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Evaluation of Farmscoper for finding cost-effective measures to reduce diffuse agricultural pollution in the Wensum Catchment

Project summary SC120043/S1

This report summarises an evaluation of an agricultural decision support tool called Farmscoper in the Wensum catchment in Norfolk. This was a collaborative MSc project between the Environment Agency and Cranfield University.

Farming practices such as conventional tillage, chemical fertilisation and manure application to fields, high livestock stocking rates and overgrazing have all been identified as potential causes of diffuse agricultural pollution leading to pressures on water quality in many catchments. Managing agricultural pollution at the farm and catchment scale needs to take into account trade-offs between environmental and economic objectives. However, accurate quantification of pollution losses from agricultural activities is a major challenge.

In this study, the ADAS Farmscoper (**Farm SC**ale **O**ptimisation of **P**ollutant **E**mission **R**eductions) decision support tool (v.2.1) was used to assess diffuse agricultural pollutant loads (nitrate and sediment) and quantify the cost-effectiveness of farm mitigation methods on these pollutants in the Wensum catchment. The model was run for two soil types (permeable and impermeable), and four crops (sugar beet, winter wheat, winter oilseed rape and spring barley).

Farmscoper was run to predict the most effective and cost-effective measures to control the sources and transport or delivery of sediments and nitrates to watercourses. For sediment reduction, 'soil management' and 'delivery management' plans were selected, and for nitrate reduction 'nutrient management' and 'delivery management' plans were selected to activate the corresponding mitigation measures in the model.

The effectiveness and cost of the top nine measures for reducing nitrate or sediment was verified according to available literature (Nix Farm Management Pocketbook) and agronomist interviews (two farmer events in Norfolk, and through email correspondence).

The top nine measures identified by Farmscoper were:

- reduced cultivation systems
- use plants with improved nitrogen use efficiency
- use a fertiliser recommendation system
- cultivate compacted tillage soils
- establish riparian buffer strips
- allow field drainage systems to deteriorate
- establish cover crops in the autumn
- cultivate land for crops in spring rather than autumn
- undersown spring cereals.

The difference in costs predicted by Farmscoper for the nine measures and those published in the literature was less than £20/ha, except for 'undersown spring cereals', for which Farmscoper predicted a much higher cost than that from the literature (note: only six mitigation measures were evaluated for cost).

Comparing literature values for percentage pollutant reductions to values generated using Farmscoper suggested Farmscoper was more accurate for predicting nitrate losses than sediment losses. For all nine measures, the difference between literature values and Farmscoper predictions of nitrate reduction were no more than 23%. In contrast, the difference in sediment percentage reduction between the literature and Farmscoper predictions were up to 50%, except for 'establish riparian buffer strips' and adopt 'reduced cultivation systems' where the differences were even greater. This can be explained by the large range in effectiveness of these measures depending on local climatic conditions, soil type, vegetation composition etc.

Feedback from the agronomists suggested implementation of mitigation measures is site specific and depends largely on farm planning, soil type, crop rotations, farmer's perception and incentives. Implementation also depends on perceived and real risks such as reduction in yield, disease, pests and compaction. Farmscoper is unable to take these unique factors into account when assessing the cost-effectiveness of mitigation measures. The significant uncertainty in the Farmscoper results partly reflects the lack of allowance for site-specific factors such as soil texture, slope, rainfall intensity, and connectivity between fields.

Farmscoper is a useful software tool for providing guidance to farmers and agronomists on the selection of mitigation measures. But further work needs to be done on establishing how realistic the prices are and what

constraints there are against implementing the low (or money saving) cost options. Note: costs were revised in 2014 by ADAS, and are incorporated in the latest version of Farmscoper (v3.0).

This summary relates to information from MSc project:
Samson Collier (2012). *Evaluation of Farmscoper in Finding Cost-effective Measures to Reduce Diffuse Pollution in the Wensum Catchment*. Unpublished MSc Thesis. Cranfield University.

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