science summary

Environment Agency

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Assessing land-use scenarios to improve groundwater quality: a Slea catchment study

Summary SC030126/TS

A report considering options for reducing agricultural diffuse pollution has been published by the Environment Agency as part of a European project, Water4all. It suggests that modifying agricultural land use within specific areas – those where the risks of nutrients leaching to groundwater are high – could significantly improve water quality in the UK and help meet water quality standards set by the EU.

Many European countries encourage land use practices which incorporate water quality management, but this approach is rare in the UK, where more emphasis has been placed on end-of-pipe water treatment. This strategy, however, appears increasingly expensive and unsustainable.

Meeting the requirements of the EU Water Framework Directive (WFD) poses challenges for water and land management – indeed, nitrate pollution has already been identified as a major reason why the UK may fail to meet WFD targets. The requirement to achieve 'good ecological and chemical status' in groundwaters by 2015 is particularly difficult for intensively-farmed areas which often suffer diffuse pollution from fertilisers, pesticides or livestock. Changes in farming practices may reduce these problems, but place further demands on farm businesses already facing an uncertain future from Common Agricultural Policy (CAP) reforms.

As part of the European Water4all project (www.water4all.com), the Environment Agency worked with the University of East Anglia to explore ways in which land use could be adapted to improve water quality in the UK. A pilot study was set up to investigate the effectiveness of a range of measures in reducing groundwater nitrate levels in a catchment area, working closely with local groups in the area.

The River Slea in Lincolnshire was chosen for its high groundwater nitrate levels and its suitability for exploring issues typical of lowland UK. Boreholes in the area's limestone aquifer are an important source of public and private water supply and there have been local concerns regarding pressures on water resources from population expansion (especially in the town of Sleaford) and agricultural demands.

Focus groups and interviews were set up with local stakeholders (farmers, civic groups, planners and so on) to draw up a set of possible future land-use scenarios for the area, listed below:

- Recent past (RP) - continuation of existing measures (such as Nitrate Vulnerable Zones);
- Impact of current policy reforms (CP) - likely land-use changes arising from CAP reforms, new agri-environment schemes and so on;
- Nitrate best practice (BP) – extension of CP with best practice measures (such as use of cover crops) to reduce nitrate leaching;
- Regional Nitrate Sensitive Areas (NSA) - use of practices from the 1990s NSA scheme;
- Land use protection zones (PZ) - use of zones (such as low input grass or woodland) in targeted areas such as well capture zones;
- Whole catchment change (WC) - conversion of 40 per cent of arable to grass or woodland and a reduction in livestock of 40 per cent.

A two-step modelling process was then used to simulate the effects of these scenarios on groundwater nitrate concentrations in the catchment.

The study found that nitrate concentrations could be reduced by up to 30 per cent by 2015 if some 40 per cent of arable land was converted to wood and/or grassland in the Slea catchment, or if protection zones were targeted in the vicinity of the main springs and boreholes in the area.

Land use protection zones were the most positively received scenario when the study's findings were discussed with the local groups. There was local interest in exploring such measures, particularly the idea of creating more grass and woodland areas to the

west of Sleaford, and this could involve farmers if the financial terms were right.

Economic analysis suggests it would cost an extra £1.33 million per year to compensate farmers for the income lost by changing land practices to reduce groundwater nitrate levels below the 50 mg/l NO_3 regulatory standard, which would eliminate the need for water treatment.

Equivalent treatment costs for nitrate are currently around £230,000 per year, which means that it would not be possible to fund enough land-use adaptation simply by transferring the current costs of water treatment

In other words, the costs of preventing nitrate pollution through changing land use (around £30 per person) are nearly four times higher than the costs of treating water to reduce the pollution to within regulatory limits (£8 per person).

However, this difference could narrow in the future as treatment costs increase, and would be closer to being bridged if other benefits arising from land-use change were taken into account, such as a more diverse landscape, more opportunities for recreation, greater biodiversity and reductions in other diffuse pollutants. Careful selection of areas for land use change can maximise these benefits, resulting in 'win-win' solutions.

Land management and conversion may also become increasingly attractive to farmers if levels of return from crops and livestock continue to fall. Indeed, the economics of agriculture and water supply appear to be moving in favour of land-use measures all the time.

To summarise, the study found that considerable changes in land use - beyond those likely from current policy reforms - would be necessary to enable groundwater nitrate concentrations to meet EU targets and remove or minimise the need for water treatment. However, these land-use changes could produce substantial reductions in nitrate levels on a timescale of 10 to 20 years.

Other recommendations of the study include:

- Investigate in more detail the economic impacts of the land-use scenarios on farm businesses and possible benefits such as a reduction in other pollutants.
- Explore the potential for a pilot scheme or small-scale pilot activities in the Slea area based on the protection zone (PZ) scenario.
- Appoint a 'local champion' or adviser to further the scheme as suggested in the previous point.
- Develop and/or set up routine access to systems of collecting agricultural data on a kilometre square grid basis, which would enable more accurate modelling of trends in land use and water quality.
- Improve access to information on water treatment costs. Access is difficult due to commercial confidentiality, but given the requirements of the WFD, there needs to be more transparency regarding treatment costs.
- Greater public promotion and education on water resource issues in the UK.

This report will be useful to groups interested or involved in the monitoring and management of land use and groundwater quality, particular for nitrate pollution and other pollutants typical of intensively-farmed land.

The report will also be of use to government, regulatory, planning, farming and landowner groups required to meet targets set by EU directives such as the WFD on water quality and land management.

This summary relates to information from Science Project SC030126 reported in detail in the following output(s):-

Science Report: Assessing land-use scenarios to improve groundwater quality: a Slea catchment study.
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The Science Group provides scientfific knowledge, tools and techniques to enable us to protect and manage the environment as effectively as possible.

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