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Sphagnum Production, Nutrient Content, and Community Composition in the SPRUCE Experiment

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Sphagnum contributes a substantial fraction of the net primary productivity of the S-1 bog, and it is the source of the accumulation of peat in the ecosystem. Hence, characterizing *Sphagnum* production and its response to the warming and CO_2 treatments are important objectives of the SPRUCE experiment. We will test the hypothesis that by accelerating soil nutrient cycles, warming will promote shrub production to the detriment of the *Sphagnum* community via increased competition for light and nutrients. We also hypothesize that moss species that are more adapted to drier condition (*Sphagnum magellanicum* and *Polytrichum* sp.), which are present primarily on hummocks, will increase in importance relative to *S. angustifolium* and *S. fallax*. We measured the production and composition of *Sphagnum* community in 10 enclosures and two open plots in 2017. There were five levels of heating (+0 ∘C to +9 ∘C) combined with ambient or elevated (+500 ppm) CO_2. *Sphagnum* productivity was measured by placing a known quantity of either *S. magellanicum* or *S. angustifolium/fallax* (which are difficult to distinguish) in a 3.8-cm diameter mesh tube and inserting the tube in the bog, ensuring close contact with the surrounding *Sphagnum* community. The tubes were installed in October and removed one year later, dry weight of new tissue measured, and the capitula were analyzed for N and P content. Species composition of the moss layer was measured in 25 5×5 cm locations distributed along three transects in each plot. Mosses covered 97% of the ground area of the open plots: 67.6% was covered with *S. angustifolium/fallax*, 20.6% with *S. magellanicum*, and 8.8% with *Polytrichum*. The fraction of area without live moss (bare ground, dead moss, or grass) increased sharply with enclosure temperature, and only 40% of the ground was moss covered in the +9 ∘C enclosures. The fraction of *S. angustifolium*/fallax in the moss-covered area increased with temperature and *S. magellanicum* and *Polytrichum* declined, in opposition to the response we had hypothesized. Sphagnum production in the open plots averaged 440 g m^{-2}. Production of S. *angustifolium/fallax* in both hummocks and hollows declined with increasing temperature; there was no effect of CO_2. Plot-level production was significantly greater in open plots and declined dramatically with increasing temperature in the enclosures. Nitrogen and phosphorus concentrations in *Sphagnum* capitula increased with warming, consistent with evidence of their increased availability. The nitrogen:phosphorus ratio of 9 suggests the *Sphagnum* community is N limited.