Multiple Element Limitation in Northern Hardwood Ecosystems

TREE WATER USE PATTERNS ARE MAINLY DRIVEN BY ENVIRONMENTAL VARIABLES AND TREE STRUCTURAL PARAMETERS IN HUMID TEMPERATE DECIDUOUS HARDWOOD FORESTS

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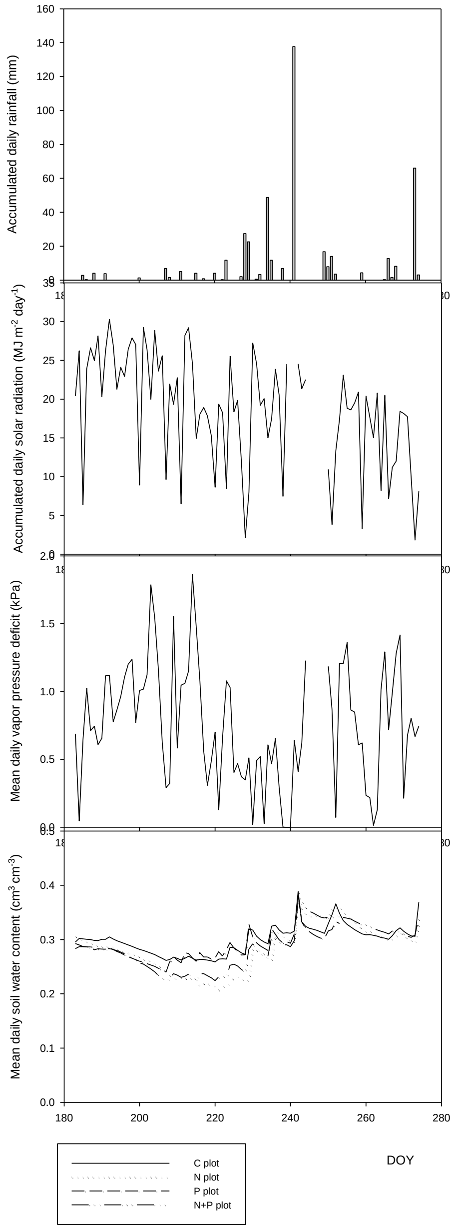
OBJECTIVE

- To examine the short-term response of tree water use and canopy conductance to N and P amendments in relation to microclimate and structural factors (tree size and density), in three dominant tree species in the northern deciduous hardwood forests: *A. saccharum, F. grandifolia,* and *B. alleghaniensis*.

MEASUREMENTS/METHODS

MEASUREMENT	WHERE	WHEN	HOW
Tree and plot water use			
Sap velocity measurements	BEF+HB, 4 treatments	July-Sept	HRM
Sapwood: Allometric equations	BEF, HB, Harvard Forest	August, Oct	Pressler borer
LAI: species and plot	BEF+HB, 4 treatments	Aug, Nov	Li-2200, Camera points
Water potential	BEF, 4 treatments	August (2)	
Tree conductance soil-to-leaf water potential gradient	BEF, 4 treatments	August (2)	Water pot+sap flow
Canopy conductance	Penman Monteith	July-Sept	Plot transpiration + meteo variables
Soil moisture	BEF, 4 treatments	July-Sept	Ech2o probes
Solar radiation, vapor pressure deficit	BEF+HB, 4 treatments, Tower BEF	July-Sept	Sensors, canopy

