Geophysical Research Abstracts
Vol. 13, EGU2011-3884, 2011
EGU General Assembly 2011

In-stream fate and transport of nutrients at multiple spatial and temporal scales

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Studies of nutrient losses from plots and fields are common; however, most researchers do not concern themselves with the fate of the nutrients once they reach the stream environment. In-stream fate and transport of nutrients can be as important to the delivery of nutrients as upland transport processes to the total amount of nutrients delivered to a receiving water. The objectives of this work have been to quantify the in-stream processes of nutrient fate and transport across spatial and temporal scales. The eight sites used for this study range from 300 to 19,000 ha, are located in the St. Joseph River watershed, northeast Indiana, USA. In-stream nutrient injections were used to assess nutrient transport at each of the sites. Phosphorus uptake length (Snet) was correlated with ditch geomorphology and sediment properties. The nested paired watershed design used in this watershed scale monitoring study has allowed for assessment of nutrient transport over much larger spatial and temporal scales than most process-oriented studies allow. Using the load-flow plot approach, three basic categories of nutrient fate can be observed: 1) high nutrient retention at low flows; 2) high nutrient retention at intermediate flows; or 3) nutrient release from sediments at low flows. In this watershed study, these three mechanisms have all been observed. In fact, we have observed a decrease in the mass of nutrients over rather large reaches of streams (approximately 3 km) following anthropogenic disturbance. These studies help to quantify the processes involved with in-stream nutrient transport in this highly enriched agricultural stream network.