European Commission

Science for Environment Policy

Fine-tuned policies needed to limit phosphorus runoff

New research in Ireland has evaluated two policies designed to reduce phosphorus runoff from agricultural land into water. Data indicate that policies need to be better tailored to specific times and locations, in order to deal with, for example, the impact of seasonal changes and different soil types on phosphorus runoff.

Intensive agriculture and high populations tend to transfer excessive amounts of phosphorus and nitrogen into water bodies, leading to eutrophication and harm to ecosystems. These nutrients are often from natural and chemical fertilisers used in agriculture. The EU Water Framework Directive (WFD)[1] and Nitrates Directive (ND)[2] seek to address nutrient pollution and in Ireland they have been ratified into the Nitrates Directive National Action Programme (NAP). Despite its title, it is concerned with the mitigation of both nitrogen and phosphorus transfer from agricultural land to water.

The study analysed detailed data for four river catchment areas to investigate the appropriateness of two major mitigation policies which are part of the Irish NAP, focusing on their effects on phosphorus runoff. These policies are: 1.) implementing a closed period, where no slurry is spread on the land, required by the Nitrates Directive, and 2.) disallowing fertiliser application to soils that have a soil phosphorus index of 4. The phosphorus index evaluates and ranks the potential risk of phosphorus loss from fields based on scientific measurements, such as levels of phosphorus in soil.

Two intensive grassland and two arable river catchment areas were studied. Measurements of phosphorus in soil were taken for every two hectares of land and measurements of the delivery of phosphorus into the rivers were taken on at least an hourly basis over one year.

Currently, the NAP states that no chemical fertilisers can be applied to soils with a phosphorus index of 4. However, the results indicated that a grassland catchment with only a 6% proportion of Index 4 soils delivered higher average concentrations of phosphorus' phosphorus into the river (0.7kg per hectare per year) than a grassland catchment with a higher 26% proportion of Index 4 soils (0.5kg per hectare per year).

The higher export of phosphorus from low phosphorus index soils was most likely due to the so-called 'flashy' nature of runoff, caused by impermeable soil that cannot easily absorb water. These findings suggest that a policy based solely on limiting the use of fertiliser on high phosphorus index soils may not be sufficient. Instead, it should also consider soil characteristics, as its permeability and likelihood of runoff. A high phosphorus index on permeable soils will not always have a high risk of loss in runoff.

The second policy tool that the study evaluated was the closed period of slurry spreading during winter. Results indicated that phosphorus concentrations in the rivers varied by season; concentrations (in river baseflow) were higher in the summer than in the winter in all catchments. This was because there was a lower flow of water during the summer, which meant phosphorus (particularly persistent identifiable sources) became more concentrated, compared to winter when there is greater rainfall.

The study highlighted the importance of informing policy with more detailed data on both soil and seasonal variations in phosphorus runoff. Climate change may also influence phosphorus concentration and runoff, which should be considered in future research and policy.

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1. See: http://ec.europa.eu/environment/water/water-framework/index_en.html

2. See: http://ec.europa.eu/environment/water/water-nitrates/index_en.html