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MARINE DECREY

The efficiency of in-stream phosphate uptake and retention along a gradient of in-stream nutrient loading

MASTER THESIS
ABSTRACT

Low order streams are playing an important role in freshwater ecosystems by providing many goods and services. Increasing anthropogenic pressure, changes in land use and intensification of agriculture have led to an increase of phosphorus load in streams, which have for consequence a degradation of the water quality. Low order streams represent important sites of nutrient uptake and retention which can mitigate the downstream effect of phosphorus loading.

A better knowledge about the impact of an increasing concentration on the uptake efficiency is needed to develop a better management of freshwater ecosystems. This research aimed to understand how the in-stream phosphate uptake efficiency changes with increasing phosphate concentration. We were also interested in determining which factors influence the efficiency of in-stream phosphate uptake. We performed consecutive short term phosphate additions in nine stream reaches with different background phosphorus loads, to compare the response of streams to increasing phosphorus supply.

The analysis of the results showed that the phosphorus load in streams had a negative impact on the uptake efficiency. We showed that the uptake length increased when the background concentration increased. We also demonstrated that moderately loaded streams were adapted to phosphate pulses and consequently didn't show any saturation pattern when subjected to phosphate pulses, even if their uptake performance were low. Low loaded streams showed saturation pattern when subject to highly concentrated pulses. We also observed that the uptake efficiency was enhanced when the wetted perimeter was large.

This enlightened the fact that natural morphology, which usually provides a large surface area for the stream, is an important factor influencing uptake efficiency. Hence, efforts have to be made to reduce the phosphorus load in streams, which will allow a better uptake efficiency. Further investigations are also needed, especially to understand the role of the algae and biofilms in the uptake and their possible adaptation to phosphorus pulses.