Poster #150

Watershed Function SFA: Hydrolological and Biogeochemical Dynamics from Genomes to Watershed Scales

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Climate change, extreme weather, land-use change, and other perturbations are significantly reshaping interactions with in watersheds throughout the world. While mountainous watersheds are recognized as the water towers for the world, hydrological processes in watersheds also mediate biogeochemical processes that support all terrestrial life. Developing predictive understanding of watershed hydrological and biogeochemical functioning is challenging, as complex interactions occurring within a heterogeneous watershed can lead to a cascade of effects on downstream water availability and quality. Although these interactions can have significant implications for energy production, agriculture, water quality, and other benefits valued by society, uncertainty associated with predicting watershed function is high.

The Watershed Function SFA aims to substantially reduce this uncertainty through developing a predictive understanding of how mountainous watersheds retain and release downgradient water, nutrients, carbon, and metals. In particular, the project is exploring how early snowmelt, drought, and other disturbances will influence mountainous watershed dynamics at seasonal to decadal timescales. The Watershed Function project is being carried out in a headwater mountainous catchment of the Upper Colorado River Basin: the East River watershed, which is characterized by significant gradients in elevation, vegetation and hydrogeology. A system within system project perspective posits that the integrated watershed response to disturbances can be adequately predicted through consideration of interactions and feedbacks occurring within a limited number of subsystems, each having distinct vegetation-subsurface biogeochemical-hydrological characteristics. New types of observations and experiments are being carried out across satellite and intensive subsystem sites within the watershed, which are elucidating hydrogeological, ecohydrological, and organic-mineral interactions that influence how a range of subsystems respond to perturbations. An early intensive focus is on snowmelt timing in a Lower Montane study site. A key technological goal is the development of scale-adaptive simulation capabilities that can incorporate genomic information where and when it is useful for predicting the overall watershed response to disturbance. Through developing and integrating new microbial ecology, geochemical, hydrological, ecohydrological, computational and geophysical approaches, the project is developing new insights about biogeochemical dynamics from genome to watershed scales.