AGWAPLAN – INTEGRATED PROTECTION OF SURFACE AND GROUNDWATER IN AGRICULTURAL REGIONS

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ABSTRACT

AGWAPLAN aims to facilitate implementation of the Water Framework Directive by reducing agricultural inputs of nutrients to the aquatic environment.

This joint project between the environmental authorities, the agricultural sector and the research community tests the establishment of environmental objectives for water bodies, calculation of agricultural inputs of nitrogen and phosphorus and determination of the reductions needed to attain the environmental objectives. Appropriate methods of attaining the objectives are tested in practice.

The project also investigates the existence of possible barriers that may render farmers unwilling to change their practice to help ensure that the environmental objectives are attained, and examines how any such barriers can be overcome.

Finally, a decision-making tool is being developed for advising farmers in which environmental aspects are integrated on an equal footing with other aspects of significance for farm management.

PRESENTATION OF THE PROJECT

AGWAPLAN – a project aimed at facilitating implementation of the Water Framework Directive (WFD) by reducing agricultural inputs of nitrogen (N) and phosphorus (P) to the aquatic environment – was awarded funding under the EU LIFE-Environment programme in 2005. The project runs from 2005 to 2008, i.e. the period up to the deadline for completion of the first river basin management plans (Wiborg et al., 2004).

The project partners are Aarhus County, the Danish Agricultural Advisory Service National Centre, the Danish Institute of Agricultural Sciences, three local agricultural associations and 20 farmers in three pilot areas. Financial support for the project is also provided by the Danish Environmental Protection Agency.

The environmental authorities, the agricultural advisory service, the research community and farmers collaborate on developing a concept whereby the WFD

environmental objectives for a given water body are actively incorporated in the agricultural advice provided to the farmers while concomitantly ensuring that their economic yield is maintained.

The aim of the project is to develop an integrated advisory approach for farmers that will enable them to implement so-called good agricultural practice (GAP), i.e. one which takes account of both the environment and the farmer's economy. The effect of this on nitrogen (N) and phosphorus (P) in the surface waters and groundwater is assessed and monitored, and initial efforts are being made to quantify critical loads (environmental objectives), N and P losses from agriculture and the resultant reduction targets.

The integrated advisory approach is a further development of the existing agricultural advice and is based on analyses of the cooperation and coordination between the partners and of the basis upon which farmers make their decisions (Noe and Langvad, 2006).

The project is based in part on Aarhus County's experience with incorporating agriculture and associated pressures in the groundwater protection plans.

The three pilot areas are located in eastern Jutland. One is a waterworks catchment (Hinnerup Waterworks), another is a subcatchment of a lake (Lake Ravn), and the third is the catchment of a fjord (Norsminde Fjord). The pilot areas thus encompass both surface water and groundwater. Twenty farmers with significant areas of farmland within the pilot areas are participating in the project. The farmers are offered the integrated advice and decide to what extent they will implement GAP, whereafter the impact on leaching is monitored and/or modelled.

METHODS FOR DETERMINING NUTRIENT LOSSES AND REDUCTION TARGETS

The critical loads for N and P in the three pilot areas, i.e. the environmental objectives, are determined using models for the individual areas. From the critical loads it is possible to determine the maximum input of N and P that the individual water body can tolerate while meeting its environmental objective. The environmental objective for the Hinnerup Waterworks pilot area has been set at 50 mg nitrate/l in the waterworks' groundwater recharge catchment. Taking into account percolation in the 363 ha catchment, total acceptable leaching is calculated to be 4,520 kg N (Kristensen et al., 2006). Percolation was determined using a groundwater model for the area set up in connection with the work on planning groundwater protection (Søndergård et al., 2005). The environmental objectives for the other two pilot areas – Lake Ravn and Norsminde Fjord – have not yet been established as models for the areas are still to be developed.

