Poster #50

Carbon and Nitrogen Cycling By Sphagnum in the SPRUCE Experiment

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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, but over time, community shifts, such as replacement of *Sphagnum* by *Polytrichum* in warmer and drier plots could have a significant effect on whole-ecosystem function. Using clear-topped automatic CO_2 chambers, we estimated gross primary productivity (GPP) of the *Sphagnum* community in 2015 to be 424 g C m^{-2}. This estimate is consistent with an independent estimate of *Sphagnum* community net primary productivity (NPP) in 2015 of 205 g C m^{-2}, based on measurements of stem elongation, mass per unit stem length, C concentration, and number of stems per unit ground area. In 2016 we employed a new and more direct method of monitoring *Sphagnum* growth inside mesh columns embedded in the bog. NPP in 2016 averaged 117 g C± 7 g m^{-2}. There were no effects of the warming or CO_2 treatments on annual NPP, but in ambient CO_2 summer (mid-May to mid-October) *Sphagnum* productivity was well described by a second-order polynomial with peak productivity occurring in the +4.5 °C treatment. Based on an average *Sphagnum* C:N ratio of 34.6, less than 10% of the N needed to support the observed *Sphagnum* production was accounted for in deposition and pore water chemistry. Therefore we investigated the possible N contribution of the *Sphagnum* associated microbiome using 16S rRNA profiling. We found all samples to be dominated by *Alphaproteobacteria* (45-51%) followed by *Acidobacteria* (11-16%) and *Gammaproteobacteria* (8-9%). N2 fixing diazotroph abundance decreased with increased temperature (6% in ambient control, 3% in ambient + 6 °C) and methanotroph abundance increased with temperature (0.14% in ambient control, 1.3% in ambient + 6 °C respectively). Current experiments are exploring how increased temperature influences diazotroph abundance, N_2–fixation rates and *Sphagnum* net photosynthesis.