

William Richardson, John Duff, Jim Tessioro, Kathy Lee, Lynn Bartsch, and Mark Munn. Introduction to the USGS NAWQA Nutrient Enrichment Effects Team: New Study of Nitrogen Cycling and Mass Balance on Valley Creek, MN. St. Croix River Research Rendezvous – Annual Meeting, 10/17/06, Marine on St. Croix, MN

[abstract] The detrimental effects of agriculture on water quality of streams and rivers are relatively well studied at local or watershed scales. Anthropogenic effects attributed to agricultural landscapes are more difficult to understand at large scales (basin and ecoregion). Further, metrics of eutrophication commonly determined (e.g., nutrient loads and concentrations, algal standing stocks) can only address a small subset of processes and outcomes potentially effected by excess nutrient loads. Ecosystem metabolism, cycling of nutrients (esp. nitrogen), algal and invertebrate diversity are a few of the primary biological and biogeochemical processes that respond to nutrient enrichment but are rarely measured at multiple sites spanning a range of agricultural conditions. The USGS NAWQA NEET studies are an attempt to evaluate the effects of agriculturally derived nutrients on metabolism, biogeochemical processes, productivity and biodiversity of streams over a gradient of agricultural intensities, types, and ecoregions. The objectives of the NAWQA-NEET are: 1. Determine the relations between biological communities and nutrient conditions in streams from contrasting environmental settings; 2. Evaluate the relations among nutrients, algae, and stream metabolism in streams from contrasting environmental settings; 3. Determine the influence of biota and hydrologic exchange on nutrient loads, nitrogen transformations and stream metabolism at the reach scale; 4. Determine the extent to which biota and nutrient relations can be regionalized. Since 2001, 30 streams in each of 8 NAWQA Study Units (encompassing 7 EPA Level-3 Nutrient Ecoregions) have been, or will be sampled, to accomplish Objectives 1, 2 & 4. For Objective 3 (nutrient mass balance and nitrogen biogeochemistry), only one stream in each Study Unit was sampled due to the complexity and intensity of the sampling.

In September 2006, an Objective 3 study was conducted in a reach of the main branch of Valley Creek, Minnesota, (Belwin Foundation property extending from the confluence of North and South Branches to Putnam Rd., ~1.3 km ). This site was selected for its unique combination nutrient and water quality metrics (high nitrate and low phosphorus concentrations but low turbidity and high biodiversity), long history of high quality monitoring and biologic studies; and highly cooperative land owners (Belwin Foundation).

Sampling was conducted to estimate the water budget, nitrogen and phosphorus mass balance, sediment denitrification and nitrification, and sediment nitrate uptake. Because these data are currently being analyzed results from other Objective 3 study sites will be discussed.