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In-stream nutrient uptake kinetics along stream size and development gradients in a rapidly developing mountain resort watershed

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Land use / land cover (LULC) change including mountain resort development often lead to increased nutrient loading to streams, however the potential influence on stream ecosystem nutrient uptake kinetics and transport remain poorly understood. Given the deleterious impacts elevated nutrient loading can have on aquatic ecosystems, it is imperative to improve understanding of nutrient retention capacities across stream scales and watershed development intensities. We performed seventeen nutrient addition experiments on six streams across the West Fork Gallatin Watershed, Montana, USA, to quantify nitrogen (N) uptake kinetics and retention dynamics across stream sizes (1st to 4th order) and along a mountain resort development gradient. We observed that stream N uptake kinetics and spiraling parameters varied across streams of different development intensity and scale. In more developed watersheds we observed a fertilization affect, however, none of the streams exhibited saturation with respect to N. Additionally, we observed that elevated loading led to increased biomass and retentive capacities in developed streams that helped maintain export at low levels during baseflow. Our results indicate that LULC can enhance in-stream uptake of limiting nutrients and highlight the value of characterizing uptake kinetic curves from ambient to saturation.