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Constructed wetlands to reduce diffuse pollution from agriculture

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Across Europe, many rivers and lakes are polluted. Sediment can disturb aquatic ecosystems, and is associated with the transport of pesticides, pathogens, toxic metals and nutrients, including phosphorus (P). P is growth-limiting in freshwaters, and rivers and lakes may become eutrophic where concentrations are high, leading to algal blooms and loss of biodiversity. For example, in the UK, the Biodiversity Action Plan estimates that over 70% of lakes are eutrophic. Concern about water quality has resulted in EU policy drivers to protect rivers and lakes. Under the requirements of the Water Framework Directive (WFD), surface waters must achieve 'good ecological and chemical condition' by 2015. Studies in the UK indicate that P concentrations need to be an order of magnitude lower in fresh waters to comply with the requirements of the WFD, and methods of controlling sediment and P inputs into surface waters are urgently required. Pollution sources such as sewage treatment works can be regulated, but non point (diffuse) sources are difficult to control. As agricultural activities have been estimated to account for 30% of P inputs to surface waters, controlling the transfer of diffuse pollutants in runoff from agricultural land is a priority for catchment managers. The use of in-field mitigation options such as reduced tillage has been found to be effective in the UK, but pollutants can still be lost from hillslopes unchecked via subsurface runoff pathways, some of which (e.g. field drains) may contribute very high loads of sediment and P to streams. Mitigation approaches, such as wetlands, which operate at the edge-of-field, where hillslope pathways have already discharged their pollutant loads into the receiving stream, are therefore essential. Over the next two years we will establish ten wetland sites in the UK and use these to: 1) reduce levels of sediment and nutrients leaving agricultural fields; 2) determine the effectiveness of different wetland designs for reducing agricultural pollution; and 3) understand which hydrological and biogeochemical processes influence wetland effectiveness. We have already created one wetland system and have been monitoring runoff, turbidity and nutrient concentrations at flumes in wetland inlets and outlets since Autumn 2008. The initial results of the monitoring are presented in this paper.