

Title: The Argonne National Laboratory Subsurface Biogeochemical Research Program SFA: Wetland Hydrobiogeochemistry

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<https://www.anl.gov/bio/project/subsurface-biogeochemical-research>

Project Abstract: Within wetlands, movement of water and biogeochemically catalyzed transformations of its constituents determine the mobility of nutrients and contaminants, the emission of greenhouse gasses into the atmosphere, carbon (C) cycling, and the quality of water itself. The long-term objective of the Argonne *Wetland Hydrobiogeochemistry* Scientific Focus Area (SFA) is the *development of a mechanistic understanding and ability to model the coupled hydrological, geochemical, and biological processes controlling water quality in wetlands and the implications of these processes for watersheds commonly found in humid regions of the United States*. To accomplish this, the Argonne *Wetland Hydrobiogeochemistry* SFA studies hydrobiogeochemistry with a focus on a riparian wetland field site within Tims Branch at the Savannah River Site. This site is representative of many riparian wetlands found in humid regions of the Southeast that have C-rich soils and high Fe content. However, it is unique in that it received large amounts of contaminant metals and uranium as a result of previous industrial- scale manufacturing of nuclear fuel and target assemblies. Understanding the function of the wetlands in relation to water quality, including the concentration of metals and uranium within the soluble and particulate components of groundwater and surface waters of Tims Branch addresses the goal of the SBR Program to *advance a robust, predictive understanding of watershed function*.

The overarching hypothesis of our work is that *hydrologically driven biogeochemical processes that create redox dynamic conditions from the nanometer to meter scales are a major driver of groundwater and surface water quality within riparian wetland environments*.

We identified three major components of the Tims Branch riparian wetland that represent critical zones containing hydrologically driven biogeochemical drivers, which determine water quality: *sediment, rhizosphere, and stream*. These three components are interdependent and are considered as a whole for a systems-level