RESULTS: meteorological variables

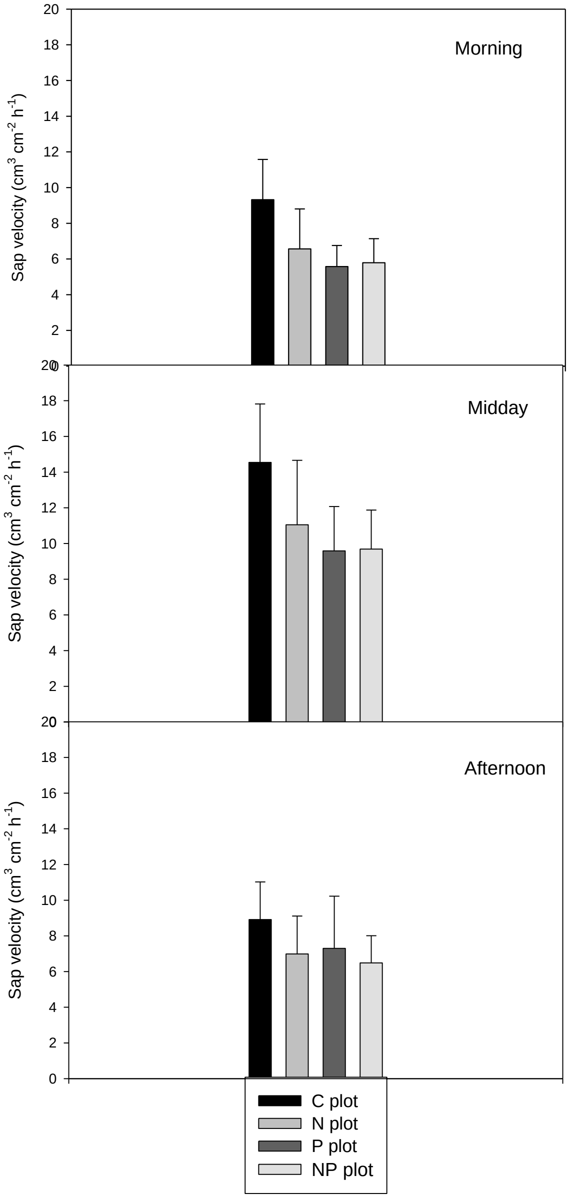


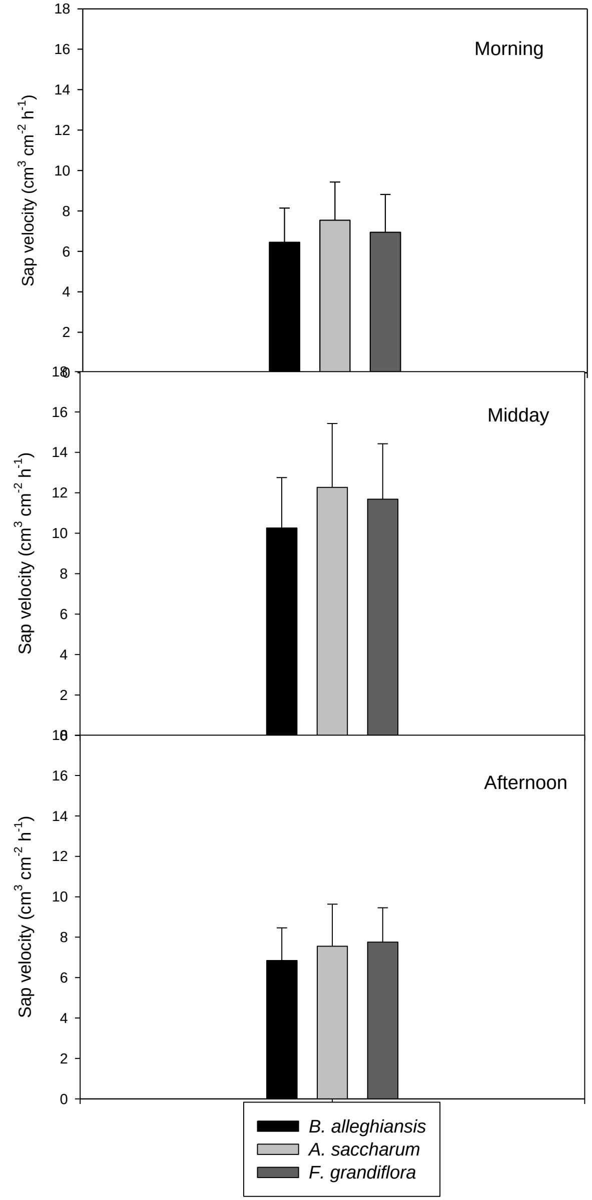
Mean temperatures (20°C) slightly higher compared to the 30-year average (1950-1980, 17 °C) (http://www.pnet.sr.unh.edu/climcalc/).

