Focus Areas - Section 9

Water Quality

f9

Agriculture's key role in restoring Lough Neagh

Adam Mellor, Yvonne McElarney, Rachel Cassidy, Ewan Hunter

Key messages:

- Cyanobacterial blooms in Lough Neagh are symptomatic of an ecosystem that is out of balance, nutrient enrichment being a key factor.
- Agriculture is the largest contributor of surplus nutrients to the Lough.
- Catchment to coast modelling offers the opportunity to test potential mitigation and management solutions prior to implementation.
- Agriculture has the potential to improve the ecological trajectory for Lough Neagh.

Background

Following weeks of warm, settled weather in summer 2023, dense buoyant mats of toxic cyanobacteria appeared across Lough Neagh causing concern for human and animal health. Impacts around the lake were acute, whilst communities on the coast also felt the impact of what was initially perceived as a freshwater problem.

Nutrient enrichment is not new to Lough Neagh, and a long history of scientific study explains the current problems and identifies potential solutions. Lough Neagh's waters and sediments contain highly elevated levels of nutrients resulting from inputs from agricultural land, and to a lesser degree, from wastewater. With a largely rural catchment, agriculture can play a key role in restoring the ecological quality of the lough.

Research studies

High nutrient levels in the Lough have nourished blooms of cyanobacteria since the 1960's. Management measures in the Neagh-Bann catchment have not addressed aquatic nutrient concentrations, indeed increases have been recently identified. Phosphorus presence is currently over four times the ideal background level, due to sustained inputs from the catchment and recycling from the enriched sediments in the Lough.

Invasive species and increasing temperatures are also affecting Lough Neagh's ecology, but management solutions for these are not yet possible. Reducing nutrient losses and improving sustainability are appropriate targets for agriculture, with these efficiency gains being crucial for improving the Lough's water quality. As most nutrients come from diffuse sources, broad-scale mitigation measures will have a bigger impact than end of pipe solutions, and this societal challenge can stimulate innovation and opportunities to help develop agriculture for longer-term sustainability.

AFBI have been leading the way on modelling nutrient dynamics at large catchment scales, and at smaller scales, where process-based modelling is used to understand the pathways and conditions where excess nutrients enter the aquatic environment. While research indicates that nutrient supply to the Lough is being underestimated, our models can inform mitigation and management strategies. Enhancing observation programmes and model parameterisation will help to evaluate effective solutions by accurately identifying loads and predicting ecological responses.

Research findings

Assessing the most effective and economically sustainable measures to reduce nutrient losses requires consideration at both field and landscape scales. AFBI's Fisheries and Aquatic Ecosystems Branch 'catchment-to-coast' approach provides this framework.

To understand ecosystem responses to nutrient reductions, modelling and monitoring of the catchment must predict the ecological outcomes of interventions. Recent research suggests that recovery may take up to 40 years, so recognising the economic and welfare requirements for restoration is essential, as other catchments are under similar pressures. Human, agricultural, economic and ecological health are all at risk.

Potential Impact for Farming for the Future

Restoration of Lough Neagh to a healthy state will not be easy or quick, and requires excellent science, clear communication and societal commitment. Reducing nutrient losses and improving sustainability are appropriate targets for agriculture, and these gains are crucial for improving water quality. A proportionate agricultural response including transparent target setting and monitoring offers the opportunity to restore the Lough and to enhance public perception of agriculture as a restorative sector.

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Do incentivised alterations to pesticide practice lead to lasting water quality improvements?

Luke Farrow, Phoebe Morton and Rachel Cassidy

Reducing MCPA concentrations in-stream through best practice.

Key messages

- MCPA is a highly water-soluble herbicide that easily runs off into rivers and lakes.
- Drinking water regulations stipulate a maximum concentration of MCPA in tap water. MCPA is difficult to remove from water.
- Best practice and use of alternative incentivised management techniques reduced MCPA concentrations in surface water.
- The improvements diminished with time once the incentive scheme ended.

Background

The herbicide MCPA (2-methyl-4-chlorophenoxyacetic acid) is commonly used to control rushes in grassland. However, it is highly water-soluble and, following application or accidental spill, rapidly enters surface water bodies after rainfall. In Northern Ireland, over 99% of drinking water is abstracted from surface water.

Drinking water regulations stipulate maximum concentrations for individual pesticides (0.1 micrograms per litre (µg/L)) and total pesticide concentrations (0.5 µg/L) in drinking water. A single drop of undiluted MCPA in a stream 1 m wide can breach the 0.1 µg/L limit for over 30 kilometres. Whilst abstracted water is treated before entering the drinking water supply, MCPA is difficult and expensive to remove. Therefore, we investigated whether a financial incentive scheme would be an effective approach for reducing the amount of MCPA entering surface waters from land.

Research Studies

The Derg and Finn catchments (located on the western Irish border) hosted the Source to Tap (2017–21) and follow-up projects (2021–23) that aimed to reduce MCPA concentrations in the 16 million litres of water abstracted from the River Derg each day for drinking. The Source to Tap project implemented a catchment-wide community engagement and knowledge transfer scheme as well as a £1m Land Incentive Scheme (LIS) to incentivise farmers to adopt more sustainable pesticide usage practices. The Finn was the "Business as usual" catchment with no LIS or knowledge transfer scheme. The follow-up project investigated how long the water quality benefits persisted after the LIS ended.

Funded changes in pesticide usage practice included adoption of bunded pesticide storage units, reducing the chance of accidental leaks and spills, and use of weed-wiping with glyphosate to control rush extent instead of boom-spraying with MCPA. Weed-wipers use a pesticide-covered drum to apply pesticide only to plants above a specific height (Figure 1). MCPA concentrations were monitored in both rivers throughout both projects.

