

Popular Science summary of results from EUTROPIA project

A CNP analysis robot is developed and implemented in cooperation with NIVA. This instrument enables efficient and accurate determination of nutrient fractions in water. Passive sampling of free phosphate (P) and low molecular weight organic phosphate compounds is tested using DGT. A new DGT adsorbent of TiO is found to have much better properties. The results show that DGT is a promising tool for monitoring of bio-available P in the water.

Ongoing water monitoring is extended with respect to chemical parameters. A forest fields and agricultural fields are instrumented and soil and water samples collected with a focus on episode studies. Water chemistry during winter in Vansjø is mapped. Soil samples from uncultivated land in the whole catchment area are collected. Water samples are analyzed for particle content and major anions and cations, and P fractions. The chemical and mineral composition of the particles is determined. Soil samples are analyzed with respect to physical and chemical properties, focusing on the differing pools of P. Experimental trials on P leaching from photo-oxidation of dissolved natural organic matter (DNOM) is performed and studied further. Sediments in Sæbyvannet is about to be investigated.

Runoff from forests, which account for 85% of the catchment area, contributes a significant amount DNOM and labile inorganic aluminum (Ali). The concentration of DNOM is almost doubled, while Ali has been reduced to a third over the last 30 years in fresh water in southern Norway. Increased DNOM provides increased flux of nutrients (C, N, P) bound to organic material. Background influx of P is particularly high in areas such as Morsa where 90% of the watershed has marine sediments. When DNOM is partially mineralized by photo-oxidation in lakes it releases bio-available P, but also Al and Fe. The Al and Fe will precipitate and co-precipitate phosphate. The importance of nutrient transport by DNOM is therefore unclear and is studied further. Reduced leaching of Ali, due to reduction in acid rain, lead to reduced co-precipitation of free phosphorus when forest runoff downstream mixes with runoff from agriculture. This reduced Ali precipitation of phosphorus can be a key explanation for why the measures against eutrophication apparently has not given the expected effect. Water chemistry in Vansjø suggest that the importance of particulate P is overvalued. Drainage pipes is an important transportation route to P. This is due to the rapid transport of P from the plow layer through macro pores and that the soil around the pipes are marine clay saturated with P. Up to 80% of the flux of total P in a typical agricultural stream occurs within 36 days of high flow, and most come in during the spring melt and autumn. Years with mild winters (07/08) have significantly higher P flux than the years with cold winters (09/08 & 10/09).

Data from the monitoring program along with project data are now used to calibrate the SWAT (Soil and Water Assessment Tool) and MyLake models. SWAT is calibrated for JOVAs Skuterud catchment, which is representative for large parts of western Vansjø's watersheds. The challenge lies in linking the understanding of the processes that occur in the soil and how it affects the nutrient runoff in the first-order streams, with the mechanisms governing water chemistry of rivers that drain into Vansjø.

Simulation models cannot be run simultaneously, and not necessarily connected to the expert-based models, to assess the overall uncertainty in the prediction of abatement action. A Bayesian network will be used to connect the simulation results between the different domain models applied in Eutropia; Seamless model that calculates the costs of various agricultural technical measures, SWAT, the MAGIC model that calculates concentrations of Ali, the P-loss formula and MyLake. The

interfaces between the models and the probability distributions for input and output variables taken into the Bayesian network are specified.

The Bayesian network will be used to assess the overall uncertainty in the causal chain, to identify the most uncertain parameters in the entire chain, and to make cost-effectiveness assessments of abatement actions. Optimal measures for reducing nutrient flow to the Vansjø are already completed. A key challenge for the project is therefore whether the models will be able to detect the effects of marginal measures.

The minutes from Morsa's Executive Committee / Board are analyzed and form the basis of 30 interviews to be conducted with the members. The interview guide has been formulated and approved by NSD. Overview of interviewees among farmers are obtained. 20 farmers will be selected in order to have different types of production and localization represented. Interview template is completed and approved by NSD. The interview guide is worded to cover matters that fall outside of a model-based Bayesian analysis. Interview guides are designed as semi-structured.

Assessment of the DPSIR will include an assessment of the relationship between the DPSIR and Bayesian network analysis. The work will be done next year to be coordinated with other work.