Reduced P losses after implementation of mitigation measures in a small agricultural catchment in Sweden

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Aim:
The aim of this study was to investigate the effects of implemented mitigation measures on losses of phosphorous (P) in a Swedish agricultural catchment dominated by heavy clay soils. The study was run within the project ‘Focus on Phosphorous’, where farmers, agricultural advisers, researchers and authorities have cooperated since 2007 in order to find and implement effective strategies to reduce P losses from agricultural land to water.

Methods:
Since 1994 water flow is measured continuously and water samples are collected manually every fortnight at the stream outlet of the catchment. In addition, an equipment for flow proportional sampling was installed in 2007. Both total and dissolved P were analyzed in the water samples.

Several mitigation measures were implemented in the area during 2009-2010:
- Sediment and vegetation were removed from the main stream (2009)
- 7% of the total arable land was converted into buffer zones (2010)
- Autumn tillage of arable land decreased from 7% in 2009 to 2% in 2010.
- About 90% of the arable land was structure limed with 4000 kg lime ha⁻¹ corresponding to 800 kg Ca(OH)₂ ha⁻¹ (2010)

Results:
P concentrations
Reduced total P concentrations have been observed in the manually collected samples since June 2010 (Figure 1).

In the flow proportional samples total P concentrations were low in June 2010 - September 2011, but peaks occurred during high water flow in the fall 2012 (Figure 1).

P loads
Despite quite large water discharge in subsequent years after the implementation of mitigation measures, annual total P loads calculated on manual samples were halved in 2011 and 2012 compared to the long term average (Figure 2).

In 2011-2012 the flow proportional sampling method resulted in higher annual total P loads compared to the manual sampling method (Figure 2). However, regarding the flow proportional samples it was more difficult to draw conclusions about any trends in annual total P loads due to the short period of sampling.

Conclusions:
• Decreased P concentrations were observed in both manual and flow proportional samples after the implementation of several mitigation measures in the area. When calculating P loads on manual samples, annual total P loads were halved in 2011 and 2012 compared to the long time average, despite quite large annual water discharges during those years.
• The results indicate that the implemented measures reduced the P losses in the catchment, although the effect of each measure could not be determined separately in this study.

Figure 1. Concentrations of total phosphorous (tot-P) in manual samples and flow proportional samples.

Figure 2. Annual water discharges (mm) and annual total P loads (kg/ha) from the catchment area.