Reconsidering Nitrate Uptake Experiments in Streams

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Abstract. Headwater streams have large surface-to-volume ratios that favor retention and removal of nitrogen and play an important role in regulating basin-scale nutrient delivery. With an increase in anthropogenic nitrogen leading to pollution and oxygen depletion in coastal areas, examining nutrient uptake in headwater streams is important in reducing nitrogen loads. By conducting nutrient injection experiments across a gradient of impacted streams and rehabilitation tactics, we can model how nitrogen fate and transport are affected by land use and various rehabilitation techniques. Traditionally, nutrient injection experiments have been performed by collecting nitrogen data at steady-state and applying linear regression to estimate uptake lengths. This method has resulted in data that show considerable variability. We performed nutrient injection experiments, along with detailed physical characterizations of geomorphic complexity, along Spring Creek in Fort Collins, Colorado. Nitrate data collected from the nutrient injections were highly variable and inconclusive, which is similar to results of others using this current methodology. To potentially reduce this variability and obtain more meaningful results, we will implement a transport-based approach for analyzing nutrient uptake. In the transport-based approach, a transient storage model is applied and time-series data are collected. Utilizing the transport-based approach can improve the science of modeling basin-scale nutrient delivery. Improved techniques for investigating linkages between nitrogen uptake and geomorphic complexity may also prove beneficial in managing streams and using stream rehabilitation as a tool to promote uptake of nitrogen and reduce nitrogen loads downstream.

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