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Combating eutrophication in agricultural catchments: factors controlling effectiveness and challenges of changing climate and nutrient legacies

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Reducing eutrophication requires large financial investments that can be for example used to support catchment stakeholders in building agri-environment mitigation measures. These measures aim at reducing nutrient and sediment losses from agricultural land to recipient waters. In recent years, a large number of studies has looked into their effectiveness and generally show that some measures are successful and others fail to deliver expected improvements in water quality, which is increasingly difficult to communicate to stakeholders expecting immediate results. Particularly, transport mitigation measures that aim at intercepting stream or drainage flow, can have a varying effectiveness. Two measures of the same type and built in a seemingly similar way can have completely opposite impact on water quality, depending on the local catchment properties. In this paper we examine factors controlling effectiveness of mitigation measures looking at their hydrochemical positioning in the catchment in relation to pollution sources including nutrient legacy sources, their hydrochemical behaviour, design, management and stakeholders' engagement, using examples for transport mitigation measures: constructed wetlands, sedimentation ponds, two-stage ditches and drainage filters. We discuss also typical trade-offs in attainment of different ecosystem services which catchment stakeholders should consider prior to selecting and building the measures, including pollution swapping mechanisms e.g. reducing P-controlled eutrophication but increasing N-controlled eutrophication or reducing eutrophication vs. increasing greenhouse gas emissions. We show also how increasing weather variability and nutrient saturation can lead to further deterioration in water quality despite implementation of measures, making mitigation efforts ineffective under changing climate and in catchments with nutrient legacy sources.