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KEYNOTE

EXTENDED ABSTRACT ONLY

Mitigation knowledge gaps: a call to arms

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Abstract: Over the past few years, I have been involved in a number of modelling projects using catchment-scale steady-state models for central and regional government to predict the impact of various mitigation measures on freshwater quality. While there has been much written about the need for reliable input and calibration data requirements for water quality model development and testing, less attention has been paid to data needed for scenario creation. In my presentatoin, I want to share the experiences I have had setting up mitigation scenarios for water quality models due to gaps in our knowledge about the efficacy and implementation of mitigation measures.

I have chosen riparian planting as an example since this mitigation measure has been a key scenario in most of the projects I have worked on. It is a widely accepted measure and an integral part of national and regions strategies for improving freshwater quality both due to bank strengthening, and stock exclusion (Hughes 2016). However, there is little quantitative information either internationally or in New Zealand about how well riparian planting reduces the loads of sediment, nutrient and bacteria reaching waterways. For example, while riparian buffers can be very effective at removing nitrate from soils (up to 70%), the amount of removal is highly variable spatially and seasonally due to differences in soil properties, plant types, buffer width and climate. However, there is insufficient data to quantify how nitrate removal varies (personal communication, Lucy McKergow, June 2021). Another issue is that the research that has been done has tended to be at the farm-scale and the effects of mitigation at the catchment-scale are largely unknown. Moreover, we lack information on the current implementation of mitigation measures to set model baselines. For riparian planting, we do not know where have streams banks been planted, which plants have been used or buffer width. The data that are available include industry reports and self-reporting by farmers (e.g., via the bi-annual Survey of Rural Decision Makers)[1]. These data are not purpose collected and, at best, available only regionally.

This has meant that the model applications used simple future state scenarios that are based on a professional judgement as much as on evidence. For example, in the absence of data on the relative efficacy of riparian planting with fencing for stock exclusion, our national E. coli modelling (Semadeni-Davies and Elliott 2017; Semadeni-Davies *et al.* 2020), we used a flat 10% increase in *E. coli* removal compared to fencing on its own.

These experiences are not unique to riparian planting or indeed to steady-state modelling. Dynamic models require the same access to information to create mitigation scenarios. The lack of fundamental knowledge on the implementation and efficacy of mitigation measures is worrying given the high political, cultural and economic stakes involved in water management in New Zealand and the increasing reliance on modelling to inform water management. The challenge for us as modellers is to push for basic research and data collection on mitigation measures so that our scenarios are robust.

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[1]https://www.landcareresearch.co.nz/discover-our-research/environment/sustainable-society-and-policy/survey-of-rural-decision-makers

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