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Historical Changes and remediation Measures of Agricultural Streams

Anders Wörman, Joakim Riml, and Ida Morén
The Royal Institute of Technology, Division of River Engineering, Stockholm, Sweden (worman@kth.se)

Changes in landscapes and climate during the last centuries in Sweden can be tracer in dramatic changes in the runoff pattern over large areas. Particularly, extensive drainage works aimed at expanding arable land and reduce risks for local floods. The availability of long-term monitoring runoff time series make it possible to distinguish the effects of landscape changes from climate fluctuations. However, it is expected that these changes also have an effect on retention and attenuation of nutrients in agricultural streams. This work focuses on design approaches for remediation actions in streams that can restore some of the previous self-purifying capacity and, hence, contribute to improved eutrophication status of the Baltic Sea.
For analysis of historical time-series we propose a separation of the power spectral response of runoff in watersheds in terms of the product of the power spectra of precipitation and the impulse response function for the watershed. This allows a formal separation of the spectral response in climatic factors – the precipitation – from those of land-use change and regulation – the impulse response function. We found periodic fluctuations in runoff all over Sweden that can be explained by various climate indices. In addition, we found that the intra-annual variation in runoff was primarily affected by the land-use change in 79 unregulated catchments with up to century-long time series of measured daily discharge. Finally, we developed a design approach for stream remediation actions that restored the self-purification capacity while also increasing the risk for local floods. It is shown that step-structures, like check dams, are effective measures for inducing hyporheic exchange and thereby increasing potential for adsorption of phosphorus to soil and denitrification of nitrogen in biofilms.