Studied months of 2011 more humid (445 mm) than the average for these same months (310 mm), although 31% of the total amount of 2011 was registered the 28th of August

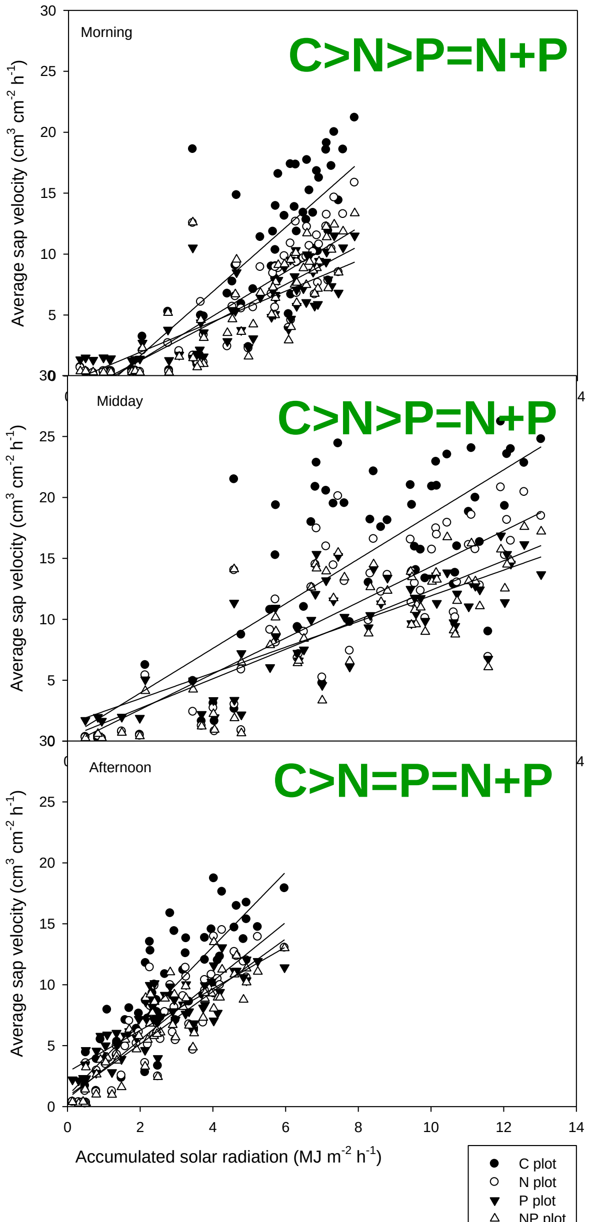
RESULTS: sap velocity (nutrients+sps)

