Rills switch catchments into a higher P-load mode - a case study

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The water quality of Lake Balaton had improved after the various interventions to reduce external P load between the late 1970`s and early 1990`s. However, the improvement seems to have reversed in the recent years and hypertrophic conditions can be frequently observed during summer period in the shallow water near the shoreline. The bad water quality is also not uncommon in the open water in the Keszthely- a Szigliget-basin. Further reduction of the external P load must be pursued to achieve WFD targets.

The loess derived and eroded soils in the southern watershed of the lake are largely under agricultural cultivation. The Somogybabod study catchment (7 km2) belongs to the catchment of the Tetves stream that drains approximately 80 km2 into the lake. Only 35 % of the study catchment is arable land the rest is woodland, orchards and bushes along the ephemeral stream in the valley bottom. The rainfall and water level is continuously monitored at the outlet of the catchment, samples are automatically taken during runoff events and later, runoff, suspended sediment an phosphorus load are calculated. The arable land was monitored for basic soil properties and 61 surface soil samples were collected. We conducted laboratory experiments with them to simulate erosion processes and P load. We analysed the data from 2006 in this study. A short but heavy rainfall on 29th June 2006 resulted in excessive runoff and erosion and formed several rills on the arable land. The rills were monitored on the field for depth and cross section, and soil bulk density was measured beside the rills, the length was derived from satellite images and the calculation was partly controlled by GPS measurements. Aerial photos were used to digitize strongly eroded spots on arable land which are white from high calcium-carbonate content in dry condition.

The calculated soil loss from rills was comparable with the exactly measured sediment loss at the outlet. However, total P concentration of the sediment indicate that bulk soil en-masse was eroded only at the very beginning of the runoff event, and later on, P-enriched soil was delivered due to the partial settlement of the particles. We calculated that at least three times more soil eroded originally from the surface than we could measure at the outlet. Partial coincidence of strongly eroded spots and rill heads indicate that periodical rill formations significantly contribute to the erosion and P load from the catchment. Comparison of the runoff events before and after the rill forming event reinforces the existence of elevated P transport due to the improved connectivity. SWAT model runs confirm the observations that with rills, slight footslopes will produce much less runoff and erosion while steep slopes in shoulder position produce more.

Our conclusion is that prevention of rill formation must be a priority tool to reduce P load into Lake Balaton and to achieve WFD target.