Artificial Rainfall Experiments on the Swiss Plateau to assess Phosphorus Losses from Soils and Manure

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Eutrophication of surface waters is still a big issue regarding the water quality of some lakes located within the Swiss Plateau. While Phosphorus (P) losses from point-sources could be reduced drastically, diffuse P losses from agricultural land became the major cause for eutrophication. Talking specifically about lake Baldegg, an intensive mitigation program implemented in the year 2000 already brought substantial progress regarding the P concentration within the lake. However, to design more efficient and cost-effective mitigation schemes to further reduce diffuse P losses, we see a need to localise critical source areas (CSA) within the catchment.
Lazzarotto (2005) developed a semi-distributed model to predict such critical source areas in the Lake Sempach region, which is located also in the Swiss Plateau. In general, the model results were promising but several questions arose regarding the respective roles of incidental P losses (IPL) and P losses from soil. To investigate those questions sprinkling experiments were carried out in summer 2008 in the catchment of Lake Baldegg in the Swiss Plateau. They were performed on two different sites with a relatively low and with high concentrations of P in the topsoil, respectively. On each site 8 runoff plots were installed and manure was applied on half of the plots, simulating band application technique. Artificial rainfall of deionized water was applied 1 day and 8 days after manure application to investigate the dependence of IPL on the time between manure application and the runoff event. With this setup it is possible to investigate and compare the influence of soil P status and manure on P losses with surface runoff. In addition, these experiments are used to improve the database for water soluble P (WSP_{soil}) in soils and the corresponding dissolved reactive P in runoff (DRP_{runoff}) for high soil P status.
The artificial rainfall experiments clearly show that high P concentrations in soil lead to high DRP concentrations in runoff, indicating a linear relationship between WSP_{soil} and DRP_{runoff} for unmanured plots. This linear relationship however, is different for different runoff types. Manure has an effect on P concentration in runoff for low and high-P soils. However, the manure P cannot override the effects of different soil P status. The effect of manure is more pronounced for soils with low P status. In addition, the performed experiments indicate that runoff type and manure application technique strongly influence P concentrations in surface runoff. Based on these findings we want to adapt the input functions of the model and improve some model components. Scenario analysis using the enhanced model will hopefully give us more insight on how to enhance present mitigation schemes.