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Benthic macroinvertebrates and the use of stable isotopes (δ^{13}C and δ^{15}N) in the impact assessment of peatland use on boreal stream ecosystems

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Stable isotope analysis (SIA) can provide insights into carbon flow dynamics and trophic positions of consumers in food webs. SIA is used in this study, where we assess the possible changes in the basal resources of Finnish boreal stream ecosystems and differences in the impact of two forms of peatland use, forestry and peat mining. About 30% of the total land area of Finland is classified as peatland, of which about 55% has been drained for forestry and about 0.6% is in peat production. Unlike forestry, peat production is regionally less scattered and can thus have measurable local impacts although the total area of peat production is small.

Three watersheds were used as study areas. Within each watershed, one stream drains a subcatchment affected only by peat mining, whereas the other stream flows through a subcatchment affected by forestry. The two subcatchment streams merge to form a single stream flowing into a lake. Studied watersheds were subject to no other forms of land use. In addition to the impacted sites, we used two pristine natural mire and two natural forest catchments as controls.

We analysed the stable isotopes of carbon (δ^{13}C) and nitrogen (δ^{15}N) from benthic macroinvertebrates, stream bank soil, stream sediment, and dissolved organic carbon (DOC) in stream water. Samples for stable isotope analyses were collected in the summer of 2011 and samples for invertebrate community analyses in the autumn of 2011. Upon sampling we measured several physical parameters at each sampling site. In addition, stream water samples collected in summer and autumn 2012 were analysed for CH_4 and CO_2 gas concentrations and autumn gas samples also for their δ^{13}C values.

Our initial SIA results of invertebrates suggest some degree of discrimination between different sources of OM and possible effects on feeding habits, presumably due to the quality of the basal resources. We will explore this result further by examining not only taxonomical structure, but also the role that functional feeding groups may have on results. Initial results on invertebrate community structure in response to land use indicate the importance of geographical site location over land use effects. We suggest that SIA results should be interpreted together with benthic macroinvertebrate community analyses to get more insight into ecological impacts of different peatland uses with respect to changed food quality. Further, we will assess whether CH_4 and CO_2 could be used as an indicator of basal resource change. In future studies, we will address the role of the quality and quantity of the basal resources in more detail, which is likely to provide more insight into the effects of different forms of peatland use on aquatic ecosystems.