

## Poster #180

### Processes Governing the Biogeochemical Consequences of Inundation History and the Character of Dissolved Organic Carbon

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*This element of the PNNL SFA will contribute to a predictive understanding of river corridor hydrobiogeochemical function by revealing processes that govern the biogeochemical consequences of inundation history and the character (e.g., thermodynamic properties) of organic carbon (OC). Hydrologic alterations are ubiquitous across watersheds, and these changes influence inundation dynamics within the parafluvial hyporheic zone. These alterations further impact the quantity and character of OC delivered to the hyporheic zone. Our previous research showed that the history of inundation and OC character strongly influence biogeochemical function within the river corridor. We found that time since last inundation strongly influenced the response of hyporheic zone microbial communities and biogeochemical rates to re-inundation. We also found that inputs of thermodynamically favorable OC protect less favorable, mineral-bound OC from microbial oxidation. In contrast, favorable OC derived from groundwater may stimulate the oxidation of less favorable river-derived dissolved OC. There are, however, significant knowledge gaps associated with processes governing the biogeochemical influences of hydrologic history and OC character. Furthermore, such processes are not represented in reactive transport models. This severely limits our ability to develop process-based models of river corridor hydrobiogeochemical function, especially under conditions of altered hydrologic regimes. We will therefore build from our previous work to evaluate hypotheses associated with the biogeochemical influences of inundation history and OC character across a range of variable river stage conditions and physical settings. We will rely on manipulative field experiments within three major hydromorphic settings distributed across the Hanford Reach of the Columbia River. Experimental design will be informed by reactive transport models that include new reaction network formulations representing hypothesized influences of history and OC character. The experiments will leverage well-characterized spatial patterns in inundation history to examine associated influences, and use *in situ* reactive tracer injections to study controls over and influences of OC character. Following manipulations of hydrologic history, biogeochemical and microbial responses will be assayed using advanced analytical and molecular tools. Influences of OC character will be evaluated by injecting OC solutions with known concentration and thermodynamic properties into the subsurface and measuring biogeochemical responses with co-injected reactive tracers. The work will involve significant molecular characterization, leveraging ESML and JGI. Resulting knowledge will be translated into predictive reactive transport models using an iterative model-experiment approach. Resulting process-based models are a critical component of the predictive watershed-scale modeling framework that will be delivered by the PNNL SFA.*