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Improving water quality in agricultural catchments: sediment and nutrient retention in field wetlands

M. C. Ockenden (1), C. Deasy (1), J. N. Quinton (1), and C. Stoate (2)

(1) Lancaster Environment Centre, Lancaster University, Lancaster, LA1 4YQ, UK (m.ockenden@lancaster.ac.uk), (2) Game & Wildlife Conservation Trust, Loddington, Leicestershire, LE7 9XE, UK

A recent update of Water Framework Directive classifications in the UK indicates that only 28% of water bodies currently achieve good ecological status and that agriculture is one of the main sectors responsible for the pressures contributed by sediment and nutrients. The use of edge-of-field features, such as field wetlands - small sediment and pollutant trapping features ($<$500 m^2) constructed along runoff pathways, is one set of mitigation options available to farmers. Before reaching the waterways, polluted runoff is slowed down by passage through the field wetland, allowing some sediment and nutrients to settle out. Although the principle of field wetlands is well accepted, and they are widely used in Scandinavia for diffuse pollution mitigation, there is little quantitative evidence of their capability for water quality improvement in the UK. Ten field wetlands have been constructed in the UK agricultural landscape in order to quantify the potential for sediment and nutrient retention and to provide guidelines on their likely effectiveness under various conditions. The ten sites covered different combinations of soil type, field wetland design, wetland size relative to catchment area and runoff source. Sediment and nutrient retention was measured by annual sediment surveys at each field wetland. Sediment trapping rates of 0.5 – 6 t ha^{-1} yr^{-1} were recorded on a sandy soil site, compared to 0.02 – 0.4 t ha^{-1} yr^{-1} on a silty soil site and 0.01 – 0.07 t ha^{-1} yr^{-1} on a clay soil site, although rainfall was a confounding factor, with much lower rainfall at the clay site during the monitoring period. Concentrations of total phosphorus, total nitrogen and total carbon in the sediments trapped were highest at the sandy site, where there was a wastewater input in addition to the agricultural runoff. The importance of land use, and ground cover in particular, was highlighted by a ten-fold increase in the sediment trapped in one field wetland from one year to the next when pasture was ploughed up for an arable crop. These multi-functional edge-of-field features have shown good potential for reduction of sediment and nutrient input to the waterways. In addition, field wetlands provide biodiversity benefits and in some circumstances may also contribute to flood attenuation, and should be considered alongside in-field measures as part of an integrated solution for catchment management.