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A SATURATED BUFFER ZONE AS COST-EFFECTIVE NATURE-BASED SOLUTION TO MITIGATE THE AGRICULTURAL NUTRIENT POLLUTION OF STREAMS IN DENMARK

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According to the EU Water Framework Directive 2000/60/EC (WFD), all waters including surface and ground waters must achieve at least good ecological status by 2027. However, it can be challenging as the compliance with the WFD can result in costly investments and set limits for agricultural and industrial production. Agriculture is reported by the European Environmental Agency as one of the key drivers for failure in realizing good ecological status in EU water bodies. Thus, intensively farmed agricultural land can have significant losses of nutrients through drainage, soil leaching, ditches, and surface runoff. According to the Danish political agreement "Agreement on green conversion of Danish agriculture" published 4th of October 2021, it is planned to achieve around 1,500 t of total nitrogen reduction using collective methods, such as afforestation as well as use of restored natural and constructed wetlands. The saturated buffer zone (SBZ) is a new drainage mitigation measure and was not tested in a Northern European context yet. The simple principle is that drain water from the field becomes reconnected to the non-cropped riparian zone. Specifically, drainage water and riparian buffer soil are reconnected by a buried, lateral perforated distribution pipe running parallel to the stream (0.5-1 m below soil surface), which redirect the drainage water into the riparian zone. In this paper, we present the performance of the first pilot-scale SBZ established in Denmark in 2018. Based on comprehensive field-testing the efficiency of the newly established SBZ for removing nutrients from agricultural tile-drain water was proven during three subsequent drain seasons from 2019 to 2022. Specifically, we investigated: 1) the site hydrology, i.e., water inflow and spatial differences of soil water fluxes, hydraulic conductivity, and ground water table changes, 2) effects on water quality and nutrient removal such as total dissolved nitrogen, nitrate, ammonium, and phosphate and 3) assessment of long-term performance regarding P sorption and cost efficiency. The SBZ investigated showed an overall N removal and P retention of 77% and 72%, respectively. Additionally, biomass analysis from the pilot site shows that the plant uptake could explain 30% of the N removal and all the P removal. This underlines SBZs as promising mitigation measure for agricultural drainage water, however specific site factors need to be considered before of successful implementation.

BIO of Presenter:
I have 23 years' experience in freshwater and wetland-related environmental research, land use change, conservation, restoration. My research is strongly dedicated to interdisciplinary research integrating biology, ecology, microbiology, and hydrochemistry across aquatic and terrestrial systems.