



## Natural phosphorus and dry matter loading from clayey boreal catchments in Finland

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Lake management design and water quality modeling utilize data on diffuse nutrient export from catchments to the receiving lakes. Background nutrient export estimation from fine-grained soils requires examination of catchments in their natural state. However, Finnish fine-grained soils are mainly cultivated or otherwise utilized, which makes the estimation challenging. For this reason the study aimed to model the natural levels of dry matter and phosphorus loading from the catchment based on lake sediments that accumulated before significant human action.

The study lakes were selected based on three main criteria: 1) Ratio of 1/10 between lake and catchment size was set as target. 2) simple lake basin morphology: round-shaped with a flat bottom, 3) The percentage range of fine grained materials within the catchment was as wide as possible so that a sufficient composition gradient was obtained. A total of 22 lakes with sizes ranging between 15 and 1 242 ha were selected from Southern Finland.

Natural lake water phosphorus concentration was inferred with diatom-based modeling utilizing biotic assemblages from sediment that accumulated before human impact. The inferred concentration varied between 12 and 79  $\mu\text{g/l}$ . There is some bias in the inferred values due to model properties that result in overestimation of the lowest phosphorus concentrations. The results suggest that natural lake water phosphorus content increases as sediment grain size decreases. However, sediment phosphorus concentrations decrease as well.

Natural and recent (1986 – 2011) dry matter accumulations were compared by dating the samples with  $^{14}\text{C}$  and  $^{137}\text{Cs}$  methods. The accumulation results were 16 – 217  $\text{g/m}^2/\text{a}$  and 346 – 2626  $\text{g/m}^2/\text{a}$  respectively. Dry matter accumulation increased as the sediment grain size decreased, counteracting the influence of decreasing sedimentary phosphorus concentrations on net accumulation of phosphorus in the basin.