

Influence of catchment characteristics on soluble inorganic nitrogen in the Manawatu River

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Management of water quality at the catchment scale requires a sound understanding of the catchment characteristics that influence the spatio-temporal variations in contaminant concentrations in streams and rivers. This study assessed the relationship between different catchment characteristics and soluble inorganic nitrogen (SIN) concentrations in streams and rivers in the Tararua Groundwater Management Zone (TGWMZ) in the Manawatu River catchment.

We used 15 sites in the TGWMZ: these sites have continuous water flow and monthly water quality measurements from January, 2005 to December, 2014. The measured SIN (ammoniacal-nitrogen, nitrite-nitrogen, and nitrate-nitrogen) concentrations were regressed with major catchment characteristics including land use, soil texture, soil drainage, morphology (e.g. mean slope), rock type, and hydrological indices (e.g. base flow index "BFI"). Given the high co-dependence amongst explanatory variables, partial least squares regression (PLSR) was used to evaluate their relationship with SIN concentration. Using PLSR, the significance and direction of the relationship between the most influential catchment characteristics and SIN concentration were evaluated using the variable influence on projection (VIP) and regression coefficient, respectively.

Our results show a profound effect of several catchment characteristics on SIN concentrations. Land use had a positive relationship but less significant effect on SIN concentrations. Rock types such as mudstone, with a high potential to attenuate nitrogen, moderately well drained soils and mean slope (%) had a significant negative relationship with SIN concentrations. In comparison, rocks such as gravel, with low potential to attenuate nitrogen, had a positive relationship. River flow, base flow and effective rainfall were not among the influential variables, but BFI had a significant positive relationship with SIN concentrations suggesting higher values of SIN concentrations in sub-catchments with higher BFI. This study highlights the importance of considering catchment characteristics beyond land use in effective management of nutrient loads to surface waters in agricultural catchments.