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Do awareness-focussed approaches to mitigate diffuse pollution work? A study on combined behavioural and water quality evidence

Murat Okumah

University of Leeds, Sustainability Research Institute, School of Earth and Environment, United Kingdom of Great Britain and Northern Ireland (ee15sa@leeds.ac.uk)

Recent efforts to tackle diffuse water pollution from agriculture (DWPA) have focussed on improving farmers' awareness under the expectation that this would contribute to adoption of best management practices (BMPs) and result in water quality improvements. To date, however, no study has studied the full awareness-behaviour-water quality pathway; with previous studies having mostly addressed the awareness-behaviour link relying on disciplinary approaches. Here, we investigated whether awareness-focussed approaches to mitigating DWPA work, addressing the pathway in full using a multidisciplinary approach. We did this by working with Welsh Water (a utility company in the UK) on their Weed wiper project which encourages farmers to consider 'smarter' ways of weed, pest and disease control and promotes the safe storage, use and disposal of pesticides and thus safeguard drinking water sources. One aim of this project was to mitigate pesticide pollution in watercourses, through a free 'weed wiper' hire trial. The main goal of the trial was to promote farmers' awareness and uptake of BMPs to tackle the rising concentrations of the pesticide MCPA (2-methyl-4-chlorophenoxyacetic acid) in drinking water sources in three catchments in Wales. Weed wipers are a proven and effective method of managing weeds and have multiple benefits. By wiping an herbicide directly onto weeds, weed wipers dramatically reduce spray drift in comparison to more traditional methods, such as boom or knapsack spraying. Using less chemical can save land managers money and reduce the risk to their health, water and the wider environment. Using factorial analysis of variance, we analysed MCPA concentrations from 2005 to 2019 for all water treatment works (WTWs) in the three catchments where the weed wiper trial had occurred and all the WTWs within three control catchments that had not been part of the trial but were in a similar location and of a similar characteristics. This was followed by semi-structured in-depth interviews with institutional stakeholders and farmers with varying degrees of exposure to the Weed wiper project. Results show that MCPA concentration for both treatment and control catchments had reduced following the weed wiper trial, however, considerably larger (38.9%) decreases were observed in the treatment catchments than in the control catchments (10%) and these differences were statistically significant ($p < 0.05$, $n = 2858$). Results from the stakeholder interviews suggest that the weed wiper project had contributed to changes in behaviour and that these are very likely to have resulted in the water quality improvements. Further analysis revealed, however, that other psychosocial, agronomic, catchment and climate factors also influenced farmers' behaviour. Therefore, while awareness is an important step towards improving water quality, policymakers need to consider the role of

these other variables in their interventions and how they interact with awareness. This research is the first one to cover the full awareness-behaviour-water quality pathway, and to combine different scientific disciplinary 'knowledges' with local non-scientific knowledge to explain water quality responses within the context of awareness-focussed interventions.