Nordic Bioeconomy Pathways - water quality impacts of various scenarios and projections in the peatland-dominated catchment

# Abstract

The alternative pathways for using bioresources can lead to plausible stressors in Nordic catchments. The impact of potential future bioeconomy projections on land system management (LSM) attributes, and the impacts on water quality, was analysed in a northern Finnish catchment Simojoki, characterized by peatland forestry. The LSM attributes include catchment management strategy, biomass removal and stand management, and fertiliser use. The catchment-scale projections were downscaled from Nordic Bioeconomic Pathways (NBPs) which are subsets of Shared Socioeconomic Pathways (SSPs). A stakeholder-driven questionnaire, the Finnish forest dynamics model (MELA), and a hydrological catchment model (SWAT) were integrated to explore the consequences of land management practices in different NBP scenarios. The hydrology and water quality parameters were calibrated in the SWAT model. Then, based on stakeholders' and output of the MELA model for multiple LSM attributes, NBP scenarios were built to simulate flow, nutrients, and suspended solids. Greenhouse gas emission pathways were also integrated with NBP scenarios to analyse an extended perception of climate change (CC). The impacts of stakeholders' opinions, the MELA model, and their input on the SWAT model were noticeable in hydrology and nutrients. For catchment management strategy attribute, the outcomes of the proposed scenarios resulted in an annual decrease of total nitrogen (0.7%) and total phosphorus (0.5%) for NBP 1 and NBP 2, whereas for other NBPs, there was around a 0.25% increase for both nutrients. When climate input was integrated with the attributes, there was lower variability. The reduced stand management and biomass removal led to lower flow and nutrients for NBP 1 and NBP 2, whereas other NBP scenarios resulted in increased flow and nutrients with decreased evapotranspiration. The approach followed in this study can aid to identify the spatial zones of excessive or reduced loading in a catchment with peatland forestry compared to the current condition.

Keywords: Stakeholder, Climate change, Sustainability, Nutrients, Modeling, Landuse