called fourth stage of treatment. In addition to the proper treatment of wastewater and the removal and monitoring of the harmful substances contained in it, wastewater treatment plants must also achieve energy neutrality, which will be a real challenge due to the additional costs associated with the installation, operation and maintenance of the fourth stage. In the fight against global climate change, the new directive also requires the examination of greenhouse gases and gas emission points, and reducing emissions, with a special focus on nitrous oxide and carbon dioxide.

Microplastic Pollution in Hungarian Water Bodies: Urban Ponds and the Tisza River System

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Microplastic pollution (MP) in freshwater systems poses significant ecological risks as these persistent particles can adsorb harmful chemicals and serve as vectors for invasive species and pathogens. We have examined this issue from different perspectives in urban lakes and in the Tisza River system.

MP pollution was investigated in Szeged, southeastern Hungary (population ~160,000), across four urban ponds with different land use characteristics in their watersheds. All ponds act as stormwater storage wetlands, urban runoff is directly discharged into the ponds through drainage channels. Samples were collected during both dry and wet periods in 2024/2025 to analyse MP concentrations, shapes, and colors in surface water and sediments. In parallel, research along the Tisza River system examined the sink-source dynamics affecting MP transport and deposition in river water and sediments between 2020 and 2023.

The MP concentration in clay deposits of the Tisza River varied between 859±562 items/kg and 1737±889 items/kg. Compared to the river sediments, the MP concentration in sediments from urban ponds were 2 to 4 times higher. The results showed that the pond sediments contained an average of ~2100 particles/kg during the dry period and ~4200 db/kg in the wet period. Water samples from ponds averaged ~22 pieces/L in the dry period, while the wet period averaged slightly less, ~14 pieces/L, which can be partly explained by the significant accumulation of MPs in the ice sheet present during the wet period. In the river, MP pollution was strongly associated with wastewater discharges, with fibers constituting 89.8-98.7% of MP types. In the ponds, the most probable sources of MPs are surface runoff through drainage channels and direct waste disposal.

The research findings indicate that one of the major sources of microplastics (MPs) in water systems comes from urban areas, especially through urban runoff, as evidenced by high microplastic concentrations in urban ponds. The studies also indicate that effective sewage treatment systems can significantly reduce the amount of microplastics discharged into rivers.

The effect of water pollution caused by detergent residues on living aquatic organisms

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Detergents and cleaning agents are substances used in large quantities in everyday life. However, no conventional wastewater treatment method can completely remove the residues of synthetic detergents and cleaning agents from wastewater, so they can be detected in living water and cause several problems. They change the pH and conductivity of waters and reduce the resistance of aquatic biota to environmental stress. Knowing all this, the need for solutions that do not burden the environment has become more and more increasing.

In our research, we investigated the ecotoxic effects of four commercially available detergents and laundry soap on Lemna minor at 10-, 50-fold and 100-fold dilutions of the detergent concentrations recommended by the manufacturers for washing. Synthetic detergents were diluted by 10 times the manufacturer's recommended concentration resulted in the death of the organisms. However, a significant reproduction was observed in the solution of laundry soap even at this concentration. The size, weight and protein content of the plants were reduced by detergents in 50-fold dilution, but laundry soap did not cause inhibition. The number of photosynthetic pigments was inhibited by synthetic detergents in a 50-fold dilution. The enzyme guaiacol peroxidase was significantly increased at this concentration for all detergents. With the increase of concentration, the enzyme activity in synthetic detergents solutions ceased, which mean the death of plants.

In solutions of synthetic detergents 100 times thinner than the concentration used during washing, the physiological parameters of Lemna minor were not significantly inhibited, but they were intensively reduced by increasing the concentration. However, even in its most concentrated solution, the laundry soap solution did not cause significant inhibition of the studied physiological parameters of Lemna minor.

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