

An integrating nexus of land and water management for a sustainable Nordic bioeconomy (BIOWATER)



Nordic water bodies face multiple stressors due to human activities, generating diffuse loading and climate change. The 'green shift' towards a bio-based economy poses new demands and increased pressure on the environment. Bioeconomy related pressures consist primarily of more intensive land management to maximise production of biomass. These activities can add considerable nutrient and sediment loads to receiving waters, posing a threat to ecosystem services and good ecological status of surface waters. The potential threats of climate change and the 'green shift' highlight the need for improved understanding of catchment-scale water and element fluxes. BIOWATER consortium will provide solutions for land, environmental and water resources management in the face of potential and competing demands for biomass, land and water resources related to the green shift.

During the recent years, Biowater has developed socio-economic pathways which take into account climate change by using shared socioeconomic pathways (SSP) in Nordic context. These five Nordic Bioeconomy Pathways (NBPs) are based on relationships between climate change adaptation and mitigation. NBPs were analysed simultaneously in expert workshops held in Norway, Sweden, Denmark and Finland. Finnish workshop took place in Oulu mid April 2019 together with official river basin co-operation group of North-Ostrobothnia. Effects of Land use and climate change on biogeochemical budgets of C, N and P are being analysed together by using a Nordic dataset from ~60 research catchments. In general, loading of organic carbon has increased and brownification is very obvious and visible in watercourses. Despite of huge efforts related to water protection, also nitrogen fluxes are still increasing, particularly from peat-dominated river basins in North-Ostrobothnian area. Biowater brownification experiments related to river biota have taken place at Paltamo experimental station starting from summer 2018 with results showing the decrease in biodiversity with increasing humic contents.

Biowater case study catchment is river Simojoki, where effects of peatland drainage are visible in water quality. Ecosystem service valuation is realized at same catchment by using choice experiment approach by interviewing local citizens in June 2019. Similar interviews are done at all Nordic countries. The preliminary results show preference for a more balanced distribution of agriculture and forest, improved water clarity, increased area used for nature reserves, reduced flood frequency and increased employment from agriculture, forestry and fishery. Variation among study areas is significant in several of these attributes, and likely linked to respondent and catchment characteristics. Since the landscape attributes can be affected by the transition to a bioeconomy, policy makers should take into account the effects of this transition on the supply of cultural services by considering the effects on welfare generated by cultural services when implementing policy.

In addition to the survey analysis we have developed a methodology for ecosystem service assessment. The developed framework integrates all potentially relevant services across a catchment or landscape, is minimal in its assumptions, allows implementation of scenarios, keeps track of the different service flows in a transparent way and uses a monetary evaluation step to compare scenarios. The framework was tested in two catchments, Lillebæk (Denmark) and Ovre Haldenvassdraget (Norway) with four future bio-economy scenarios for 2050. The results show that our framework has sufficient resolution to show differences in service delivery among scenarios.

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