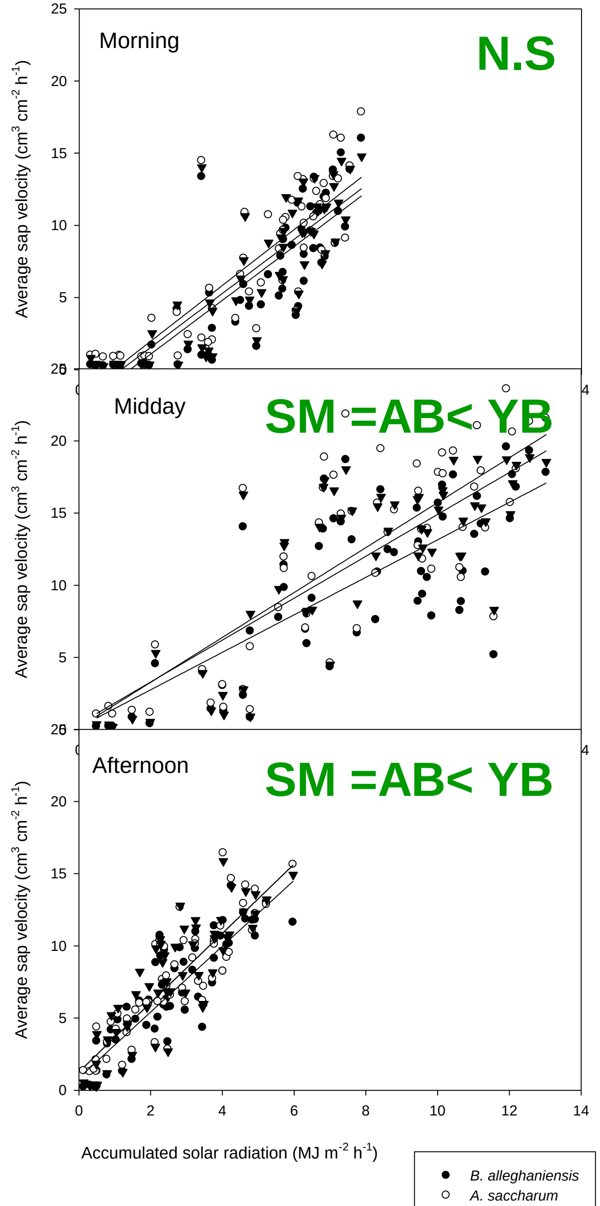
no significant differences (p>0.05)





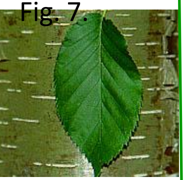
RESULTS: sap velocity(nutrients+sps)*DOY

