Poster #1-37

Divergent Morphological and Hydrological Responses of Dominant Woody Bog Species to Whole Ecosystem Warming and Elevated CO_2 at SPRUCE

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The SPRUCE climate change experiment has been exposing a southern boreal forested bog to whole ecosystem warming since 2016 and elevated CO_2 (eCO_2) concentrations since 2017.
This long-term project was designed to test mechanistic responses of a vulnerable ecosystem to changing environment conditions in order to inform and improve prognostic terrestrial biosphere models. Using large open-topped chambers, the ecosystem was subjected to increased temperature (T) up to +9 °C that has accelerated spring phenology in the warmest plots by up to 6 weeks. Together with T-driven increases in nutrient availability and vapor pressure deficit, we hypothesize that the treatments would induce changes in morphology and relationships with plant water relations of dominant woody plants. In 2017 we collected terminal shoots that fully developed under treatments from black spruce (*Picea mariana*) (current and year-old cohorts developed under T treatments, but only current cohort under CO_2 treatments), leatherleaf (*Chamaedaphne calyculata*), tamarack (*Larix laricina*), and bog Labrador tea (*Rhododendron groenlandicum*). Morphological plant traits measured included growth rate, leaf mass per area (LMA), branch silhouette to projected leaf area ratio (SPAR), C:N and xylem hydraulic anatomy. Sapflow and predawn/midday water potentials were measured to assess treatment x morphology impacts on plant water relations. In August 2017, LMA declined with T in L. laricina exposed to eCO_2 but increased for aCO_2. In contrast, LMA declined with T in P. mariana under both CO2 treatments (R2=0.63). Whole shoot SPAR values declined with T for *L. laricina* by up to 14%, but increased with T for *P. mariana* by 8% for both CO_2 treatments. In contrast, the *R. groenlandicum* shrub STAR values exhibited a threshold response, declining with T up to +6.75 °C, but increasing dramatically for +9 °C treatments, regardless of CO_2 treatment. We expect there are species-specific limits to foliar plasticity in response to T that may result in ecological advantages those species with broader acclimation capacity. In addition, the divergent responses of the trees may reflect their different anisohydric (*Larix*) or isohydric (*Picea*) strategies. Indeed, in response to T, *P. mariana* closed stomata prior to the *pretreatment* turgor loss point, which maintained water potentials and sapflow at constant levels. In contrast, *L. laricina* kept stomata open in response to T, approaching or exceeding the turgor loss point, dramatically increasing predawn/midday water potential stress and doubling plant water use. Results improve mechanistic understanding of plant responses to future environmental conditions, including net primary productivity, water use and biogeochemical cycling.