

## Poster #181

### Interactions Between River Stage Dynamics and Physical Setting on Hydrologic Exchange Flows and Primary Producer Biomass within the River Corridor

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*This element of the PNNL SFA will contribute to a predictive understanding of river corridor hydrobiogeochemical function by revealing interactive influences of river stage dynamics, hydromorphic setting, and hydrogeologic heterogeneity on hydrologic exchange flows (HEFs) and associated biogeochemical function.* In the U.S. 90% of water discharge is hydrologically altered, whereby river stage dynamics are continually perturbed. There is a pressing need to understand how hydrologic alterations impact HEFs due to zones of hydrologic exchange contributing up to 96% of metabolism in riverine ecosystem. This project will, therefore, fill a fundamental knowledge gap that impedes progress towards process-based watershed management. Previous simulations indicated that the influence of variable discharge on HEFs will result from interactions between mean river stage and river stage dynamics. We hypothesize that hydromorphic setting will combine with these interactions to govern HEFs. In addition to evaluating this hypothesis we will characterize features of the river corridor system needed to setup hydrobiogeochemical models. These features include the three-dimensional structure of subsurface hydrogeology and reach-scale spatial distributions of primary producer biomass and associated carbon stocks. For hypothesis testing and feature characterization we will leverage a spatiotemporal mosaic of river stage variability, hydromorphology, and hydrogeology throughout the Hanford Reach of the Columbia River. Field sites will be distributed across ~100 km to study a continuum of variable river stage fluctuations and physical characteristics. Discrete field sites will focus on characterization of HEFs using *in situ* temperature and pressure sensors. In select sites we will also characterize hydrogeologic structure and *in situ* biogeochemical rates across river stage conditions using a combination of conservative salt tracer and reactive tracer injections into the subsurface. Salt tracer will act as a contrasting agent for time-lapse electrical resistivity tomography (ERT). To infer hydrogeologic structure, ERT surveys will be analyzed using the hydrogeophysical inversion code PFLOTRAN-E4D. Time series of reactive tracer concentrations will provide estimates of biogeochemical rates. Those estimates will be linked to hydrogeology, proximity to riparian vegetation, and river stage conditions. In addition, we will use remote sensing and UAV-based data collection via the ARM user facility to estimate spatial variation in aquatic and terrestrial primary producer biomass. Resulting knowledge and data products are integral to the PNNL SBR SFA and will be used in an iterative model-experiment approach to facilitate the calibration/evaluation of mechanistic models at the scale of hydromorphic units and evaluation of reduced-order models at reach to watershed scales.