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Transport and Removal of Nitrate in Agricultural Headwater Streams

The objective of this on-going study is to determine which biotic and abiotic factors control denitrification in headwater streams located within agricultural watersheds. We hypothesized that forested riparian land use would increase carbon supply and decrease stream water velocity and thus favor nitrate removal via denitrification. Two 50-meter reaches are being examined (one agricultural/urban reach with heavy channelization and one forested reach) along five headwater streams (n = 5) in the Upper Sugar Creek Watershed in Northeast Ohio (40°51'42"N, 81°50'29"W). Currently, we have collected data from late summer and fall of 2005. Agricultural/urban and forested reaches have similar carbon supply both in terms of dissolved organic carbon concentrations (2.93 ± 1.15 and 2.85 ± 1.18 mg C L^{-1}, respectively; mean ± 1 standard deviation) and sediment carbon content (3.38 ± 0.68 % and 3.53 ± 1.00 %, respectively). Also, agricultural/urban streams have higher water velocities (velocity = 2.80*discharge + 0.04, R^2 = 0.49) than forested streams (velocity = 3.80*discharge + 0.02, R^2 = 0.79) over our range of measured discharge events. Despite an absence of significance differences due to high variability, our data indicate that forested reaches might be more efficient at processing nitrate. Indeed, agricultural/urban reaches have an average nitrate uptake length and nitrate loss rate of 2.1 x 10^5 ± 4.8 x 10^5 km and 37 ± 48 % removed d^{-1}, respectively; while forested reaches have an average uptake length and loss rate of 7.7 x 10^4 ± 2.0 x 10^5 km and 68 ± 150 % removed d^{-1}, respectively. Our data set consist of two extreme sampling periods: late summer (low nitrate concentrations, low discharge events, and high water temperature) versus fall (high nitrate concentrations, high discharge events, and low water temperatures). This research will continue over another 1.5 years in order to provide clearer conclusions.

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