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Tree species' responses to throughfall removal experiments superimposed on a natural drought event in two contrasting humid temperate forests in New Hampshire, USA

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Climate change is likely to affect Northeastern U.S. forests through the increased frequency and severity of drought events. However, our understanding of how these humid temperate forests will respond to moderate to extreme droughts is limited. Given the important role that these forests play in providing ecosystem services and in supplying forest products, enhancing our knowledge about the impacts of drought is critical to guiding forest management and climate change adaptation efforts. We conducted ~50% throughfall removal experiments at two contrasting sites in the Northeastern US (Hubbard Brook Experimental Forest and Thompson Farm, NH, USA), which were superimposed on the severe natural drought occurring in August-September 2016. Preliminary analysis suggests that the two sites respond differently to simulated drought. Pinus strobus trees at Thompson Farm reduced their transpiration rates in response to both the natural and experimental drought, particularly evident during a 5-day period at the height of the drought were transpiration nearly ceased. Both P. strobus and Quercus rubra trees increased their water use efficiency in response to reduced soil water availability, with Q. rubra allowing its midday water potential to reach more negative values, consistent with its more drought tolerant strategy compared to P. strobus. In contrast, we did not detect any significant differences in tree transpiration rates or growth in the dominant tree species, Acer rubrum, in response to the experimental drought treatment at Hubbard Brook. However, both soil respiration and fine root biomass production were lower in the drought treatment plots relative to the control plots at Hubbard Brook. We plan to continue these throughfall removal experiments for at least two more years to better understand the implications of future drought in these humid temperate forests and identify differences in species' physiological adaptations and threshold responses.