ENIGMA: Long-Term Continuous Monitoring Gives Insight into Patterns Between Groundwater and Weather Events

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Project Goals: ENIGMA -Ecosystems and Networks Integrated with Genes and Molecular Assemblies use a systems biology approach to understand the interaction between microbial communities and the ecosystems that they inhabit. To link genetic, ecological, and environmental factors to the structure and function of microbial communities, ENIGMA integrates and develops laboratory, field, and computational methods.

The main goals of this project are to use long-term continuous monitoring to understand the fluctuations seen in the microbial communities and geochemistry of groundwater over time, including diurnal, seasonal and annual time scales.

Abstract: To take an environmental systems approach to studying the microbial communities found in groundwater and sediment, we began long-term continuous monitoring as a way to understand how ecosystem phenomena were playing a role in these microscopic environments. To do this, we deployed two down-well groundwater monitoring units (In-Situ AquaTroll600) and set up two meteorological stations (HOBO U30) within contaminated and uncontaminated research field sites at Y-12 National Security Complex in Oak Ridge, Tenn.
After monitoring the groundwater and weather at these sites, we have seen interesting trends within the data. There are natural diurnal fluctuations in the groundwater elevation, relative humidity and air temperature. We also see increases in groundwater elevation and changes in groundwater geochemistry (dissolved oxygen, pH, conductivity) following heavy rain events. However, there is a distinct delay between the detected rainfall and a rise in the groundwater elevation. We will begin monthly sampling of groundwater in the spring to detect the fluctuations in microbial community and geochemistry in these sites. Our ENIGMA team members are developing a sampling plan for sediment coring in the coming months. With the continued use of these units and the collection of groundwater and sediment, we are hoping to capture the extended, especially annual and seasonal, relationships between all of these parameters and their effect on the microbial community. This data is also being used to guide future scientific focus on meteorological events of interest, seasonal focus for sampling and geochemical variations over time.

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