A catchment scale monitoring solution for MCPA

Time and space considerations

[1]Phil Jordan, [2]Rachel Cassidy, [2]Phoebe Morton, [1]Kevin Atcheson, [2]Stewart Floyd, [2]Colin McRoberts, [2]Donnacha Doody

1. School of Geography and Environmental Sciences, Ulster University, N. Ireland
2. Agri-Environment Branch, Agri-Food Biosciences Institute, Newforge Lane, Belfast, N. Ireland

1. INTRODUCTION

The selective herbicide 2-methyl-4-chlorophenoxyacetic acid (MCPA) is widely used for the control of broadleaf weeds in grassland pastures and cereal fields. In semi-upland agricultural areas of Ireland MCPA is also used for rush (*Juncus* spp.) control in spring and early summer in areas of extensive grassland.

As MCPA has a low affinity with soil (soil-organic-carbon-to-water partitioning coefficient K_{OC} = 54 to 118 L kg^{-1}) and desorption is high (~11 – 52%), those applications reaching the soil surface are prone to incidental losses to water when rainfall generates runoff before the herbicide has fully decayed.

Upland surface water catchments in both Northern Ireland and the Republic of Ireland are important drinking water source areas and respective water authorities are regulated to remove pesticide residues at drinking water treatment works (WTW), at high cost.

2. LAND INCENTIVE PROJECT

A major project in the Irish border area (**www.sourcetotap.eu**) is investigating the utility of incentivising change in agricultural management practices in source water catchments to offset the costs of treating raw water.

The Derg River catchment (380 km^2) in NW Ireland abstracts water for ~30,000 customers and is susceptible to rush growth on extensive grasslands (Fig. 1). The project required a monitoring solution to characterise the MCPA issue at catchment scale and provide a basis for determining the success of changed management.

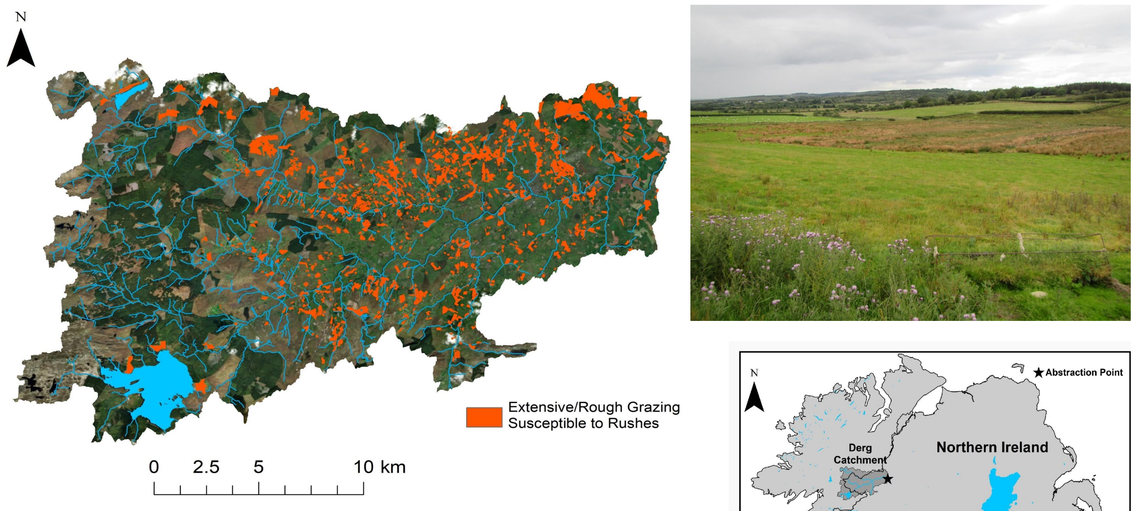


Figure 1: The Derg River catchment in NW Ireland showing areas of extensive grassland susceptible to *Juncus* spp., and a typical field showing areas of growth (mid-ground).

3. MONITORING

To characterise the spatial risk of MCPA transfer across the Derg River catchment water samples were taken in a grab sampling campaign over 13 weeks at 11 sub-catchment locations in the spring-summer 2018. To characterise the temporal risk of MCPA transfer and to investigate hydrological relationships, a fixed monitoring station close to the drinking water abstraction point collected samples on a 7 hourly basis (24 samples/week) during the period when MCPA applications were most likely (27/04/2018 to 11/12/2018) (Fig. 2).

A project supported by the European Union's INTERREG VA Programme, managed by the Special EU Programmes Body (SEUPB)

