VARIABLE NITROGEN ATTENUATION CAPACITY FOR TARGETED AND EFFECTIVE WATER QUALITY MANAGEMENT IN NEW ZEALAND AGRICUTURAL CATCHMENTS

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Soluble inorganic nitrogen, particularly nitrate has been implicated as one of the key contaminant in the deterioration of surface and ground water quality across New Zealand's agricultural catchments. Hence, there are increasing efforts to identify and reduce nitrogen losses from intensive farming activities. However, there is great deal that is yet to be understood about the manifold processes and pathways that lead to nitrogen contamination of rivers and lakes in New Zealand agricultural catchments. In the simplest of terms, nitrogen movement from farms to rivers and lakes might be thought of as a three stage process: nitrogen exits the root zone, travels through a complex range of intermediary subsurface materials, and enters and effects the receiving water body. During the middle phase of this journey, which varies in time from days to many years, nitrate may undergo transformation before entering the receiving water body. Our on-going field observations, surveys and experiments suggests that, in low oxygen subsurface environments, nitrate can be reduced and emitted as a nitrogen gas via a biogeochemical process of denitrification in the subsurface environment. As a result, nitrogen losses are said to be attenuated before entering and effecting the receiving water body.

The flow of nitrogen from farms to rivers and lakes, however, is simply viewed as a black box in the formulation and implementation of policy and management practices for decreased nitrogen contamination of receiving waters in sensitive agricultural catchments. Unfortunately, Regional Councils have to set N loss allocations in this context of limited knowledge, and they generally tend to assume a value of 0.5 for the nitrogen attenuation factor. However, our research in the Manawatu and Rangitikei River catchments has shown that nitrogen attenuation factor is only occasionally 0.5, but rather it varies markedly across sub-catchments within the catchment.

In this paper, we will discuss some of the implications of this variable nitrogen attenuation phenomena to present day policy and regulation formulation, particularly those initiatives that seek to allocate N loss limits to farmers based on the Landuse Classification system (LUC). We will explain why, in theory, such frameworks are unlikely to deliver the desired water quality outcome unless accurate and detailed spatially variable nitrogen attenuation factors are assessed and used. Finally, we will present and discuss a potential process or mechanism for setting N loss allocations for farms using spatially explicit nitrogen attenuation factor for achieving targeted and effective water quality outcomes in New Zealand agricultural catchments.

Editor's Note: An extended manuscript has not been submitted for this presentation.