Poster #9-3

The Consequences of Warming on *Sphagnum* Peat Moss Productivity and Microbial Community Composition

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Peatland ecosystems are estimated to store a third of stored terrestrial carbon as dead organic peat. The moss plant Sphagnum is a keystone genus in these ecosystems, with its biological function (e.g., photosynthetic CO_2 gain, recalcitrant decomposition, acidification) and abiotic environment influencing ecosystem structure and function and potentially global C cycling. We explored the carbon and nitrogen cycling responses of *Sphagnum* to warming and CO_2 enrichment as part of the Spruce and Peatland Responses Under Climatic and Environmental Change (SPRUCE) project in an ombrotrophic spruce bog in the Marcell Experimental Forest in northern Minnesota. Intact plots in the bog are being exposed to a range of warming levels from ambient to ambient +9 °C in combination with ambient or elevated (900 ppm) CO_2 within 12- m diameter, open-top enclosures. The *Sphagnum* community is dominated by *Sphagnum angustifolium, S. fallax* (together comprising 70% cover), and *S. magellanicum* (19% cover). After one year of treatment we saw no evidence of an effect on community composition. In the second year of warming, dry matter increment of Sphagnum increased with modest warming to a maximum at 5°C above ambient and decreased with additional warming. *Sphagnum* cover declined from close to 100% of the ground area to less than 50% in the warmest enclosures. After three years of warming, annual productivity declined linearly with increasing temperature (13 to 29 g C m^{-2} per °C warming) due to wide–spread desiccation and loss of *Sphagnum*. Productivity was less in elevated CO_2 enclosures, which we attribute to likely indirect effects of CO_2 on shrubs.

Sphagnum capitula N concentration was about 10 mg g-1 in untreated plots and increased 0.5 mg g-1 per degree C temperature increase. This may correspond to an increase in N availability with warming and have downstream consequences on *Sphagnum* associated N fixing symbionts (diazotroph). Therefore, we investigated the effects of warming on the microbial community and N_2 fixation activity. We found that the taxonomic diversity of the microbial community, including diazotrophs, decreased with warming ($P<0.05$). This was mirrored by a decease in N_2-fixation rates. The warming treatment shifted the diazotrophs from a mixed community of *Nostocales* (Cyanobacteria) and *Rhizobiales* (Alphaproteobacteria) to those predominantly composed of *Nostocales*. Some diazotrophic genera returned to similar relative abundance as control plots after two years of warming, indicating possible taxon specific resiliency. Our results demonstrate that warming substantially alters the community composition and N_2 fixation activity of peat moss microbiomes.