Poster #9-5

Warming Increases Plant-Available Nutrients in the SPRUCE Bog

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Warming is expected to increase the release of carbon from highly-organic peatland soils, potentially leading to a positive feedback to future warming. This response is expected to be mediated by the response of peatland vegetation to rising atmospheric [CO_2], as well as the effects of warming on plant-available nutrients and water.

We quantified the effects of a range of ecosystem warming (from +0°C to +9°C), as well as elevated [CO_2], on plant-available nutrients in the SPRUCE (Spruce and Peatland Responses Under Changing Environments) experiment in an ombrotrophic bog in northern Minnesota, USA. We used ion-exchange resin capsules to monitor monthly changes in plant-available nutrients (i.e., NH_4-N, NO_3-N, and PO_4^{3-}) throughout the peat profile and across hummock- hollow microtopography. NH_4-N was by far the most available N source, with NO_3-N making up a negligible fraction; PO_3^- availability was intermediate. Warming—combined with a longer frost-free period—tripled the availability of NH_4^+ and PO_4^{3-} in the warmest treatment plots. Furthermore, increases in PO_4^{3-} availability with warming were greater than increases in NH_4^+, especially in deeper peat. However, the increase in nutrients was much greater below the rooting zone. There is thus far no effect of elevated [CO_2] on nutrient availability.

Interestingly, the same warming response was not apparent in the subset of porewater nutrients collected and measured at bi-weekly intervals at a comparable depth increment in the hollows. While porewater total organic carbon concentrations were increased by warming, indicating increased mineralization of organic matter, there was no difference in porewater NH_4^+, NO_3^-, or PO_4^{3-} concentrations across the warmed plots.

Taken together, these lines of evidence indicate that warming has increased the mineralization of peat, leading to increased nutrient availability. In turn, increased nutrient uptake by the vegetation has depleted the availability of nutrients in the rooting zone and in porewater. The additional nutrients taken up by the plant community are detectable in increased N and P concentrations in *Sphagnum* mosses; however, this may be luxury uptake, as evidence indicates that moss production has declined with warming. The relative balance of peat accumulation will depend in part on whether vegetation growth is increased in response to warming and increased nutrient availability, or whether this response is limited by increased drying in the warmed treatments.