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Land cover controls the export of terminal electron acceptors from boreal catchments

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NO_3, Mn, Fe and SO4 act as terminal electron acceptors (TEAs) modifying mineralization pathways and coupling biogeochemical cycles. Although single TEA concentrations and fluxes have been intensively studied, the factors regulating the simultaneous fluxes and molar ratios of TEAs are poorly elucidated.

We studied the mean concentrations, exports and molar ratios of TEAs from 27 boreal catchments differing in land cover (percentage of agricultural land, peatland, forest and built-up area) in the years 2000–2011. TEA exports and molar ratios were strongly controlled by land cover and only little by atmospheric deposition. There were a great variability of the export of TEAs from different land cover classes. Fields produced the highest export of TEAs, particularly NO_3. Peatland was linked to low NO_3 and SO4 but high Fe exports. NO_3, Mn and Fe exports from forests were low, SO4 having proportionally the highest export. Together, the percentages of field and peatland predicted 93%, 80%, 75% and 67% of the variation in the export of NO_3, Mn, Fe and SO4, respectively.

Our results showed that the export and molar ratios of TEAs in northern European boreal catchments are predominantly a function of land cover and catchment processes rather than atmospheric deposition. The variable export of TEAs having different availability and physical behavior may create different premises for anaerobic mineralization in downstream systems, which adds a new dimension to the link between terrestrial system, land use and environmental problems such as eutrophication and climate change.