The effects of land use on carbon export in boreal catchments

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Aims:

1) Estimate total organic carbon (TOC) export from terrestrial part of the catchment
2) Evaluate how much background leaching and land use explain the C export and concentrations in lakes
3) Assess the relative importance of different export sources and possibilities to control C loading

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
- Kustaa computation tool was modified to TOC export using specific export approach
- Terrestrial export = background leaching + area*specific export
- Background leaching was predicted by using the share of peatlands in the catchments (Kortelainen et al. 2006)
- Dissolved carbon and suspended solids (SS) were computed separately
- TOC = dissolved C + SS C content
- It was assumed that background leaching, forestry, municipalities organic matter content of SS is 50% and C content of organic matter is 50%
- In agricultural areas organic matter content of SS was assumed to be 10% and in peat mining areas it was assumed to be 80%

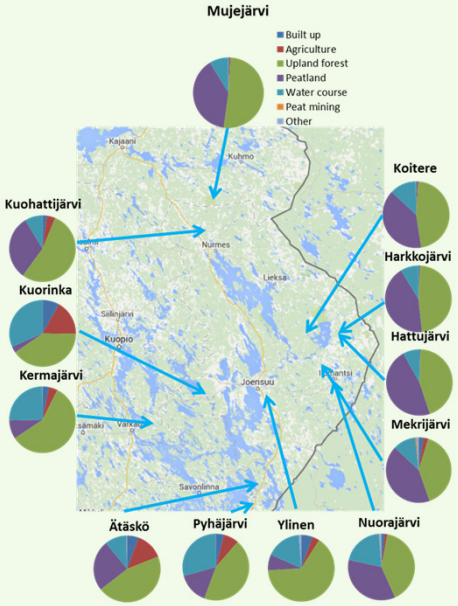

Figure 1. The location of lakes and land use in their catchments.

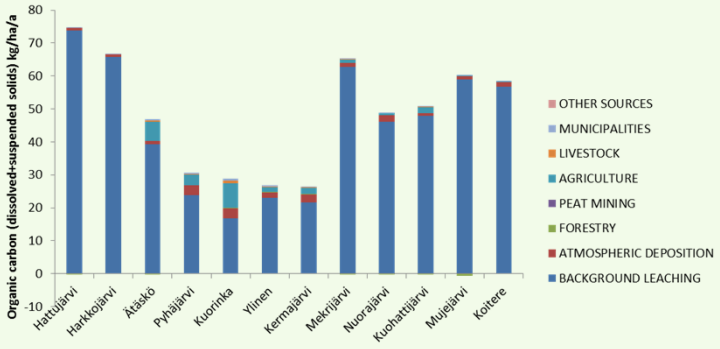

Figure 2. Annual organic C export estimated by Kustaa-tool.

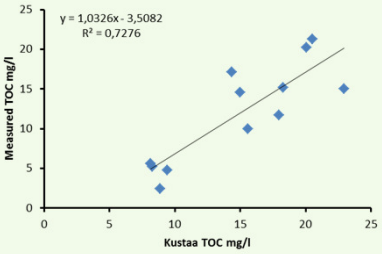

Figure 3. Measured and predicted TOC concentrations in the study lakes.

Background leaching dominates C export

- The proportion of peatlands in catchments is the most important factor determining C export
- In the catchments where the proportion of peatlands was low agriculture was the largest source of C export
- The significance of forestry was small, only ≤1% of the total C export
- Forest regeneration increases C export but maintenance ditching decreases
- C export can be predicted reasonably well by using simple specific export computation (Kustaa tool)
- More data would be needed about the C export from agricultural areas
- Possibilities for controlling C loading are limited to catchments where peatland proportion is low and anthropogenic sources significant

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Reference: Kortelainen P, Mattsson T, Finér L, Ahtiainen M, Saukkonen S and Sallantaus T 2006. Controls on the export of C, N, P and Fe from undisturbed boreal catchments, Finland. Aquatic Sciences 68: 453-468.

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