Function and effect of vegetated buffer strips on nutrient emission at tile-drained field sites

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It has been shown in several studies that vegetated buffer strips have a positive impact on the reduction of sediment and nutrient transport to surface waters. It remains, however, unclear to what extent buffer strips influence water quality at artificially drained sites where it is believed that no filter mechanism is operational within the strip since nutrient loaded soil and groundwater is directly routed in pipes to the surface water resources.

The objective of this study was (i) to identify flow and transport processes operating within buffer strips at tile drained field sites and (ii) to quantify a possible nutrient reduction in artificially drained landscapes at the sub-catchment scale.
At a densely instrumented field site with several transects of groundwater wells, three widths of buffer strips (1, 3, 7 m) were established along a ditch receiving water from various tile drainage systems. In addition, two comparable sub-catchments only differing in the configuration of the buffer strips were subjected to regular water quality monitoring.

At high groundwater levels during winter, groundwater flows towards the ditch adjacent to the field site. However, hydraulic conductivity and resulting flux rate were low. Accordingly, nitrate concentrations decreased with decreasing distance to ditch and increasing depth with a minimum value for nitrate of < 1mg/l in 4 m depth and 1 m apart from the ditch. The buffer strip width had no impact.
The comparison of the water quality parameters of the sub-catchments revealed that the nitrate concentration level of drain pipes discharging into the ditches did not differ between sites. The concentration level in the ditch of the sub-catchment with a long established buffer strip was, however, slightly lower than at the other site where no buffer strip exists. In both ditches a natural attenuation of nitrate along flow direction from spring to outlet was observed indicating self-cleaning processes.