Effective Management of Nutrient Flow Pathways and their Attenuation in NZ Agricultural Catchments

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Grazed pastoral systems and other intensive landuses are inherently leaky with respect to nitrogen (N), one of the key nutrients in the management of surface and ground water quality in New Zealand's agricultural catchments. Current N management efforts, however, appear to be focused within the farm boundary and concentrate on identifying and reducing N loss from the root zone of farms. In many regions, the predicted farm rootzone N loss must comply with a set limit or allocation. Farm N loss allowances, as specified in regional council rules, are generally derived using assumptions about the attenuation of nitrate-nitrogen (NO3-N) as it passes from the paddock root zone to rivers and lakes. This approach ignores the spatial and temporal dynamics of the transport and transformations of NO3-N along flow pathways from farms to rivers and lakes as relatively little is known about these processes in NZ agricultural catchments.

Our research in the Manawatu River catchment suggests that N loads measured in the river are significantly smaller than the estimates of N leached from the root zone. The on-going field observations, surveys and experiments indicate that denitrification is a key NO3-N attenuation process in the catchment. This N attenuation capacity appears to vary among the sub-catchments within the catchment.

We, therefore, suggest that more cost-effective improvements in water quality can be achieved by selecting landuse practises and mitigation options according to the N attenuation capacity in the subsurface environment (below the root zone) in agricultural catchments. By taking a catchment perspective, we will be able to help redesign landuse practices in a coordinated fashion by spatially aligning intensive landuse practices with high N attenuation pathways, i.e. 'matching landuse with land suitability', to increase agricultural production while reducing environmental impacts.