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Integrated buffer zones as a new mitigation measure for enhancing nutrient retention

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Recently, the effects of integrated buffer zones (IBZs) for nutrient removal were tested at two experimental facilities established along two smaller streams in, respectively, eastern and western Jutland, Denmark for improvement of the ecosystem services offered by vegetated buffer zones (Zak et al., 2018). Following the outcome of the first year results from testing in the two experimental IBZs, two new full scale IBZs were established along two other smaller streams in eastern Jutland, Denmark. A common feature of all the studied IBZ sites is that tile drainage water and surface runoff from the adjoining arable fields previously discharged directly into the neighboring streams and both tile drainage water and surface runoff is intercepted within the IBZ, thereby enhancing hydraulic-residence-time and the potential for biogeochemical processing. Specifically, the design of IBZs combines a pond, where soil particles present in tile drain water can settle, with a planted sub-surface flow infiltration zone, and together these should provide an optimum environment for microbial processes and plant uptake.

A follow up study was conducted in the experimental IBZ in eastern Jutland, Denmark, for studying the potential effects of aging of IBZs, and for studying the nutrient retention capacity of the two new established full scale IBZs. Daily and monthly water, nitrogen and phosphorus mass-balances was established utilizing continuously monitoring of drain water inflow, eventual groundwater inflow, outflow from the IBZ and with piezometers the infiltration of water through the IBZ, coupled to water sampling in all hydrological pathways. The study period covers generally the first year after construction in the experimental IBZs and in the experimental IBZ in eastern Jutland also year 4 after construction. Despite their small size (0.1 ha) and thus small proportion of the drained catchment (mostly < 1%), these studies cumulatively suggest that IBZs are effective enhancements to traditional vegetated buffer zones as they significantly lowered nitrogen and phosphorus losses from the arable fields to streams.

References

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