



Assessing the risk of phosphorus transfer in high ecological status rivers.

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Introduction

Diffuse, non-point pollution remains a major threat to surface waters due to eutrophication caused by nitrogen (N) and phosphorus (P) transfers originating, in part, from agricultural land. In Ireland, phosphorus (P) transfer from agricultural land has been asserted as the primary cause of degradation in 53 % of the river water bodies that failed to achieve 'good' ecological status under the WFD. However, it is difficult to make the same assertion about rivers that are at risk of failing to maintain 'high' ecological status due to the uncertainty around the causes of degradation and also due to natural variations in high status conditions. Nevertheless, P transfer from agriculture does warrant consideration given its wider importance for the ecological quality of rivers. The objectives of this research were to characterize the geochemical and hydrological setting for agriculture in high status catchments in Ireland, and assess current nutrient management at field scale and the relative risk of P loss under different biogeochemical and hydrological condition.

Materials and Methods

Three case study catchments were selected from an existing database of 508 high status catchments. Catchment selection used a simple multi-criteria decision approach to represent agriculture on the dominant

soils across the wider high status catchment population. The catchments selected were the River Allow in County Cork, the River Black in County Galway/Mayo and the River Urrin in County Wexford (Figure 1). The upstream catchment of the River Allow is dominated by poorly drained surface water gleys underlain by siliceous drift and shale bedrock with blanket peat in the upland areas toward the river's source. The catchment of the River Black is dominated by well drained brown earth mineral soils underlain by calcareous drift and limestone geology but interspersed with large areas of lowland raised bog peat. Situated in the south east, the River Urrin catchment is dominated by well drained acid brown earth, mineral soils underlain by siliceous drift and shale and slate geology, blanket peat exist in the upland areas near to the source of the river.

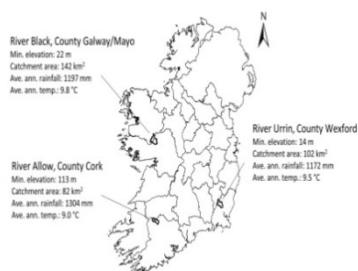


Figure 1. Location of case-study catchments

Results and Discussion

In total 10, 13 and 16 farm surveys were completed in the Allow, Black and Urrin catchments, respectively, to gather soil samples and information on farm and field nutrient management practices. These farms were selected to represent the range of farming systems present. Across the 39 farms surveyed, a total of 520 fields (195 in the Allow, 112 in the Black, and 213 in the Urrin catchments), were sampled and records of P management were assessed.

At farm scale, P surpluses were common on extensive farm enterprises despite a lower P requirement and level of intensity. At field scale, data from 520 fields showed that Histic topsoils with elevated organic matter contents had low P reserves due to poor sorption capacities, and received applications of P in excess of recommended rates. On this soil type 67 % of fields recorded a field P surplus of between 1 and 31 kg ha⁻¹, accounting for 46 % of fields surveyed across 10 farms in a pressured high status catchment. A P risk assessment combined nutrient management, soil biogeochemical and hydrological data at field scale, across 3 catchments and the relative risks of P transfer were highest when fertilizer quantities that exceeded current recommendations on soils with a high risk of mobilization and high risk of transport as indicated by topographic wetness index values. This situation occurred on 21 % of fields surveyed in the least intensively managed catchment with no on-farm nutrient management planning and soil testing. In contrast, the two intensively managed catchments presented a risk of P transfer in only 3 % and 1 % of

fields surveyed across 29 farms (Figure 2).

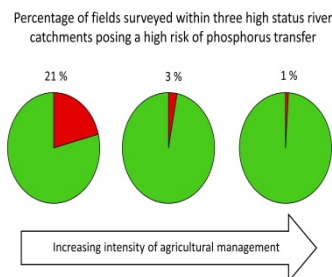


Figure 6. Percentage of fields surveyed within three high status river catchments posing a high risk of phosphorus transfer.

Conclusions

Future agri-environmental schemes under the EU Common Agricultural Policy and Rural Development Programme could consider providing % OM surveys on a field-by-field basis to farms in high status catchments. Farmers in these areas need greater access to advisory services.

Acknowledgements

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References

Roberts, W., Doody, D., Gonzalez, J., Jordan, P. and Daly, K. 2017. Assessing the risk of phosphorus transfer to high ecological status rivers: Integration of nutrient management with soil geochemical and hydrological conditions. *Science of the Total Environment*. 589, 25-35.