European Commission

Science for Environment Policy

Constructed wetlands help keep farmland soil out of rivers

Small, artificial wetlands can reduce river pollution by trapping soil and nutrients swept off agricultural land by rainfall, a recent study finds. The researchers recommend that they are used as a back-up option to soil management measures also designed to reduce runoff into rivers.

18 September 2014
Issue 356

Subscribe to free weekly News Alert

Source: Ockenden, M. C., Deasy, C., Quinton, J. N., *et al*. (2014). Keeping agricultural soil out of rivers: evidence of sediment and nutrient accumulation within field wetlands in the UK. *Journal of Environmental Management*. 135: 54–62. Doi:10.1016/j.jenvman.2014.01.015. This study is free to view at: www.sciencedirect.com/science/article/pii/S0301479714000309

Contact: m.ockenden@lancaster.ac.uk

Read more about: Agriculture, Green Infrastructure, Soil, Water

Intensive agriculture can degrade and erode soil, allowing it to be washed into streams and rivers. This pollutes the water with nutrients, which may compromise efforts to meet the goals of the EU's Water Framework Directive.

This UK study[1] explored the potential of artificially-constructed wetlands to store runoff from agricultural land. These wetlands trap both sediment and nutrients, with the latter then taken up by plants and microorganisms. They are not widely used in the UK, partly because there is a perception that only large wetlands are effective. However, this study suggests that this is not necessarily the case.

The researchers created 10 wetlands on four farmland sites and measured how much sediment and nutrients they accumulated over three years. The wetlands were unlined ponds in unproductive areas of farmland, and each set of ponds took up just 0.025-0.1% of each catchment area. The sites represented a range of soil types and both grassland and cropland.

Wetlands at a site with sandy soil collected the most sediment: 70 tonnes over three years, an average annual rate of 0.8 tonnes per hectare (t/ha/yr). Forty tonnes accumulated in ponds at a site with silty soil, equating to 0.3 t/ha/yr, and 2 tonnes at a clay soil site (0.04 t/ha/yr).

The sandy site also trapped the most nutrients. For instance, accumulation rates of nitrogen were estimated to be 0.5-7 kg/ha/yr here, compared to 0.2-0.6 kg/ha/yr at the silty site and 0.02-0.3 kg/ha/yr at the clay site. Around 1% of nutrients applied to the land as fertiliser at the silty site was thought to have been trapped in the wetlands. Figures for this were harder to judge on the other sites, partly because other nutrient sources, such as wastewater, also flowed into the ponds.

These accumulation rates represent differences in erosion rates of different soil types. The researchers believe that the wetlands successfully trapped a significant amount of the sediment that they received, because the accumulation rates are similar to erosion rates reported by separate studies on similar land.

Other factors also affected sediment accumulation. For example, accumulation levels rose steeply on one site when it was converted from grassland to cropland, which has more runoff during periods of little or no crop cover. Rainfall was also influential, but its timing was more important than the amount. More sediment accumulated after heavy rainfall but only when it coincided with periods of bare land or poor crop cover.

The sediment in the ponds could be dredged and reused as top-soil, the researchers propose. However, it is not useful as a fertiliser, as its nutrient levels are too low.

Small artificial wetlands can successfully reduce the amount of sediment, and nutrients, entering rivers from farmland, the study concludes. They should be used as 'back-up' to more sustainable 'in-field' soil management measures to reduce runoff, such as minimised tillage.

1.The Mitigation of Phosphorus and Sediment (MOPS) 2 project was funded by the UK Department of Environment, Food and Rural Affairs (DEFRA)002E