# Coupled River Corridor Processes across Scale

Peter S. Nico[1], Dipankar Dwivedi[1], Michelle Newcomer[1], Patricia Fox[1], John Christensen[1], Jillian Banfield[1,2], Susan Mullen[1,2], Bhavna Arora[1], Cam Anderson[7], Curtis Beutler[3], Rosemary W.H. Carroll[4], Christian Dewey[5], Wenming Dong[1], Boris Faybishenko[1], Scott Fendorf[5], Marco Keiluweit[7], Helen Malenda[6], Benjamin Gilbert[1], Sergio Carrero[1], Kenneth H. Williams[1,3], Alexander W. Newman[3]

[1] Lawrence Berkeley National Laboratory, Berkeley, CA;
[2] University of California, Berkeley, CA;
[3] Rocky Mountain Biological Laboratory, Crested Butte, Gothic, CO;
[4] Desert Research Institute, Reno, NV;
[5] Department of Earth System Science, Stanford University, Palo Alto, CA;
[6] U.S. Geological Survey;
[7] School of Earth & Sustainability and Stockbridge School of Agriculture, University of Massachusetts Amherst, Amherst, MA

**Contact**: (psnico@lbl.gov)

**Project Lead Principal Investigator (PI):** Eoin Brodie

**BER Program**: ESS

**Project**: Berkeley Lab Watershed Function SFA

**Project Website**: watershed.lbl.gov

**Abstract**:

The river corridor processes component of the Watershed Science SFA seeks to examine how the complex coupling of physical, chemical, and biological processes along the river corridor of the East River in Colorado control the local carbon, metal, and nutrient dynamics. At the largest scale the team has shown the heterogeneity of behavior along different reaches of the river, with reaches of similar length showing very different changes (increases/decreases) in the fluxes of specific species, e.g. nitrate, sulfate, DIC, and dissolved cations. The drivers of this difference in behavior are being analyzed in terms of the watershed functional zonation work and in terms of key river corridors features such as floodplain wetland complexes and the confluence of significant tributaries. Further, the observed floodplain dynamics couple with hydrologic perturbations to show how the size of the snowmelt hydrologic pulse impacts the chemical contributions of the floodplain to the river. Reactive transport modeling at the meander to reach scale confirms how river morphology and connectivity to hyporheic exchange exert strong influences on the degree of biogeochemical processing and identifies particular potential locations of concentrated activity. Further, a numerical exploration of river sinuosity as represented by meander amplitude is explored to further understand this impact and present a possibility for scaling motifs. At the smallest scale, the transformation of sulfur species from their origin as a by-product of rock

weathering to their interactions with river stage perturbations is tracked in order to move toward a system scale understanding of key biogeochemical cycles. Similarly, a detailed exploration of microbiological conditions along the river corridor reveal evidence of hyporheic organisms with a capacity for methane oxidation and nitrogen fixation. This insight highlights the complexity of the fundamental process that create the emergent behavior observable at the river corridor scale.