Geophysical Research Abstracts
Vol. 20, EGU2018-12055, 2018
EGU General Assembly 2018

Internal loading from stream bed sediment: insignificant or a missing link?

Emma Lannergård, Oskar Agstam-Norlin, Brian Huser, and Martyn Futter
Swedish University of Agricultural Sciences, Aquatic Sciences and Assessment, Uppsala, Sweden (emma.lannergard@slu.se)

It is well known that internal loading of phosphorus (P) in lakes can impede recovery despite reduced input of excess nutrients. On a catchment level, streams are important pathways for P transport to lakes and estuaries. However, they may also temporarily store significant amounts of P. Stream bed sediment P storage depends on degree of sediment mobilization and chemical composition. Thus, stream sediment can act both as a sink and a source of P depending on abiotic and biotic factors.

We hypothesized that stream bed sediment in a mixed land use catchment in Sweden could be a significant source of legacy P. To assess the potential for internal loading from stream sediment compared to lakes we collected triplicate sediment cores from 9 streams ranging from headwaters to 4th order and a mix of forest and agricultural land cover, as well as 5 lakes in the same catchment. All cores were collected with a sediment gravity corer, and sliced in to sample intervals of 1 cm and 2 cm. To evaluate sediment P stores with varying solubility and reactivity, a well-known sequential chemical extraction method was used. The method is commonly used on lakes, but rarely on streams. We quantified different P fractions, with varying solubility and reactivity. The fractions were operationally defined as loosely bound P, Fe/Mn bound P, Al bound P, organically bound P and Ca bound P.

Concentrations of different P forms in stream sediment were comparable to the amounts found in lake sediment, but varied also substantially in some cases. The 5 lakes showed similar patterns regarding total amount of P, trends in concentration with depth in the sediment and the distribution of P within the different pools, while the streams showed large variation between sites. Stream order, land use type, water flow intensity and watershed soil type were all related to the amounts and proportions of sediment P fractions in the different streams. We found more P in 1st order streams draining forests and less in higher order streams draining agricultural land and with higher daily mean water flow. Sediment P composition also differed between streams. In the 1st order streams draining forests, P bound to organic matter, Fe and Ca were the dominant fractions. In higher order streams draining agricultural land, P bound to Ca was the dominant fraction. In some streams the fractions of seasonally bioavailable P (defined as loosely bound plus Fe-bound) were as large as in lakes, while in other streams these fractions were considerably lower.

These results are important for understanding P transport in a catchment, for example when using process-based models. The results also indicate that measures like dredging of streams could have a considerable larger environmental importance than previously assumed. The controls on readily available P in lake and stream sediments need to be further investigated to gain improved quantification of the relative importance of P storage and transport from streams in mixed land use catchments.