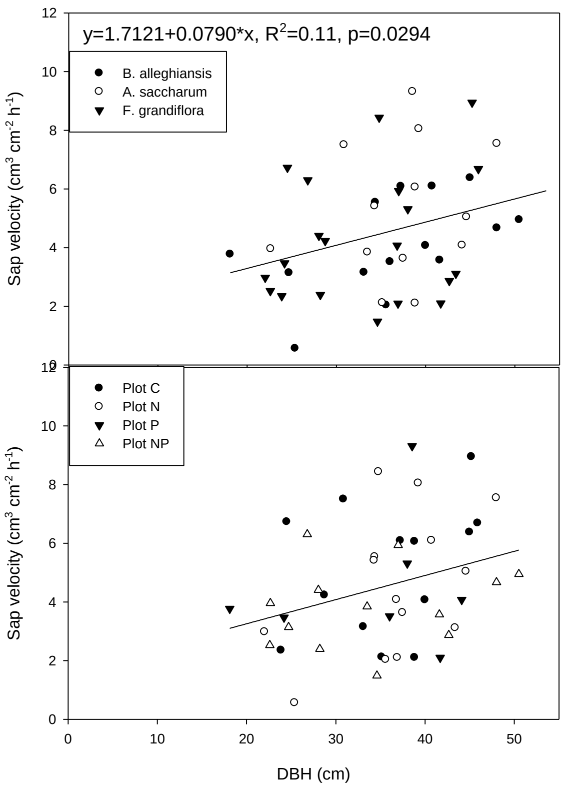


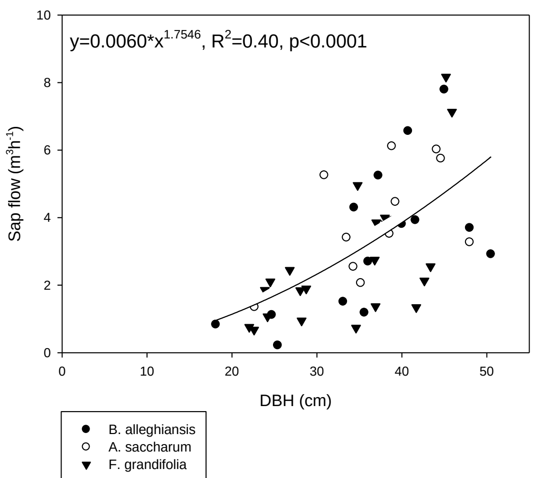


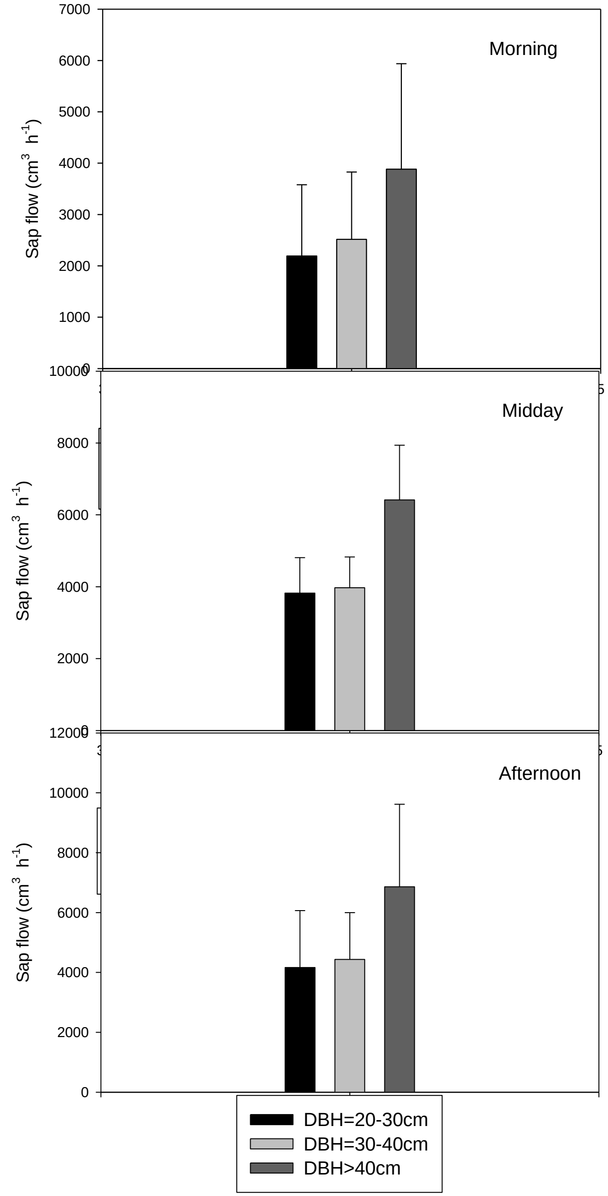
RESULTS: size effect on sap velocity and sap flow

