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Nutrient reduction in field wetlands: do they work for dissolved nutrients?

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Pollution of natural waters arises from both point sources (direct inputs) and diffuse inputs (many small sources entering the waterways by numerous pathways). Legislation has ensured that pollution from point sources has been reduced, thus increasing the significance of diffuse sources, and the contribution from agriculture in particular. Field wetlands (small sediment and nutrient trapping features, < 500 m^2), constructed along runoff pathways, are one set of options for diffuse pollution mitigation. Polluted surface runoff as well as subsurface drainage is slowed down by passage through the field wetland, allowing more opportunity for sediment and associated nutrients to settle out. However, the nutrients transported from soil to water are not only attached to the sediment but also in soluble form, and field drains have been identified as a fast pathway for dissolved nutrients to reach the waterways. The soluble form is critical in the short term because it is readily available for aquatic organisms. On the other hand, the particulate form (associated with sediment) is a reservoir for growth and development of aquatic organisms and represents a problem in the long term. The ability of field wetlands to reduce both the particulate and dissolved nutrient loads is being tested in the UK as part of a project on Mitigation Options for Phosphorus and Sediment. Ten field wetlands have been built on farms in the UK, capturing surface runoff and subsurface field drainage, to quantify the sediment and nutrient retention under a range of different conditions. At Whinton Hill in Cumbria (sandy soil), samples from the inlet and outlet of a field wetland system showed an average decrease in the concentration of total solids of 11%. Total phosphorus (TP) was reduced by an average of 43%. However, soluble reactive phosphorus, which accounted for approximately 50% of the TP at the inlet, was reduced by an average of 74%, showing that this wetland made a significant difference to both the particulate and dissolved fractions of phosphorus. For nitrogen, at least 80% of the total nitrogen was in dissolved form at the inlet, with most of this being in the form of ammonium. Concentrations of ammonium were reduced by an average of 72% between the inlet and outlet. We conclude that the long hydraulic residence times in this field wetland, due to very limited flow at the outlet of the wetland, maximise the opportunity for biological activity and uptake of soluble nutrients.