Dr. Christopher Spiese, Assistant Professor in the Department of Chemistry and Biochemistry and Bryan Boulanger from Civil Engineering at the Ohio Northern University completed an Ohio Water Resources Center funded project via joined USGS 104(b) and OWDA grant. His project titled "**Rural On-site Waste Treatment as a Source of Nutrients to a Eutrophic Watershed"** will determine the extent to which residential on-site wastewater treatment in rural watersheds are source of nitrogen and phosphorus. 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. Dr. Spiese ONU sampling tile drainage water.

At six sites across Putnam County, Ohio, tile drainage water was sampled over the course of two years (Figure 1). Caffeine was found at all of the sites with mean ± standard deviation concentrations ranging from non-detect at the control site to 1.2±1.4 μg/L in tile drainage effluents from sites having on-site wastewater treatment (OSWT) systems. Although nitrogen is a large component of human waste, there was no relationship apparent between nitrogen and caffeine. Caffeine and total phosphorus on the other hand had a significant negative correlation (Figure 2a). The study results are interesting, because the observed caffeine-total phosphorous correlation indicates that septic effluents are not significant contributors to nutrient loadings within the rural watershed. Additionally, commonalities in nutrient fingerprints (total and dissolved phosphorous and nitrogen) in groundwater and tile drainage highlight the complex relationships for nutrient and water quality management in irrigation drainage waters. At nearly all sites tested, both fecal coliform bacteria and *E. coli* were detected (Figure 2b). Both microbe types were correlated with caffeine concentration, indicating a common source. In summary, in this agricultural watershed, OSWT systems do not contribute significantly to nutrients, but do appear to be a source of bacteria. These results urge caution when making policy decisions related to nutrient reduction by targeting residential OSWT systems.

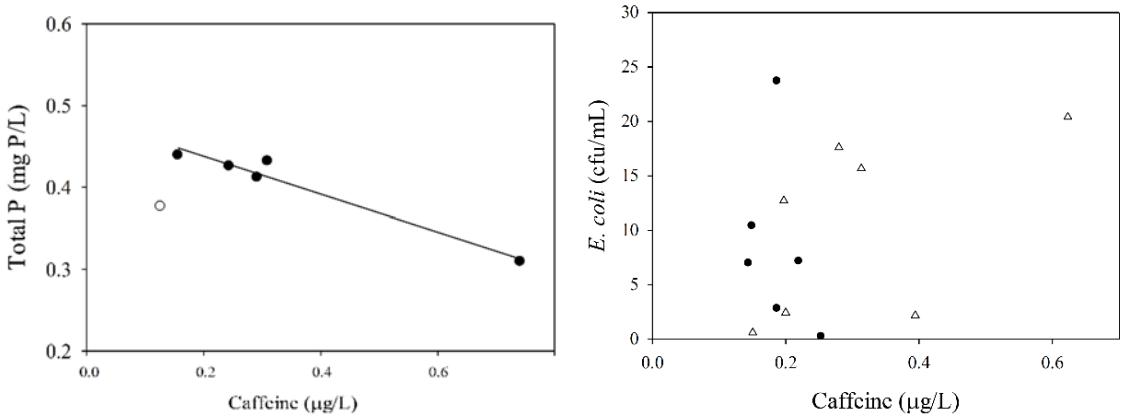

Figure 2 Correlations between caffeine and a) total phosphorus, b) *E. Coli*. Points denote mean of all samples. Correlation coefficients were significant for both.

<u>Researcher Profile:</u> Dr. Christopher Spiese is an environmental chemist and biogeochemist. His research area is a highly interdisciplinary program that incorporates chemistry, biology, geology, and limnology, but his main focus is on physical and analytical chemistry in environmental systems. He currently has projects examining the role of contaminants on membrane transport, the prevalence of microplastics in rivers and the release of bound phosphorus from soils and sediments.