Poster #1-25

Seasonal Dynamics of Arctic Tundra Microbes

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Arctic soils are one of the world's largest terrestrial carbon storages thus an important focal point for climate change research. With increasing global temperatures, arctic soil carbon stores may become available for rapid microbial mineralization and result in increased greenhouse gas (GHG) emissions. Different landscape features in soil surface and subsurface such as slope, redox gradients, ice wedge formation, depth of permafrost can result in diverse microbial habitats that might respond differently to warming and perturbations. Seasonal changes in soil microbiomes and its impact on GHG production potential is not well understood. In this project, we applied metagenomics and microarrays (Geochip) to determine the phylogenetic and functional differences in the active layer soil microbiomes from two NGEE-Arctic field sites: polygonal arctic tundra at the Barrow Environmental Observatory (BEO) and a watershed (Teller Rd) nearby Nome in Seward Peninsula. In BEO, Arctic tundra microbiomes are structured along topographical features. This structuring had a direct impact on distribution of key genes for GHG emissions where GHG production potential was localized and showed large variations between different polygons. Microbial genomes showed improved resilience to changes in carbon availability, fluctuating temperatures and nutrient-deficient conditions in tundra soils. Even though microbiomes showed seasonal variations; over a thaw season landscape topography remained as a main distinguishing factor for distribution of microbial functions. Landscape topography in hill slopes of Teller Rd watershed, was also a strong determinant for soil geochemistry, vegetation distribution, soil microbiomes and GHG fluxes. In this field site besides topography, nutrient availability and pH were strongly correlated with soil microbiomes and GHG fluxes. We are currently developing statistical models to determine relationships between microbial activity, competition for resources and topography. Integrating microbial functions with geochemistry and GHG fluxes aids us in determining the impact of landscape topography in biogeochemical cycles in Arctic soils and in the future, these efforts will contribute to resolving uncertainties surrounding ecosystem responses.