Agricultural inputs of nutrients to the water bodies are determined using a variety of methods (Wiborg et al., 2004). This is due to the fact that some methods are suitable for calculating at area level, others at farm holding and field levels. As environmental objectives are set at the catchment level and the integrated advice pertains to farm holding level, there is a need for calculations at both levels. Similarly, the statistical reliability of the data used in the calculations varies. The data used at the catchment level are from registers and general surveys, while those used at farm holding level are the cultivation data from the participating farmers and the data from EM38 surveys of

their land. These types of data have been chosen because their use is realistic in a practical situation after completion of the project. The project includes a comparison of the data used. The work on determining agricultural inputs is performed in close cooperation between the project partners so that experience can be exchanged and differences can be discussed during the process.

The methods used to determine N and P inputs from agriculture are at the catchment level CTTools (Aarhus County Agricultural Database, which provides N and P balances for the area at block level) and SKEP/Daisy (a leaching model system developed by the Danish Institute of Agricultural Sciences). At the 20 participating farms, nitrate leaching is determined using Daisy (a dynamic, numerical leaching model) (Aarhus County, 2004), and "Green Accounts" including N and P balances are drawn up. In addition, a P index is determined that can be used to identify areas where considerable P is available for leaching or erosion and where the risk of leaching or erosion is concomitantly great (Wiborg et al., 2004).

During data collection, model analysis and results in Hinnerup, there has been a close cooperation with agricultural representatives to achieve understanding and accept of the data and models used to describe nitrate leaching and determine reduction target.

If input to the area exceeds the environmental objective, a reduction target is established for the pilot area. In the case of Hinnerup Waterworks, the reduction target has been set at 2,663 kg N (Kristensen et al., 2006). This reduction target serves as the basis for the subsequent integrated advice to the farmers about implementing GAP aimed at achieving the reduction target. As the present project does not involve contact to all the farmers, the measures taken by the participating farmers will be scaled up to the catchment level in an appropriate manner in order to be able to model whether the reduction target has been attained.

ANALYSIS OF BARRIERS AND POSSIBILITIES FOR INTEGRATED ADVICE

A river basin management plan first has an effect when a change actually takes place that helps ensure attainment of the objectives stipulated in the plan. It is therefore interesting to know for example how to get a farmer to change his practice. It is not sufficient that he reads the plan and sees the reduction targets – he also has to understand the relations between GAP and the reduction target, and he actually has to initiate some changes on his own farm to ensure the plan's implementation.

The traditional advice provided to farmers by the Danish Agricultural Advisory Service does not incorporate local environmental conditions as an integrated part of the advice. As part of the project an interview survey is being performed at the beginning and end of the project. The results of the initial survey are used to determine what the integrated advisory approach should encompass in order to ensure that the farmer changes his practice (Noe and Langvad, 2006).

The interviews are designed to elucidate both the farmers' barriers to implementing necessary changes in practice, and the barriers hindering cooperation and mutual understanding among the environmental authorities, the research community and the agricultural advisory service. The interview method has been used in similar contexts and encompasses behavioural, cultural, technical, economic, organizational and

legislative barriers. The surveys will result in publication of a barrier report that will serve as the basis for drawing up a communication strategy and for defining the integrated advisory approach for advising farmers (Wiborg et al., 2004).

CONCLUSIONS AND PERSPECTIVES

We face having to draw up and implement river basin management plans within the space of just a few years. Nutrient inputs from agriculture play an important role here, and we have to accept that nutrient inputs to many water bodies will have to be reduced. If this is to be achieved it is essential that all stakeholders share a common understanding, and that the agricultural advice provided to farmers incorporates environmental aspects on an equal footing with economic aspects, etc. so that the farmers change practice in accordance with the environmental requirements.

AGWAPLAN tests the setting of reduction targets and subsequent advising of the participating farmers through broad collaboration between the project partners.

The project runs from 2005 to 2008, i.e. the period up to the deadline for completion of the first river basin management plans. The project partners expect that through the project it will be possible to identify possibilities for ensuring better implementation of the river basin management plans.

LITERATURE

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