

Overview of mitigation options to reduce nutrient losses from rural areas and to improve surface water quality

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Introduction

The role of nutrients in the eutrophication of surface water and the contamination of groundwater has long been recognised. Negative effects of eutrophication include: reduced functioning and biodiversity of aquatic ecosystems and surface water quality, algal blooms that restrict the use of surface waters for recreation, and excess nitrate concentrations with impact on drinking water production. Toxic algal substances have caused fish kills and animal and human diseases in the past. Phosphorus (P) is the element that often determines the ecological status in most European inland waters. To date, European-wide efforts have met the P problem by a combination of accidental (e.g. diminishing industrial losses through industrial decline) and targeted options (e.g. increasing the number of households that are connected with sewerage systems, and precipitating P in sewage water treatment plants). Despite these reductions, water quality status remains poor in many rivers, lakes and estuaries. During the 1990's, share of the total P input to fresh water systems attributed to agriculture increased to 50 or even 80% in intensive agricultural areas (EEA).

Within Europe, the Water Framework Directive (Directive 2000/60/EC) will force catchment management authorities to improve the ecological status of both surface and groundwater. Since both P and nitrogen (N) losses to surface and groundwater are largely driven by agriculture, there is an urgent need to determine the relationship between agriculture and chemical and ecological water quality, because the River Basin Management Plans (2009, 2015, 2021 and 2027) should only implement cost-effective mitigation options. In many European countries no mitigation options for agricultural land have been implemented in the first RBMP (2009), mainly because (1) watershed managers are often not authorised to adapt the legislation for use of nutrients on land or other management options and (2) the available information of the cost-effectiveness under different regimes within Europe is not easily available. From this point of view there is still an urgent need to bring together for information of the effectiveness and applicability of measures in rural areas under broad circumstances.

European dimension

In 2005 a COST Action was funded by the European Commission. This COST action (869) focus on the steps that need to be taken within the WFD in order to effectively reduce the nutrient losses from agricultural land to surface waters and groundwater. The general objectives of the European COST Action are:

- Determine the techniques / tools that can be used to determine the main P and N sources, within the agricultural system as a whole, that contribute to the P and N losses to surface waters and groundwater, and also the main pathways.

- Determine the techniques / tools that can be used for evaluating the impact of a reduction of the P and N input on the ecological status of surface waters.
- Evaluate different types of integrated mitigation options.
- Evaluate implementation strategies for different types of basins / catchments.

The overall goal is (a) to collect information regarding the effectiveness of mitigation options in a large set of agricultural and environmental conditions and (b) to make this easily available for policy makers, watershed managers and intermediaries in order to help farmers and watershed managers to select the effective and relevant measures to reduce losses from land to surface waters and/or to improve the surface water quality by different type of options.

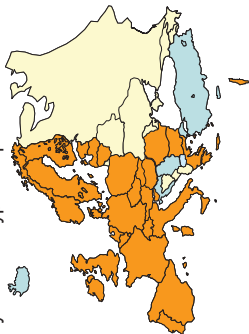


Figure 1.1 European dimension of data collection (countries involved in COST action 869).

Results

In this article the results are discussed of different potential measures to reduce nutrient losses from agricultural land or the impact of nutrient losses in surface water. The measures are based on an inventory among all participating countries of this COST Action 869 (29 countries). A total of more than 100 measures were suggested. Some of them could be combined and 62 different measures were distinguished at the end. For each of the measure a factsheet was written with information of the general description of the measure, rationale/mechanism, applicability, effectiveness including uncertainty, time frame, environmental side-effects / pollution swapping, potential for targeting, cost in terms of investments and labour needs, and references. The list of measures was divided into 8 categories (Table 1.1).

Table 1.1 Categories of mitigation options and number of measures described for each category.

Category	Factsheets	Category	Factsheets
Nutrient management	20	Water management in agricultural soils	9
Crop management	2	Land use change	3
Livestock management	8	Land infrastructure	7
Soil management	14	Surface water management	7

In this paper each category is discussed from a general point of view and shows the main outline and possibilities of the underlying measures. Further details can be found in a report (Schoumans et al., 2010) and will also be published on the COST 869 website.

References

- Schoumans, O.F., M. Bechmann, W.J. Chardon, C. Gascuel-Odoux, G. Hofman, M.I. Litaor, A. Lopoito, B. Kronvang, P. Newell-Price, G.H. Rubæk and B. Ulén, in prep. Overview and evaluation of mitigation options for reducing nutrient emission from agriculture to groundwater and surface water. COST action 869 report.
COST action 869 website: <http://www.cost869.alterra.nl/>
EEA: <http://www.eea.europa.eu/publications/92-9167-205-X/page014.html>