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Source and transport factors influencing storm phosphorus losses in agricultural catchments

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The relative risk of diffuse phosphorus (P) loss from agricultural land was assessed in a well-drained arable catchment and a poorly-drained grassland catchment and in two nested basins within each catchment. This research investigated the relative control of hydrology and soil P on P losses between basins. Quick flow (QF) P losses (defined here as both concentrations and loads), monitored in stream flow during four storm events, were compared with a dynamic metric of transport risk (QF magnitude) and a static metric of critical source area (CSA) risk (extent of highly-connected poorly-drained soils with excess plant-available soil P). The potential for static transport metrics of soil connectivity and soil drainage class, to predict relative QF magnitudes and P losses between basins was also investigated.
In basins with similar CSA risk but with contrasting QF magnitudes, mean TRP (total molybdate-reactive P) losses were consistently higher in the basins which had the highest QF magnitudes. This suggests that basin hydrology, rather than hydrology of high-P soils only, determined relative TRP losses between hydrologically contrasting basins. Furthermore, static transport metrics of soil connectivity and soil drainage class reliably discerned relative QF magnitudes and TRP losses between these basins. However, for two of the storm events (both occurring during the hydrologically active season), PP (particulate P) concentrations were frequently higher in basins which had the lowest QF magnitudes and may be attributed to a higher proportion of bare soil in these basins at these times as a result of their predominantly arable nature.
In basins with similar hydrology, relative TRP and PP losses did not reflect trends in CSA risk or QF magnitude. The dynamics of TRP and PP losses and QF magnitude between these basins varied across storms, thus could not be predicted using static metrics.
Where differences in hydrological dynamics were large, storm TRP losses were well differentiated by dynamic or static transport metrics alone, regardless of differences in soil P. Where hydrological dynamics were similar, non-static transport metrics and P source information additional to soil P, may be required to differentiate the relative risk of storm TRP in these agricultural catchments. Regardless of differences in hydrological dynamics, information on land use and management, such as time of ploughing, may be required to differentiate the relative risk of PP loss in these agricultural catchments.