Development of cost effective nitrogen management strategies with the FyrisCOST DSS

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This paper describes the structure of the FyrisCOST model and uses the model to calculate the cost efficiency of alternative scenarios for nitrogen management in an agricultural catchment in Southern Sweden. The scenarios include the spatial distribution by sub-catchment of three measures (catch crops, spring plowing and a combination of these) with alternative crop distributions.

The model FyrisCOST is a catchment scale DSS for the evaluation of alternative nutrient mitigation strategies. This model is able to evaluate a range of mitigation approaches for phosphorous and nitrogen from several sources (point and diffuse). This allows cost efficiency to be estimated for a catchment based on a combination of measures. Hydrological flows in the FyrisCOST model are built on the semi-distributed model Fyris NP and nutrient losses are derived from simulations from the Nutrient Leaching Coefficient Calculation System (NLeCCS) which includes the ICECREAM-DB model for estimating phosphorus losses and the SOILN-DB model for soil nitrogen leaching.

FyrisCOST calculates nitrogen concentrations in effluent water for each sub-catchment. The concentration of nitrogen is dependent on the current land use and geographical conditions. In order to evaluate agricultural scenarios in FyrisCOST a method for calculating N leaching from agricultural land was constructed. The calculation includes crop rotations and tillage systems and differentiates between annual and perennial crops. The model is able to take into account the probability that a primary crop is followed by a specific crop/tillage system and the effect on nutrient losses estimated using a specially developed leaching concentration calculator.

Each measure or combination of measures in a scenario is evaluated based on reduction effects and costs for each sub-catchment. An important feature in calculating cost efficiency is downstream retention. The measures can be ranked by gross cost efficiency in a sub-catchment or on net cost efficiency in a recipient. The recipient may be a lake, a coastline or a sub-catchment. FyrisCOST has the capacity of including all features for a future emissions trade system where single measures are individually evaluated in combination with other existing measures in the catchment.