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Abstract til Land Use and Water Quality

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Saturated buffer zones treating agricultural drainage water: A new mitigation measure in Denmark

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Denmark reached a new political agricultural agreement in the fall of 2021, obligating Danish agriculture to reduce nitrogen (N) leaching to aquatic environments by 10.800 tons by 2027. Of the 10.800 tons N, 1500-tons must be reduced using collective methods, such as afforestation and natural and constructed wetlands.
New mitigation measures are currently being tested in Denmark as acknowledged mitigation measures like constructed wetlands are expensive to construct and only have an N-retention efficiency of around 25%. Saturated buffer zones (SBZs) are a recognized mitigation measure in the USA showing N removal rates of up to 84%. This promising result is obtained with a simple design of water saturating the riparian zone. The SBZ is now being evaluated under Danish conditions.
Two SBZ called ‘Gylling’ and ‘Ulvskov’ were constructed as pilot-scale testing facilities near Odder, Denmark through funding from Promilleafgiftsfonden as part of the project “Videreudvikling og optimering af målrettede dræn- og lavbundsvirkemidler”. Monitoring began in September 2019 and includes investigations of hydrology, vegetation, soil, and water chemistry. Water samples were collected using automatic ISCO samplers and in piezometers installed in the SBZ. The phosphorus (P) retention and the N removal was evaluated using a mass balance approach. The investigation of the SBZ ‘Gylling’ ended in December 2020 due to low infiltration capacity of the soil matrix. Presumably due to a combination of a high groundwater table and a strongly degraded peat soil. The SBZ ‘Ulvskov’ showed greater promise with a water infiltration up to 8.6 L/s, before the adjoining bypass pipe was needed. The infiltration capacity, however, did decrease over time with bypass flow starting at 1 L/s, which might be explained by fine particles from the upland clay soil settling in the distribution pipe. Inlet flow to the SBZ increased to 2.1 L/s with no bypass flow, after rinsing the distribution pipe in December 2021. The SBZ ‘Ulvskov’ showed an overall N removal and P retention of 87% and 76%, respectively. Additionally, biomass analysis from ‘Ulvskov´ shows that the plant uptake could explain 30% of the N removal and all of the P removal. This underlines SBZs as promising mitigation measure for agricultural drainage water. In conclusions, SBZ has great potential to be implemented as a mitigation measure. The Gylling case, however, shows that SBZ are not suitable at all locations. Consequently, more data are necessary before SBZ can be an approved mitigation measure in Denmark.

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