Impacts of Drying on Hyporheic Zone Biogeochemistry

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Project Abstract: All streams have zones that are under water sometimes and are dry at other times, most streams go fully dry, and the occurrence of dry streambeds is increasing. Within streams, hyporheic zones are often a primary biogeochemical reactor that influences carbon, nutrient, and contaminant transformations and fluxes. Arguably then, watershed and river corridor hydro-biogeochemistry research should have a high level of emphasis on studying hyporheic zones that are sometimes wet and sometimes dry (i.e., that are variably inundated). This is not the case, however, which means that we are understudying one of the most common stream habitats on the planet. This gap is increasingly recognized, and research efforts focused on variably inundated hyporheic zones are increasing. I will present one such study focused on the influences of drying on hyporheic zone biogeochemistry. The study has three primary goals evaluated in hyporheic zones distributed across the contiguous United States: (1) quantify the direction and magnitude of effect that drying has on aerobic respiration rate across diverse hyporheic zone environments, (2) reveal physical, chemical, and biologic mechanisms governing the impact of drying on respiration, and (3) incorporate that mechanistic knowledge into a reactive transport model aimed at predicting the influences of drying on variably inundated hyporheic zone hydro-biogeochemistry. Those goals are motivated by single-system experiments that found a negative impact of drying on respiration that was linked to a change in the chemistry of organic matter. That chemical change caused less energy to be available to microbes that use the organic matter for respiration. While those are interesting results, we don't know if similar results happen across other hyporheic zone systems. The current study is filling that gap and extending the outcomes to both data driven and mechanistic predictive models. Such knowledge and tools will help incorporate variably inundated hyporheic zones into our holistic understanding of Earth system hydro-biogeochemistry.