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Phosphorus sources and losses in two arable catchments and implications for catchment management

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Multi-scale catchment experiments allow assessment of the impact of policy measures on nutrient losses from agriculture and water quality and testing of conceptual models of nutrient loss. The potential for catchment-specific responses to be extrapolated to similar catchments country-wide can then help guide future policy measures to achieve water quality targets, such as those in the EU Water Framework Directive (WFD). This paper presents results from the Agricultural Catchments Programme; an integrated advisory/research programme working with stakeholders to assess the efficacy of Ireland's National Action Programme (NAP) of measures in meeting the targets of the Nitrates Directive and WFD. Results are presented for P sources and losses over two water years in two catchments (9.5 and 11.2 km2) with intensive arable agriculture but contrasting soil drainage and geology and resultant hydrologic and nutrient transfer pathways. Phosphorus source pressures were characterised in terms of field-scale soil P status and P balances. Phosphorus loss was characterised in terms of P concentration and loads monitored with high-resolution bank-side analysers. Despite having similar P soil status (18-19 % in excess of agronomic optimum), P losses were much greater from the catchment with more poorly drained soils (0.7 kg ha-1 yr-1) than from the catchment with more freely drained soils (0.2 kg ha-1 yr-1). This paper considers the factors controlling P loss in the two catchments (farm nutrient management, soils, topography and hydrology) to explain the differences between the two catchments and the spatio-temporal variability observed. Agricultural and non-agricultural point sources, in addition to diffuse agricultural sources, are considered. Although both catchments are subject to the same NAP measures, the outcomes, in terms of both P loads and concentrations, showed that inter-annual hydrological patterns and inter-catchment hydrological properties are critical. This highlights the importance of considering soil, geological and landscape factors when considering policy measures to decrease nutrient losses to water and improve the sustainability of agricultural production systems.