Horse paddock as a hot spot for P leaching in a small Swedish catchment

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Grazed grassland (savannas, grasslands, prairies steppes and shrub lands) covers more than 25% of the total earth land area and is a significant source of phosphorus (P) losses to natural waters (Parkyn and Wilcock, 2004). If the land is grazed for a long period this could lead to highly enhanced P concentrations in recipient water bodies (Nash et al., 2000), due to accumulation of manure and the decreased infiltration capacity of the soils in the trampled pastures. A horse paddock (3 ha) in central Sweden with dominant clay soil was studied in order to evaluate the risk of this being a "hot spot" for P losses to a recipient lake, which serves as the reserve drinking water reservoir for the city of Stockholm.

P concentration in drainage water from the underlying culvert of the entire catchment (30 ha) has been monitored for 10 years (1998-2008), and a soil characterisation was carried out in June 2009. The soil characterisation revealed that extracted P in an acid (pH 3.75) ammonium lactate solution (P-AL) from topsoil samples was in some areas of the paddock more than 500 mg P-AL kg^{-1} soil. The average for the five most frequently used yards was 190 mg P-AL kg $soil^{-1}$. The degree of P saturation in the same soil extracts (DPS-AL) was15%, which was similar (12%) to DPS estimated from oxalate soil extraction (DPS-ox). Flow-weighted averages of total phosphorus (TP) and dissolved reactive P (DRP) in subsurface run-off water were 0.50 and 0.37 mg L^{-1}, respectively. Concentration levels in tile drain water from a nearby monitored 4.4 ha agricultural field with a cereal and ley rotation were 0.17 and 0.05 mg L^{-1} for TP and DRP, respectively. In other words, the leaching load from the catchment with the horse paddock was approximately three times larger than from the nearby field while, the proportion of DRP (74%) was approximately twice as high. In addition, the seasonal leaching patterns were quite different with elevated P concentrations in summer periods from the horse paddock catchment. As opposed to high P concentrations that only appeared in connection to high water flow pulses during water saturated conditions in the field.

To mitigate P transports from the studied horse paddock and protect the recipient water body, a designed wetland has been constructed in August 2009. This contains a deeper sedimentation basin and two shallower vegetation-filter parts with planted wetland vegetation.

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