Ranking high P load risk fields in a lowland plain for mitigation measures

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Dutch manure policy has substantially reduced agricultural nutrient surpluses but is still insufficient to reach the quality standards set by the EU-WFD in all water bodies by 2015 (Van der Bolt et al., 2008). In the eastern and southern sandy regions this is mainly caused by high soil P content due to excessive use of animal manure in the past. Additional measures are needed to further reduce P loads to surface waters. For the sake of cost-effectiveness such measures need to be targeted to critical fields. Three different methods to rank P-load risk are compared.

In the Netherlands P leaching is simulated at national scale with the mechanistic simulation model STONE (Wolf et al., 2005) that distinguishes 6405 spatial units (plots) with unique combinations of input data (soil, hydrology, crop, fertilizers), and with an average area of about 500 ha. Identification of critical fields requires a much higher spatial resolution. STONE is less suitable for this purpose, because of the large number of required input parameters. Besides, the 1D approach of surface runoff in STONE is a conceptual simplification of this poorly understood process under flat conditions. Hence we developed two alternative approaches along separate lines.

The PLEASE model (Schoumans et al., in prep.) combines the same mechanistic process description for inorganic P as STONE and soil P test information to calculate the P concentration profile in the soil, and uses a simplified description of the lateral flow from soil to surface waters to calculate P-loads. PLEASE requires input on the local characteristics precipitation surplus, seepage flux, depth of groundwater table, soil P test value (Pw) and phosphate adsorption capacity.

The third approach was developed for the P policy framework of the Province of Limburg (Noij et al., 2009). It ranks hydrological transport routes according to their expected contribution to P-load for every separate field. We distinguish surface runoff (SR), pipe drain discharge (PD), and lateral groundwater flow to small field ditches (FD) and larger ditches (LD). Shallow routes are more important for P. SR risk per field is ranked based on soil elevation data and connectivity. The importance of soil P was classified based on a comparison with STONE results for specific plots. The effectiveness of measures was judged by the ranking of the transport routes they tackle. The ranking of critical fields with the methods will be compared for the same region.

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