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Impact of transpiration rates on foliar silicon concentrations across a range of angiosperm species exposed to water stress.

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It is widely observed that silicon availability (Si) can enhance plant growth and increase the tolerance of plants to a range of biotic and abiotic stresses, although the specific mechanisms underlying these positive effects are not always understood. Silicon is acquired by plants both actively via transporters located in roots and/or passively as plants transport water during transpiration. The relative importance of each of these mechanisms depends strongly on the plant species and the level of stress experienced by the plant. Currently there is a lively debate in the literature regarding the relationship between plant Si accumulation and transpiration rates. Rates of transpiration can affect the amount of Si moving through a plant and in turn the concentration of available Si in soils can make the plant less vulnerable to the effects of drought stress. In order to better understand these relationships between plant water fluxes and Si accumulation in leaves, nine angiosperm tree species (from five families including both deciduous and evergreen species) were grown in a greenhouse and exposed to contrasting watering treatments. For each species, three trees were well watered throughout the growing season whilst three others were exposed to water stress. Whole plant transpiration fluxes were monitored continuously with balances, and pre-dawn leaf water potentials were measured regularly during the experiment. In addition the foliar Si concentrations of each plant were measured by ICP-AES after alkaline fusion both at the beginning and the middle of the growing season. In this presentation, we show our first results examining the relationship between leaf Si concentrations and plant water fluxes in contrasting species. We tested the hypothesis that drought stress significantly decreased the foliar Si concentration in all of the species measured and that foliar Si concentrations were correlated with the cumulative transpiration rates of plants and thus expected to increase significantly over the growing season.