

Title: Sap Flux-scaled Transpiration, Canopy Conductance and Gross Primary Productivity in Response to Throughfall Manipulation in Three Co-occurring Species

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BER Program: ESS

Project: University project: Understanding spatial and temporal drivers of variation in tree hydraulic processes and their consequences for climate feedbacks

Project Abstract: We recently started INATWE, the INdiana Acclimation of Trees to Water stress Experiment, in three forests in Indiana. This project will examine whether long-term exposure to different levels of water availability alters trees' short-term responses to droughts, and integrate results from the project into the FATES-HYDRO model and other models. It is still too early to present results from this project. Here, we present results from preliminary experiments conducted in deciduous forest in west-central Indiana. We investigated the influence of decreased precipitation and increased soil water limitation on (1) within- and across-season rates of transpiration, canopy conductance and gross primary productivity, (2) responses of these variables to soil moisture and other environmental conditions, and (3) responses to soil and atmospheric moisture during natural droughts. Using a 3-year throughfall exclusion experiment, we examined responses of co-occurring tree species to reduced water input and soil water availability by quantifying physiological responses for three deciduous species across ambient rainfall, moderate (-45%), and extreme (-80%) throughfall removal treatments. Our initial results from this ongoing research suggest that throughfall removal alters tree species' relationships between shallow soil moisture and transpiration, canopy conductance, and gross primary productivity. Trees in the drier treatments were frequently less responsive to fluctuations in soil moisture. These trees were also more physiologically conservative; at a given soil moisture level, these trees exhibited reduced transpiration, canopy conductance, and gross primary productivity compared to trees receiving ambient precipitation.