Poster #159

Spatial and Temporal Dynamics of Carbon and Nitrogen within a Mountainous Watershed

Nicholas Bouskill[1], Harry R. Beller[1], Jiamin Wan[1], Patrick O. Sorensen[1], Jillian F. Banfield[2], Markus Bill[1], Eoin L. Brodie[1], Rosemary Carroll[3], Mark S. Conrad[1], Ulas Karaoz[1], Yongman Kim[1], Adi Lavy[2], Tetsu Tokunaga[1], Shi Wang[1], Kenneth H. Williams[1]

[1] Lawrence Berkeley National Laboratory
[2] University of California, Berkeley
[3] Desert Research Institute

Contact: Nicholas Bouskill [njbouskill@lbl.gov]

Mountainous watersheds are characterized by substantial heterogeneity in geomorphology, soil texture, and vegetation that determine hydrological flow paths and residence times through distinct catchment subsystems. Despite advances in understanding of the spatial and temporal drivers of biogeochemical cycling within snowmelt-dominated ecosystems, knowledge gaps remain. Here we describe ongoing work examining the input, transformation, and export of carbon and nitrogen within the East River (CO) catchment, with a focus on data collected from one catchment subsystem, a lower montane meadow intensive study site, since the project started in Fall 2016. With respect to carbon, initial work seeks to characterize the depth- and time-resolved distribution, inventories, and fluxes of soil carbon from surface soils through fractured and consolidated bedrock to a depth of 10 m. We will show data for organic and inorganic carbon content and corresponding isotopic signatures (^{13}C and ^{14}C) in soil, soil extracts, and pore water samples collected along a hillslope-to-riparian floodplain transect across a lower montane meadow. Respiration rates and metagenome/metatranscriptome profiles will also be included. Additional ongoing work at the lower montane site focuses on seasonal trends in established vegetation plots and aims to elucidate, in particular, N biogeochemical cycling during snowmelt in this subsystem and the effects of early snowmelt. Presented baseline data will encompass: soil gas fluxes (CO_2, CH_4, and N_2O, including under-snow measurements), soil microbial biomass (C and N, and their corresponding isotopic signatures), associated microbial community composition, and soil NH_4^+, NO_3^-, and P concentrations (the soil data covers multiple depths). This and other work builds toward the broader SFA goal of the “Nitrogen Milestone”. Nitrogen is a major limiting nutrient within mountainous regions and the current work focuses on a high-resolution, cross-watershed characterization of the nitrogen cycle during different hydrological regimes (baseflow, snowmelt, drought, and monsoonal precipitation). High frequency NO_3^- measurements have been made over the past two years, both within the East River and in several tributaries, and reveal NO_3^- fluxes that span nine orders of magnitude across the catchment; work with the stable isotopes ($\delta^{15}N$ and $\delta^{18}O$) of NO_3^- continues to link this data with specific biogeochemical drivers. Overall, such baseline data on input, transformation, and export of nitrogen and carbon from catchment subsystems will be used to inform modeling efforts and contribute to scale-adaptive approaches to represent the feedback between hydrological perturbation and biogeochemical processes to improve predictions of nitrogen export from the catchment.