Variability in microbial community structure and function across and among meanders in the East River SFA Watershed Study Site

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Microbially-mediated biogeochemical processes that occur at the micron-scale impact watershed function and ecosystem outputs at the tens of kilometers scale. Building from research at the Rifle site on subsurface biogeochemical processes over meter length scales, the new Berkeley Lab Subsurface Biogeochemistry Watershed Function SFA will be conducted at a headwaters catchment (East River) and aims to develop understanding of biogeochemical processes at the watershed scale. Watershed functioning relies on complex interactions among vegetation, hydrology, topography, and geology that lead to distinct environmental compartments at the surface and in the subsurface. We hypothesize that detailed analysis of meanders, important riparian zone compartments, can generate insights about key biogeochemical processes that can be used to approximate the function of the larger system. The meanders were subdivided into river channel, hyporheic zone, and the surface and subsurface vegetated soils and sediments, whose characteristics reflect past and present river flow dynamics. We sampled soils and sediments of meanders close to the headwaters, downstream, and close to the end of the modeling domain of the East River. Our objectives are to infer processes that contribute to C and N cycling based on the metabolic potential of the microbial communities and to identify hotspots and hot moments of microbial activity in the riparian zone and their impacts on nutrients cycling in the watershed. The sampling targeted soil depths ~ 10-25 cm across a grid of sites covering up to 100 m^2 of terrain over each meander. Ninety-six samples have been submitted to the Joint Genome Institute for metagenomic sequencing. We expect to assemble draft genomes for organisms that represent ≥ 1% of the community. This work will leverage the genome-resolved metagenomic bioinformatics methods developed through research at the Rifle site. This pilot study will allow us to compare the characteristics of the three meanders and to identify patterns of variation of microbial community structure and function, correlated with solid phase geochemical and mineralogical analysis. The research will provide insight into the role of meanders for the overall functioning of the watershed. Although there are likely to be differences in nutrient degradation and other processes among the three different meander sites, we expect to find meaningful commonalities that will support the use of meanders as representative scaling motifs.