# Modeling the Effect of Buffer Strips on Surface Losses of Particulate Phosphorus

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A modified version of the ICECREAM model (Tattari et al. 2001, Larsson et al. 2007) is frequently used to estimate the influence of different agricultural management practices on phosphorus losses from Swedish agricultural fields. Since buffer strips (BS) are one of the most important practices to reduce surface losses of particulate phosphorus (PP) from agricultural land it is important to be able to represent the effects of BS in an accurate way in the simulations. In this study the model option to divide the field into different segments with different crops and management was tested to simulate the effects of grass buffer strips on PP losses with erosion. Simulations were carried out to assess the influence of different climate input, crops, soil types, and field geometrical parameters (slope, field length, and BS length) on PP losses and their reduction by a BS when run for a period of 20 years.

The parameter affecting PP losses most strongly was the slope gradient. An exponential increase of the average annual loss up to 13 kg ha$^{-1}$ a$^{-1}$ was observed when the slope steepness was shifted from 1 % (0.5 kg ha$^{-1}$ a$^{-1}$) towards 10 %. Of the investigated non field geometrical parameters, soil type had the strongest effect on PP losses. Ten different soil types, ranging from sand to clay, according to the FAO classification system, were tested. The results were differing by the factor 10 with the highest losses of up to 1.8 kg ha$^{-1}$ a$^{-1}$ (slope steepness 2 %) for soils rich in silt and clay.

Irrespective of climate, soil type, crop, and amount of PP loss, the reducing effect of a 10m BS was rather constant and ranged from 60 % to 70 % in scenarios with 40 m field length and a slope gradient of 2%. However, the field geometrical parameters influenced the relative reducing effect of the BS. With increasing BS length the reduction efficiency increased as well, although with a diminishing effect per each extra length unit added (20 % (1 m BS); 62 % (10 m BS); 81 % (30 m BS)). An exponential increase of the PP loss reduction effect could be observed when the slope steepness was elevated. Expanding the field length led to a decrease of the BS efficiency. This decrease was as well diminishing the further the field was expanded.

The still ongoing evaluation of the results indicates that the model is able to reflect the behavior of a BZ in terms of reducing PP surface losses in a reasonable way and in accordance with observations reported in literature. Hence, the modeling approach is promising and will be further tested in the national assessment of P-losses from Swedish agricultural land performed with the ICECREAM model. However, further studies on how to account for the effects of BS when scaling up the simulated results from field level to catchment and regional level have to be done.

Larsson, H. M., K. Persson, B. Ulen, A. Lindsjö, and N. J. Jarvis. 2007. A dual porosity model to quantify phosphorus losses from macroporous soils. Ecological Modelling. 205:123-134.

Tattari, S., I. Bärlund, S. Rekolainen, M. Posch, K. Siimes, H. R. Tuhkanen, and M. Yli-Halla. 2001. Modeling sediment yield and phosphorus transport in Finnish clayey soils.Trans. ASAE. 44:297-307.