Nitrogen dynamics in grassland streams along a gradient of agricultural development

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ABSTRACT: We examined nitrogen (N) uptake in seven grassland streams lying in catchments along a gradient (0-84%) of agricultural land use in New Zealand using a stable isotope (^{15}N) addition of NH_4^+ to quantify whole-stream uptake rates and uptake by specific compartments within the streams. Whole-stream uptake of NH_4^+ ranged from 1.2 mmol N m^{-2} min^{-1} to 7.9 mmol N m^{-2} min^{-1} and showed no evidence of strong saturation of uptake with increasing NH_4^+ availability along the land use gradient. The relatively simple pattern of increasing N uptake along the gradient occurred despite substantial shifts in uptake among community members. Uptake of NH_4^+ by epilithic biofilms followed a subsidy-stress relationship, with highest uptake rates at intermediate levels of pastoral development and lowest uptake rates at high pastoral development. At high (>60%) pastoral development, reduced uptake by epilithon was compensated for by enhanced uptake by macrophytes. Compensatory uptake can play an important role in streams when community composition is reorganized by human activity.

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