Poster #9-2

Peatland Vegetation Responses to 3-Years of Warming and Elevated CO_2

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We are conducting an in situ warming by elevated CO_2 study in a high-carbon, ombrotrophic peatland in northern Minnesota. Our method to warm ten 12-m diameter plots combines a recirculating warm air envelope within enclosure walls with deep soil/peat heating to simulate a broad range of future warming treatments as much as +9 °C. Whole-ecosystem warming was initiated in August 2015, followed by elevated CO_2 atmospheres (eCO_2 at + 500 ppm) in June 2016 (half the plots). Assessments of tree growth were made with annual circumference observations at dbh, automated dendrometer band records, and annual height and canopy volume evaluations via terrestrial LIDAR. Shrub-level vegetation growth above the bog surface was obtained from destructive harvest of 0.25 m2 plots in each enclosure. Sphagnum growth was measured from intact columns of selected populations. Growth data were tallied and extrapolated to the plot scale for annual estimates of plot aboveground net primary production (ANPP) for tree, shrub-layer and *Sphagnum* communities.

After three years of warming, tree growth reductions are apparent in *P. mariana* with some mortality in *Larix* evident in the warmest treatment. Shrub-layer community growth showed an increasing trend with warming, however, that community trend varied by species. No consistent growth changes driven by eCO_2 treatments for either trees or shrubs have yet developed. There was no *Sphagnum* growth response to warming or eCO_2 treatments in 2016. We observed a curvilinear response to temperature in 2017 (maximum growth for +4.5 ^{0}C plots). By 2018, a linear decline with temperature was evident. Warming reduced *Sphagnum* percent cover with declines beginning in 2016 that increased through 2017 and 2018.

Net primary production (NPP) of the *Sphagnum* community, calculated as dry matter increment times fractional cover and converted to C units, declined -13 to -29 g C m-2 °C-1 with increasing temperature in 2017 and 2018, and was less in eCO_2 plots in 2018. Shrub-layer ANPP was +3 to +4 gC m^{-2} y^{-1} $°C^{-1}$, and ANPP reductions for trees was -4 gC m^{-2} y^{-1} $°C^{-1}$. Combining all measures of ANPP shows reduced peatland C gain dominated by changes in the productivity of the *Sphagnum* layer.