



The effectiveness of different mitigation measures for nitrogen pollution is altered by interactions between mitigation measures - considerations for implementation of measures in modelling and mitigation policies

Kristoffer Piil (1), Søren Kolind Hvid (1), and Gitte Blicher-Mathiesen (2)

(1) Danish Agriculture and Food Council, SEGES, Denmark (krp@seges.dk), (2) Aarhus University, Department of Bioscience, Denmark

Over the past 25 years, Denmark has managed to reduce nitrogen load to the marine environment by ~50%. This result has mainly been achieved by limiting nitrogen loss from agriculture by ensuring a high nitrogen utilisation and effective recycling of nutrients, as well as restrictions in nitrogen application, intensive use of catch crops and through the construction of wetlands. However, Danish targets to fulfill the water quality stated in the Water Framework Directive (WFD), call for further reductions in the nitrogen loads. This effort is planned to be targeted at the catchment level and in some catchments, WFD targets call for reductions as much as a further 50%. However, it is by no means certain that currently used mitigation measures can ensure that these further reductions will be obtained. This is because many mitigation options have both decreasing marginal effect and higher marginal cost at higher rates of implementation.

The presentation will provide examples of mitigation measures from various field studies, that show a decreasing effect with higher rates of implementation and these results will be related to practical catchment management and catchment monitoring. For instance, from monitoring data and field trials with catch crops, it can be demonstrated that the effectiveness of catch crops in Danish conditions decreases with increasing catch crop area in a catchment, because catch crops will be sown progressively later when more catch crops have to be sown. In addition, from field trials where nitrogen leaching is measured with increasing rates of nitrogen fertilisation, it can be shown that restriction in nitrogen application is only an effective mitigation measure when rates of fertilisation are above the financially optimal level. It can thus be demonstrated that the implementation of more than one measure, can decrease the effectiveness of another measure.

In short it can be demonstrated that the effectiveness of mitigation measures change, when different measures are implemented in the same fields, or when one measure is used intensively. Some of these issues are very practical, e.g. that demands for large catch crop areas can cause a delay sowing time in wet years where harvest is delayed. Nonetheless, these practical issues must be considered, when modelling mitigation scenarios at the catchment level and when mitigation options are incorporated into a legal regulatory framework.