The effects of land use on organic carbon, nitrogen and phosphorus export in boreal catchments

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Aims:

1) Estimate total organic carbon (**TOC**), dissolved organic nitrogen (**DON**) and phosphorus (**DOP**) **export** from terrestrial part of the catchment

2) Evaluate how much **background leaching and land use** explain the exports and concentrations in lakes

3) Assess the relative importance of different export sources and possibilities to **control loadings**

Data and methods:

- 12 lakes in eastern Finland (Fig. 1)
- Land cover data from Corine06 database
- Forest regeneration from National Forest Inventory data and maintenance ditching from Centre for Economic development, transport and the environment records
- Lake water quality monitoring data from Finnish Environmental Centre (SYKE) OIVA database
- **Kustaa computation tool** was modified to TOC, TON and TOP export using specific export approach
- **Terrestrial export = background leaching + area*specific export**
- Background leaching of TOC and DON were predicted by using the share of peatlands in the catchments and DOP as a proportion of TOC.
- DON and DOP specific exports from agriculture were estimated from TOC export by assuming similar C:N and C:P ratios than in background leaching.
- Spesific export of TOC from livestock was estimated by using rural areas wastewater act's minimum requirement. DON and DOP exports from livestock and wastewater treatment plant were achieved by assuming that 1/3 of the total N and P export are in organic form.

Background leaching dominates TOC, DON and DOP export (Fig. 2)

- The proportion of **peatlands** in catchments is the most important factor determining exports
- In the catchments where the proportion of peatlands was low **agriculture** was the largest source of exports
- The significance of **forestry** was small, only 1% of the DOC and DON export and <10% of the DOP export
- Modelled TOC, DON and DOP concentrations corresponded well (r^2=0.78, r^2=0.55 and r^2=0.80, respectively) to the measured **lake water concentrations.**
- The model slightly overestimated the concentrations in areas with small peatland percentage.
- Model succeeded to rank lakes according to water quality suggesting this kind of models can be used for **classification of lakes** and further estimate the influence of **land use changes** to **water quality.**
- Possibilities for controlling loadings are limited to catchments where peatland proportion is low and **anthropogenic sources** significant

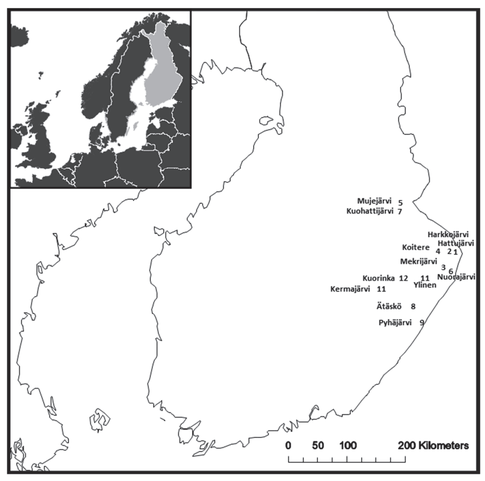

Fig. 1. Location of the study lakes.

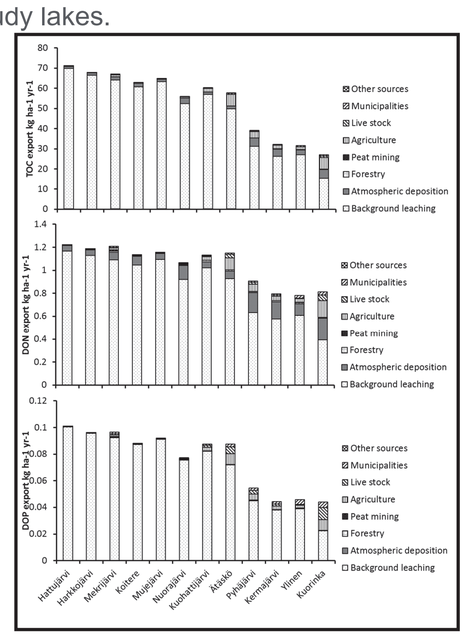

Fig. 2. Modelled total organic carbon (TOC), dissolved organic nitrogen (DON) and dissolved organic phosphorus (DOP) exports for different land use types in the study catchments.

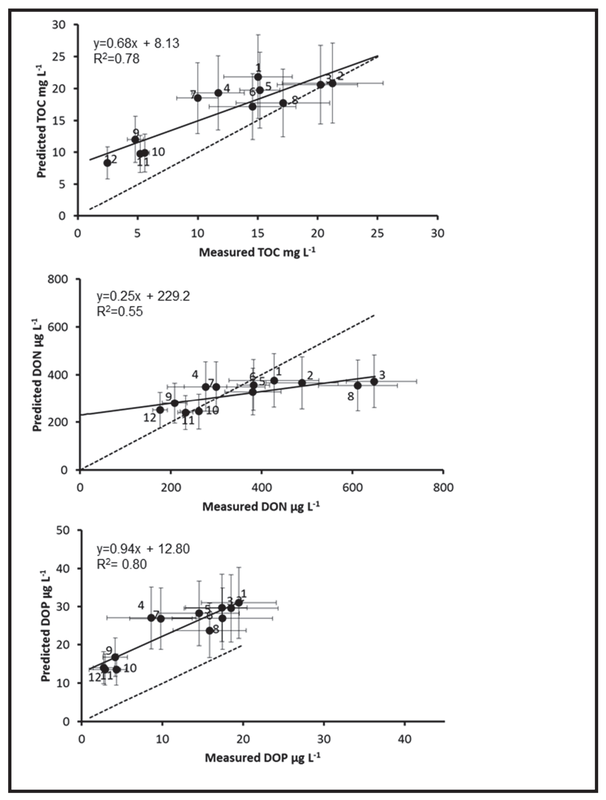

Fig. 3. Predicted and observed total organic carbon (TOC), dissolved organic nitrogen (DON) and dissolved organic phosphorus (DOP) concentrations (mean ± SD) in the study lakes. The numbers of the lakes are presented in tables 1, 2 and 4. Solid line is regression line and dashed line is 1:1 line.

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