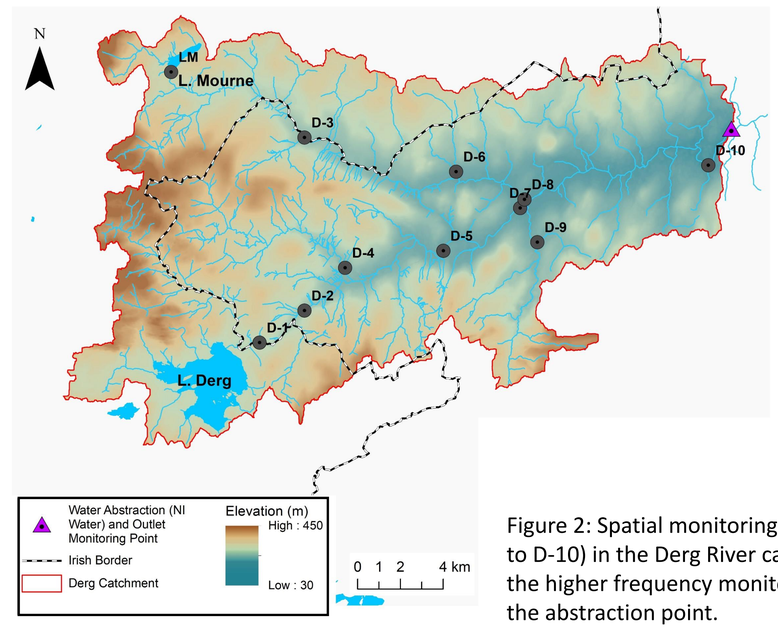


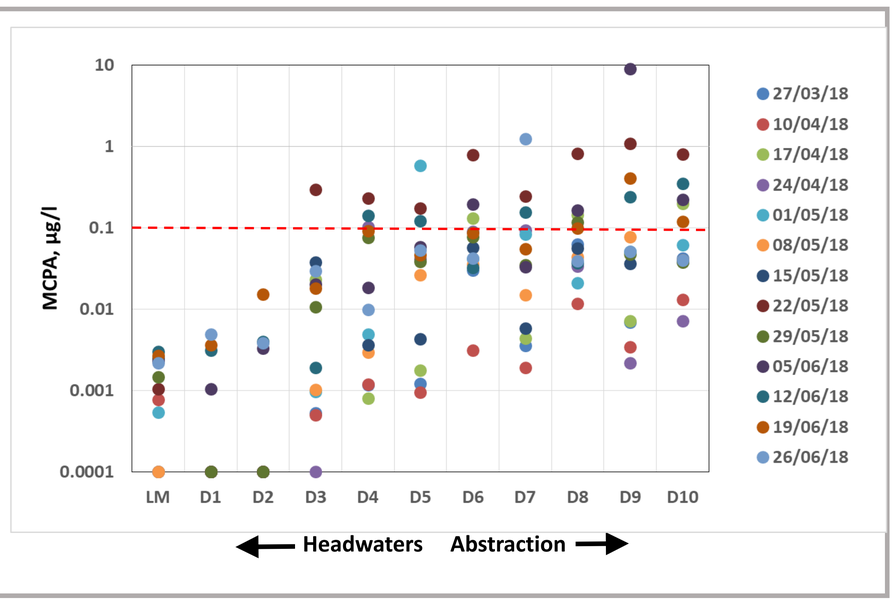
Figure 2: Spatial monitoring points (LM, D-1 to D-10) in the Derg River catchment and the higher frequency monitoring station at the abstraction point.

4. RESULTS and IMPLICATIONS

Results from the spatial sampling showed that 26 of 143 data-points were above the MCPA drinking water threshold of 0.1 µg/l, largely from 6 of the 11 sample locations. This provides a spatial basis for targeting mitigation measures within the catchment (Fig. 3).

The 7 hourly data from the abstraction point over the same period noted 148 occasions from 325 data-points when the MCPA threshold was breached (Fig. 4). These data highlighted the extent of the MCPA issue in this catchment, greater than initial assessments, and caused by a dependence on acute, storm event processes. The data also indicated a recession curve on MCPA concentration that could be used as a method to detect future change in the main MCPA runoff pathways as mitigation measures are implemented.

Figure 3: Weekly spatial data of MCPA concentrations from the Derg River sub-catchments indicating upstream areas for priority mitigation – i.e. those areas with concentrations consistently over the 0.1 µg/l threshold (red dashed line)



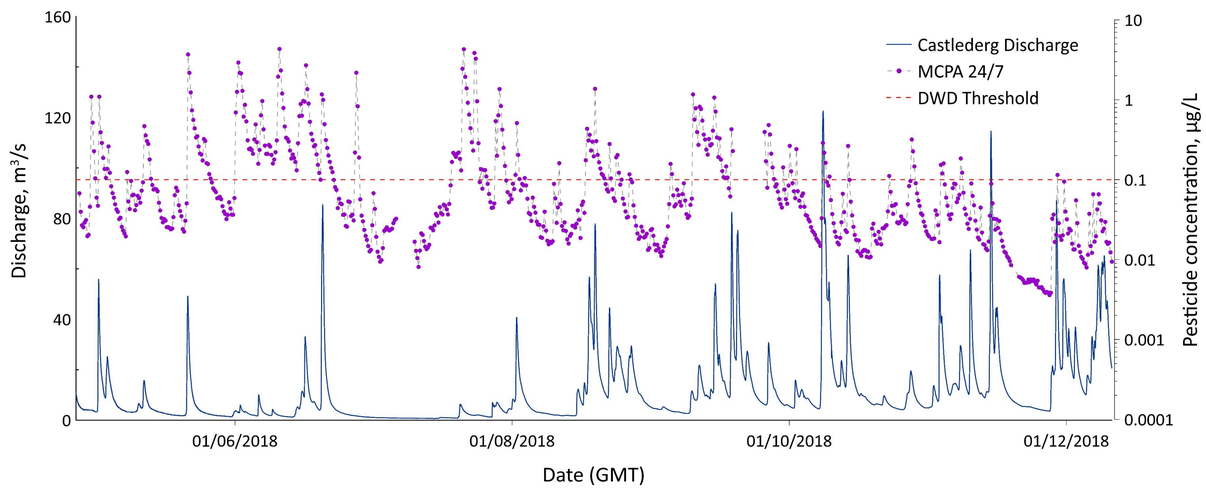


Figure 4: Spring to winter time-series showing discharge in the Derg River (15 mins) and 7 hourly MCPA concentration data. Of note: seasonality related to spring-summer incidental losses; exceedances above the 0.1 µg/l threshold; and a recession on the chemograph that never reaches zero concentration.