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

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Understanding the interplay of the Fe and S biogeochemical cycles with the hydrologic cycle is essential to accurately predict carbon cycling, nutrient availability, and contaminant mobility in near-surface and subsurface systems. The present objective of the Argonne SBR SFA is *to identify and understand the coupled biotic-abiotic transformations of Fe and S within redox- dynamic environments at the molecular- to core-scale, as well as to understand the effects of Fe and S biogeochemistry on the transformation and mobility of major/minor elements and contaminants.* The Argonne SBR SFA has been integrating two key analytical strengths at Argonne—the Advanced Photon Source for synchrotron-based interrogation of systems and next-generation DNA sequencing and bioinformatics approaches for microbial community and metabolic pathway analysis—with biogeochemistry and microbial ecology. Addressing this objective contributes directly to the goal of the United States Department of Energy, Office of Biological and Environmental Research (BER) to "advance fundamental understanding of coupled biogeochemical processes in complex subsurface environments to enable system-level environmental prediction and decision support."

Recently, the Argonne SBR SFA has begun to incorporate a wetland field component within its ongoing research on Fe and S biogeochemistry in redox dynamic environments. Specifically, the Argonne SBR SFA is expanding into wetland hydrobiogeochemistry with a focus on a riparian wetland field site (Tims Branch) at the Savannah River Site. Research will center on major (e.g., Fe and C) biogeochemical cycles and their controls on water quality and contaminant (e.g. U) transport within the wetland, building on decades of expertise previously developed within the Argonne SBR SFA. The focus on hydrobiogeochemistry within a riparian wetland in the Southeastern US expands the portfolio of existing SBR SFA field sites concerned with watersheds, rivers, and

streams in both arid and humid regions of the US that play a major role in controlling groundwater and surface water quality.

This newly focused Wetland Hydrobiogeochemistry SFA addresses two critical knowledge gaps: *(1) An in-depth understanding of the molecular scale biogeochemical processes affecting Fe, C, and contaminant speciation in wetland streams, sediments, and rhizosphere environments; and (2) An in-depth understanding of hyrologically-driven controls on the mass transfer of Fe, C, and contaminants within wetland streams, sediments, and rhizosphere environments.*

The long-term vision of the Argonne Wetland Hydrobiogeochemistry SFA is the development of a mechanistic understanding and ability to model the coupled hydrological, geochemical, and biological processes controlling water quality in many of the wetlands in the Southeastern US.