Research findings.

In the Derg, 26.9% of samples before the LIS contained over 0.1 µg/L MCPA compared to 18.6% after. The reduction was similar in the Finn (35.5% to 26.1%). However, before the LIS 7.2% of samples in both rivers contained over 0.5 µg/L MCPA: after the LIS, this reduced to 4.9% in the Finn but 4.2% in the Derg, demonstrating the LIS impact.

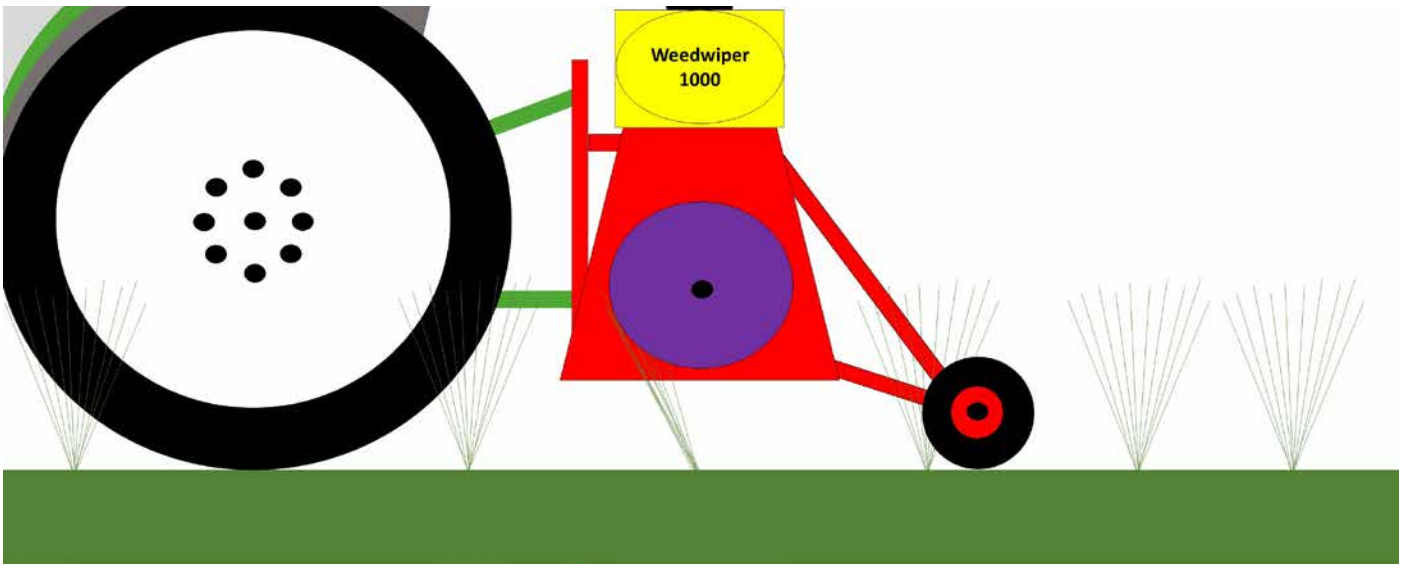

Figure 1: The pesticide-covered drum (purple) in the weed-wiper applies pesticide glyphosate) only to plants above a specific height.

The LIS also reduced average MCPA concentrations in the River Derg, but that effect began fading once the LIS ended. This is seen by dividing the data into "Peak" (summer) and "Quiescent" (winter) periods for each year (Figure 2). The Derg "Peak" MCPA concentrations were higher than those in the Finn before the LIS, but this pattern reversed during the LIS, and weakened once the LIS ended. There was no difference in glyphosate concentrations between rivers.

Potential Impact for Farming for the Future

The concentration of pesticides detected in surface waters is a concern for the public, NI Water and the regulators who renew pesticide authorisations. Actions farmers take to reduce point and diffuse sources of pesticide loss, without negatively impacting farm productivity, are mutually beneficial.

This work was funded through the Source-to-Tap project under INTERREG.

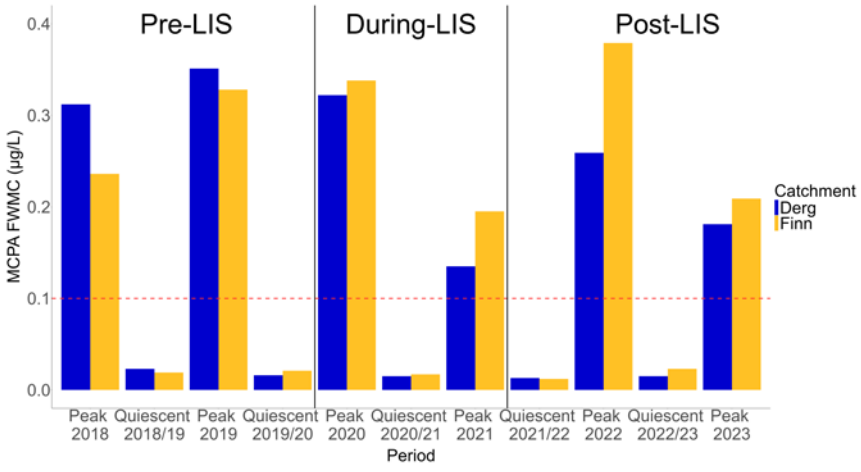

Figure 2: The difference between MCPA concentrations in the Derg and Finn catchments during the summer (peak) and winter (quiescent) periods across the different stages of the study.