Poster #1-15

Symbiotic N-fixation by Alder Impacts Nitrogen Availability on a Landscape Scale

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Alnus viridis subspp. *fruticosa* (alder) is a deciduous shrub that forms a symbiotic relationship with *Frankia* bacteria. These bacteria fix atmospheric nitrogen (N) into biologically available forms within nodules formed on the shrub's roots. Nitrogen is the primary limiting nutrient for Arctic plant productivity so inputs of available N via symbiotic fixation has the potential to alter plant, soil and microbial interactions in these rapidly warming ecosystems. To assess plant available N on a Kougarok hillslope on the Seward Peninsula, AK, we established vegetation plots across six plant communities in 2016. Aboveground biomass, inorganic N and P availability in surface soils, and foliar %N and $\delta^{15}N$ were measured across these six plant communities. Although there was a high degree of variation in observed characteristics across the six plant communities, soil inorganic N availability and foliar %N were highest within plots located near alder shrublands, suggesting that symbiotic N fixation inputs from alder shrublands impacts N availability of neighboring microsites. To quantify N inputs associated with alder at the Kougarok site, in 2017 we measured N fixation rates and nodule biomass associated with tall stature alder individuals (>1.5 m) growing in dense shrublands. Nodule biomass associated with short stature alder (<1.5 m) growing in water tracks across tussock tundra was also assessed. Nodule biomass of Alder growing in shrublands was significantly higher than that of alder growing in water tracks (18.54 g/m^2 vs 3.64 g/ m^2, $p = 0.03$). Inputs of N via symbiotic N fixation were to be driven by nodule biomass rather than rates of N fixation within root nodules. Nodule biomass was therefore compared to aboveground biomass, foliar chemistry, specific leaf area, shrub height, and basal area to identify appropriate scaling metrics. Overall, our results suggest that the inclusion of a N fixing shrub plant function type (PFT) in earth system models would improve the ability of these models to capture nutrient dynamics in Arctic ecosystems.