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Nitrogen cycling dynamics in a humid subtropical climate: insights from the Nogoa River sub-catchment, central Queensland, Australia

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The Nogoa River sub-catchment, Queensland, Australia, supports a multimillion-dollar agricultural sector. For the last decade, efforts have been made to monitor river nitrate loads (Fitzroy partnership for River Health, 2017), which may affect sensitive ecosystems downstream, such as the World Heritage-listed Great Barrier Reef (Brodie *et al*. 2012). Research into nitrous oxide, which arises from both the oxidation of ammonium fertilisers and/or reduction of subsequent nitrate, is also very important due to its increasing impact on the atmosphere. An integrated approach that considers the interactions between atmosphere, river water and groundwater nitrogen compounds is thus integral to closing the nitrogen cycle in the region.

Nitrogen fertiliser contributions to greenhouse gas emissions, riverine environments and aquifers remain uncertain for several reasons: (1) ad-hoc river water sampling frequency and infrequent shallow groundwater sampling; (2) a lack of isotopic evidence for attributing sources and highlighting attenuation processes; (3) poor understanding of groundwater recharge pathways, residence times, and contributions to the Nogoa River; and (4) a lack of quantification of river water and groundwater nitrous oxide concentrations and emissions.

In this poster, we present hydro-geochemical data (major ions, N_2O-N, δ^2H-H_2O and δ^{18}O-H_2O, δ^{15}N-NO_3^- and δ^{18}O-NO_3^-, and natural radioactive tracers) from seven sites along the Nogoa River that were repeatedly sampled over a 1-year period, and from 24 shallow groundwater bores sampled in October 2018. A comparison with historical major ion groundwater data reveals that nitrate concentrations have increased due to continued fertiliser input over the past ~20 years, reaching up to 25 mg L^{-1} NO_3^--N. Dual nitrate isotopes (δ^{15}N and δ^{18}O) reveal that denitrification occurs in both the shallow groundwater and Nogoa River samples, and suggest a predominant fertiliser source of nitrate. The data will be placed in the wider context of recharge pathways, residence times and contributions to the Nogoa River, and will be used to understand the interplay between the river and alluvial aquifer nitrate and nitrous oxide emissions.

References

Brodie, J.E., et al., 2012. Terrestrial pollutant runoff to the Great Barrier Reef: an update of issues, priorities and management responses. *Marine Pollution Bulletin*, 65(4-9), pp.81-100.

Fitzroy partnership for River Health, 2017. Accessible at: https://riverhealth.org.au/report_card/ehi