

MEASURING AND MODELING WATER AND NUTRIENT FLUX  
BETWEEN A MID-MISSOURI STREAM AND FORESTED  
RIPARIAN ZONE IN THE CENTRAL U.S.

Pennan Chinnasamy

Dr. Jason A. Hubbart, Dissertation Supervisor

ABSTRACT

To improve process based understanding of stream water-groundwater interactions, high-frequency water quantity data were collected from four stilling wells and two transects of piezometers (n = 6 each) during the 2011 water year along Brushy Creek, located in central Missouri. Weekly water quality data were also collected. Results indicate that Brushy Creek alternates between being a losing and gaining reach, along the study reach (length = 830 m), but is on average a losing stream ( $-3 \times 10^{-5} \text{ m}^3 \text{ s}^{-1} \text{ m}^{-1}$ ). Annual average stream water  $\text{NO}_3^-$  was  $0.53 \text{ mg L}^{-1}$ , while P, K and  $\text{NH}_4^+$  concentrations were 0.13, 3.29 and  $0.06 \text{ mg L}^{-1}$ , respectively. Annual average groundwater  $\text{NO}_3^-$  was  $0.01 \text{ mg L}^{-1}$ , while total P, K and  $\text{NH}_4^+$  concentrations were 0.03, 1.7 and  $0.04 \text{ mg L}^{-1}$ , respectively. Results of a hyperbolic model indicated that  $\text{NO}_3^-$  and K exhibited dilution behavior while  $\text{NH}_4^+$  had a concentration effect and P was hydrologically constant. Groundwater modeling with MODFLOW and HYDRUS – 1D indicates that karst geology promotes rapid water movement that can increase dominance of geochemical nutrient cycling pathways relative to biochemical nutrient cycling pathways. Baseline data and results of analysis presented in this dissertation will aid in identification, improvement and validation of management tools that will contribute to advancements in stream - riparian zone best management practices, in particular in karst hydrogeological environments.