Dr. Christopher Spiese, Assistant Professor in the Department of Chemistry and Biochemistry and Dr. Bryan Boulanger from Civil Engineering at the Ohio Northern University completed an Ohio Water Resources Center funded project funded through a joint USGS 104(b) and OWDA subaward. Their project titled "**Rural On-site Waste Treatment as a Source of Nutrients to a Eutrophic Watershed"** evaluated the extent to which residential on-site wastewater treatment in rural watersheds are a source of nitrogen, phosphorus, and pathogenic bacteria. Identification of sources of nutrients into Lake Erie tributaries is critical for understanding how to control these loadings and ultimately maintain a long-term oligotrophic status in the Lake.

Figure 1 Student Joanne Berry sampling tile drainage (Photo: Ken Colwell, ONU)

At six sites across Putnam County, OH, tile drainage water was sampled over the course of four months (Figure 1). Caffeine was found with mean ± standard deviation concentrations ranging from non-detect at the control site to 0.74±1.14 µg/L in some tile drainage effluents. Because nitrogen is a large component of human waste, there was a significant positive relationship between nitrate and caffeine (Figure 2). Caffeine and total phosphorus on the other hand had a significant negative correlation (Figure 2). The study results are interesting because the observed caffeine-total phosphorous correlation indicates that septic effluents are not significant contributors to phosphorus loadings within the rural watershed, but may contribute to nitrogen loadings. Additionally, commonalities in nutrient fingerprints (total and speciated phosphorous and nitrogen) in groundwater and tile drainage highlight the complex relationships for nutrient and water quality management in irrigation drainage waters. Groundwater from a nearby well indicated a mean total phosphorous 0.39 mg P/L. A mean phosphorous tile drain concentration for the entire study was determined to be 0.4±0.07 mg P/L. Taken together our results indicate that efforts to improve or replace septic systems with an aim toward mitigating phosphorus pollution may be misguided or at least less effective than anticipated.

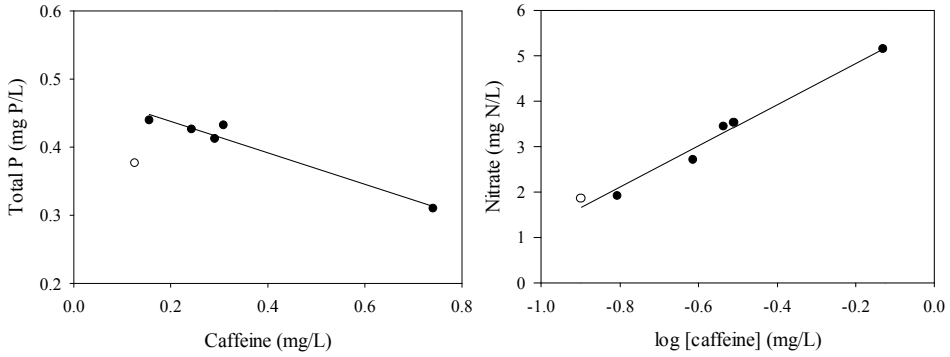

Figure 2 Correlations between caffeine and total phosphorus (left) or nitrate (right). Points denote mean of all samples. Correlation coefficients were significant for total phosphorus (p = 0.001) and nitrate (p = 0.0002).

Principal Investigator: Dr. Christopher Spiese is an environmental chemist and biogeochemist. His research area is an interdisciplinary program that incorporates chemistry, biology, geology, and limnology, but his main focus is on sulfur and phosphorus. He currently has projects examining the role of marine phytoplankton in the production of methylated sulfur compounds, the permeability of these compounds across cell membranes as well as project aimed at developing new methods for dissolved phosphorus analysis and water quality in the Blanchard River.