Assessing the effect of constructed wetlands on non-point source nitrogen and phosphorus removal.

K.S. Tonderski[1], B. Arheimer[2], A.-K. Thorén[2] & C. B. Pers[2]

[1]IFM Biology, section Ecology, Linköping University, Sweden. *karsu@ifm.liu.se*

[2]Swedish Meteorological and Hydrological Institute, Norrköping, Sweden

Introduction

In Sweden, economic subsidies have resulted in the creation of about 4000 ha wetlands during the period 1996 – 2006, aiming at increased biodiversity and/or reduction of the riverine N transport. The estimated *net* effect is 110 tons yr^{-1} lower N load to the sea [1]. However, this does not show the potential effect of wetlands on riverine N transport, as many are not located in areas with high N losses.

Aim of the study

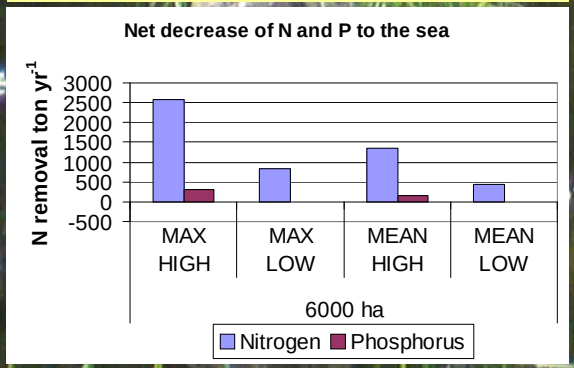
- To do a scenario analysis of the effect on the N and P load to the sea of an additional 6000 ha wetlands if created in areas with high losses of nitrogen and phosphorus from agriculture.
- To analyze some of the uncertainties associated with model assumptions and process descriptions when assessing catchment scale effects of wetlands to decrease the load of N and P to water bodies.

Methods

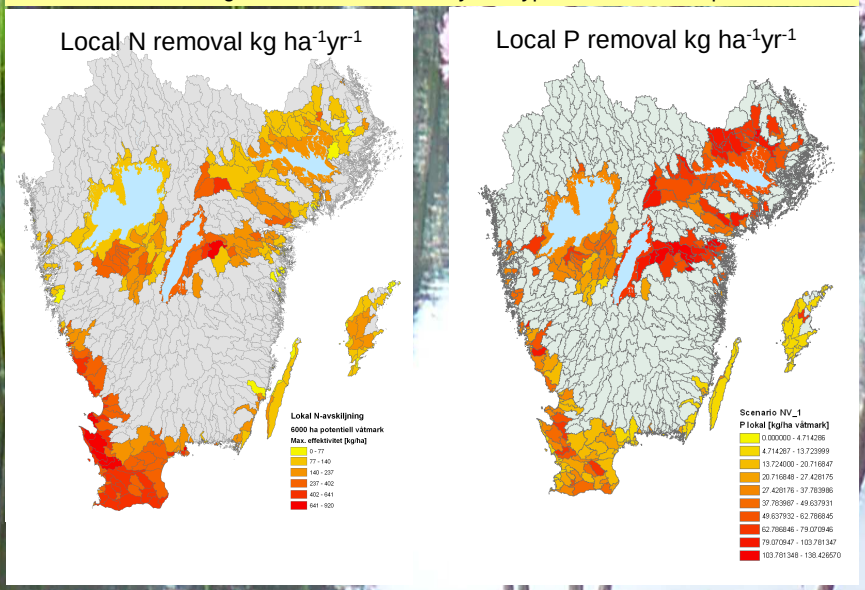
- The effect of potential new wetlands on the N and P load to the sea from South Sweden was calculated for 250 – 400 km^2 catchments [2]. The N/P transport from each catchment was simulated with the model HBV-NP, and then the N/P removal in wetlands was modelled.
- Each catchment with >22% cultivated land was assigned a certain wetland area depending on the N/P leakage (0.1 – 0.4% of agricultural land). Two scenarios for location of the wetlands (i.e. N/P loads) were simulated: assuming the drainage basin to the wetlands consisted of land with the highest N/P loss in each catchment (**Max**Load), or land with mean N/P losses in each catchment (**Mean**Load).
- Wetland N/P removal was simulated with a first order area based removal equation [3] and the rate constant, *k*, set to the highest **(H)** and lowest **(L)** values obtained from data for monitored Swedish wetlands; a min retention time of 2 days was used.

Results

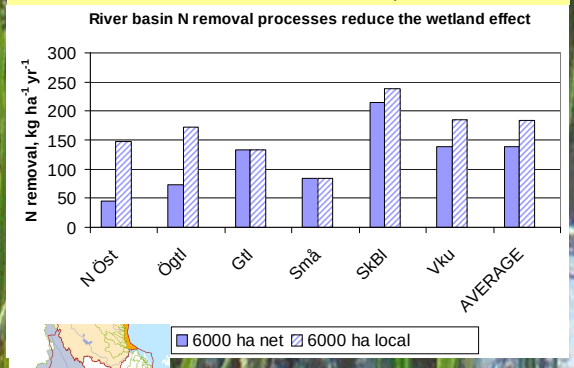
The difference between the scenario with highest and lowest effect of wetlands was about 2100 tons of N and 300 tons of P; the removal rate coefficient range was more important than difference in N and P leakage

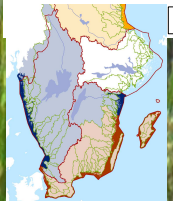


The local wetland N and P removal varied with at least a factor 10 between the catchment with the highest and lowest N or P removal in kg ha^{-1} yr^{-1}. Wetlands with highest P retention were located in other catchments than wetlands with highest N removal, due to leakage differences caused by soil type and cultivation practices



In some water districts (map below), modeled river basin N removal processes resulted in large differences between the **local** N removal in wetlands in each catchment and the **net effect** on the N transport to the sea.





Conclusions

Quantitative estimations of the large scale effect of wetlands on the N and P transport are quite uncertain - >6 times difference between the scenarios simulated. The largest uncertainty was caused by the differences in observed removal rate constants.

Modelled river basin removal processes resulted in up to three times lower ***net load*** to the sea than the ***local*** N and P removal effect – thus also the regional location should be considered for best effect.

References

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