Integrated approach to improving water quality in Ireland

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Eutrophication is a key challenge in Ireland to achieving the objectives of both the EU Nitrates and Water Framework Directives with agriculture and industrial water discharges among the main pressures. Mitigation measures under the Nitrates Directive regulations are the mechanism for improving water quality from agricultural pressures. These constrain the magnitude and timing of nutrient management on agricultural land to minimise losses. The efficacy of these measures is being evaluated through the Agricultural Catchments Programme using the source-delivery-impact design in six benchmark agricultural catchments across a land use and soil type gradient (Fealy et al., 2010; Wall et al., 2011). It focuses on high spatiotemporal resolution monitoring of aspects of the nutrient transfer continuum, these data, in conjunction with other national inventories of pressures and water quality impacts, will guide expectations on the immediate and long term benefits accruing from the regulations. While these national inventories indicate a decline in agricultural nutrient source pressures the catchment studies highlight differential nutrient mobilisation potential, especially on low permeability soils. Even in agricultural catchments, the nutrient impact on river ecology may also be influenced by rural point sources and especially in ecologically sensitive summer periods during low flow and when diffuse pathways are disconnected. Concurrently, a decision support tool, for nutrient optimisation, is being developed using current and forecast weather across three defined soil drainage classes (well, moderate and poor) to calculate the soil moisture deficit (SMD) values for 10 x11 km grid cells. These data are used to forecast potential a transport vector and slurry N, P, K fertilizer replacement values. A farmer can evaluate whether a decision to spread is likely to (i) lead to unwanted nutrient loss due to runoff or leaching and (ii) maximize the fertilizer replacement value. While there is no plan for the tool to replace legislative restrictions, if used it should increase nutrient management efficiency and reduce environmental losses. The policy expectation of reductions in nutrient loadings as a result of the mitigation measures will also have to be considered in terms of physiographic variability including soil nutrient status, soil hydrology, hydrogeology, meteorology and current water quality status. These factors result in a time lag between nutrient reduction at source and water quality response. Nitrate (NO3) and phosphorus (P) are typically differentially transported by leaching and surface/near surface flow, respectively. Time lag for NO3 includes the times for leaching through the unsaturated zone, movement through the aquifer and aquifer dilution; time lags can range 7 to 16 years for unsaturated zones <3m (Fenton et al. 2011). Phosphorus time lags include depletion of soil test P (STP), transport to receiving water and reduction of in-stream P. Depletion of STP is related to the initial total soil P content, STP and soil P balance. Estimated average time lag for STP to decrease from high to agronomically recommended was 7-16 years but may take >20 years (Schulte et al 2010). WFD expectations need to recognise the potentially long time lags involved in mitigation measure effects.

References

Fealy R.M. et al. (2010) Soil Use and Management, 26: 225 – 236
Fenton O. et al. (2011) Environmental Science and Policy 14, 419 – 431.
Schulte R. et al. (2010) Environmental Science and Policy 13: 472 – 484.
Wall D.P. et al. (2011) Environmental Science and Policy 14: 664 – 674.