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Review

Evaluation of the Dutch implementation of the nitrates directive, the water framework directive and the national emission ceilings directive

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ABSTRACT

Dutch nutrient policies for agriculture are generally implementations of European environmental Directives, i.e. the Nitrates Directive (ND), the Water Framework Directive (WFD) and the National Emission Ceilings Directive (NECD). We present an evaluation of these policies with respect to target achievement, effectiveness, costs and benefits. Implementation of the Nitrates Directive decreased nutrient surpluses and improved groundwater quality. However, the nitrate target of 50 mg/l was still exceeded in groundwater in half of the sand region. Ecological quality of surface waters improved slightly, but this improvement was mainly due to measures for the WFD and not to reduced nutrient losses from agriculture. The NECD reduced emissions of ammonia effectively, but critical loads of nitrogen were still exceeded in the majority of ecosystems. Health benefits of reducing the concentrations of ammonia aerosols were however substantial. Overall, nutrient policies have generated net benefits for Dutch society: Annual costs were estimated to be 500 million euros and societal benefits were estimated to be between 900 and 3700 million euros. With policies currently in place, the general protection goals of the Directives will not be met. Reaching more targets in a cost-effective way would first require better coordination of policies to implement the three Directives. For example 65% of phosphorus input to surface waters is caused by agriculture but the Dutch implementation of the WFD hardly contains any measures to reduce nutrient loads from agricultural soils. In addition to more strict national policies that are better enforced, regionally differentiated mitigation options would be needed. The most robust option would be mining of soil phosphorus by zero P-application in agricultural soils that affect sensitive aquatic ecosystems. Where target achievement cannot be combined with competitive agriculture, political choices would have to be made between ecology and agriculture, or for financial compensation of affected farmers. A key factor for implementation would be redistributing of costs and benefits between specific groups of farmers or regions. This would imply better integration of the Common Agricultural Policy with environmental directives.

Contents

Abbreviations: CAP, Common Agricultural Policy; EC, European Commission; EQR, Ecological Quality Ratio; FADN, Farm Accountancy Data Network; ND, Nitrates Directive; IHW, Information House Water; LMM, Minerals Policy Monitoring Programme; MINAS, Mineral Accounting System; MNLSO, Monitoring Programme for Surface Waters Predominantly Affected by Agriculture; NECD, National Emissions Ceiling Directive; PRTR, Dutch Pollutant Release and Transfer Register; RBMP, River Basin Management Plan; WFD, Water Framework Directive; WTP, Willingness to Pay.

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1. Introduction

Dutch policies to reduce losses of nitrogen and phosphorus from agriculture to the environment have been in place for three decades. These policies are generally implementations of common directives instigated by the European Commission (EC). In 1991 the Nitrates Directive to reduce nitrate emissions from agriculture was accepted followed in 2000 by the Water Framework Directive (WFD), which aims at a good ecological status of waters and, in 2001, the EC National Ceilings directive (NECD) to reduce ammonia emissions [1]. National implementation of these directives in the Netherlands halved the surplus of nitrogen since its peak of 250 kg per hectare in de mid-1990s and considerably reduced the concentration of nitrate in groundwater. However, exceedance of the 50 mg/l NO_3 target in shallow groundwater under agricultural land in the sand regions and exceedance of ecological N and P thresholds in lakes and streams is still common. This raises questions about the effectiveness and the costs and benefits of current policies and the proportionality of additional policies and measures to tackle remaining pollution impacts, relative to trade-offs to agricultural production and competitiveness of farms.

The 25th anniversary of the Nitrates Directive (ND) could be a good opportunity to evaluate the achievements of the ND and of nutrient policies in general. The objective of this article is to evaluate the achievement of goals, effectiveness and efficiency of the Dutch implementation of nutrient policies for agriculture, for which the relevant questions are:

- To what extent did the Netherlands achieve the specific objectives and the general protection goals of nutrient policies?
- What is the effectiveness of these policies? How strong is the relation with the effects on nutrients concentrations in water and air and their impacts on ecosystems and human health?
- What are the societal costs and benefits of these policies?
- What are the prospects of meeting the general protection objectives of the directives in the future, taking into account the effectiveness and costs and benefits of current policies?

We focus on fertiliser and manure policies in the period 1990–2012 taking into account linkages with the WFD and the NECD for ammonia (NECD-NH_3) and the broader context of aspirations for sustainable agriculture. This evaluation may provide useful insights for future implementations of the ND and improved linkage with the WFD and NECD-NH_3. This paper is based on previous evaluations of the Dutch fertiliser and manure policies by Refs. [2–6]. Further, the Dutch experience can be instructive for other EU regions with high livestock densities like Denmark, Flanders, Brittany, Cataluña, the Po valley and the Northern part of Germany and Poland.

2. Materials and methods

Results are mainly based on Willems et al. [6] and the underlying detailed reports for the formal evaluation of the Dutch fertiliser and manure regulation. Prospects for future target achievement were taken from a scenario study by Van Gaalen et al. [7] and underlying reports. The following primary data sources were used:

- The Farm Accountancy Data Network (FADN) [8], which contains data on the use of fertilisers and manure, measures and nutrient budgets at the farm level;
- The Minerals Policy Monitoring Programme (LMM) [8,9]. This programme measures the nitrate and phosphate concentrations in shallow groundwater and drain water on 437 farms. These farms were selected using a stratified sample so that farms were evenly distributed amongst regions, farm types and farm size;
- The monitoring programme for surface waters dominantly influenced by agriculture (MNLSO) [10];

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