Fig. 7

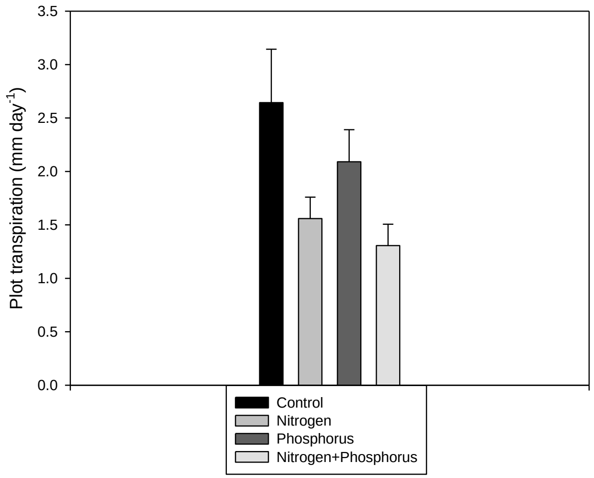


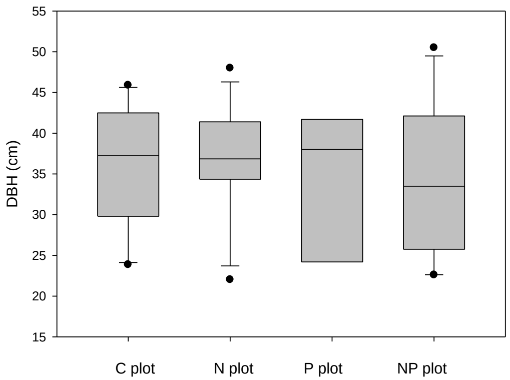


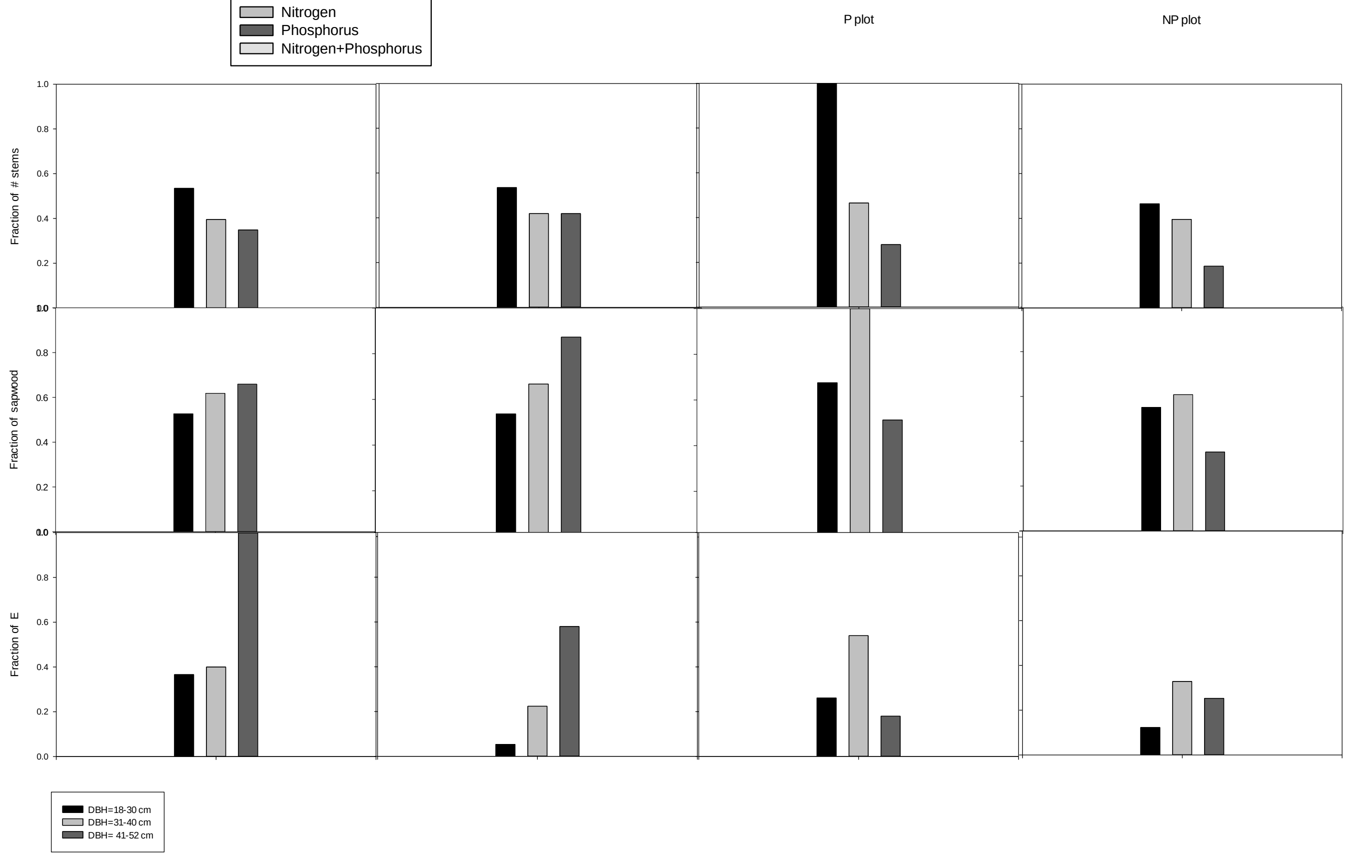




RESULTS: transpiration and plots structure







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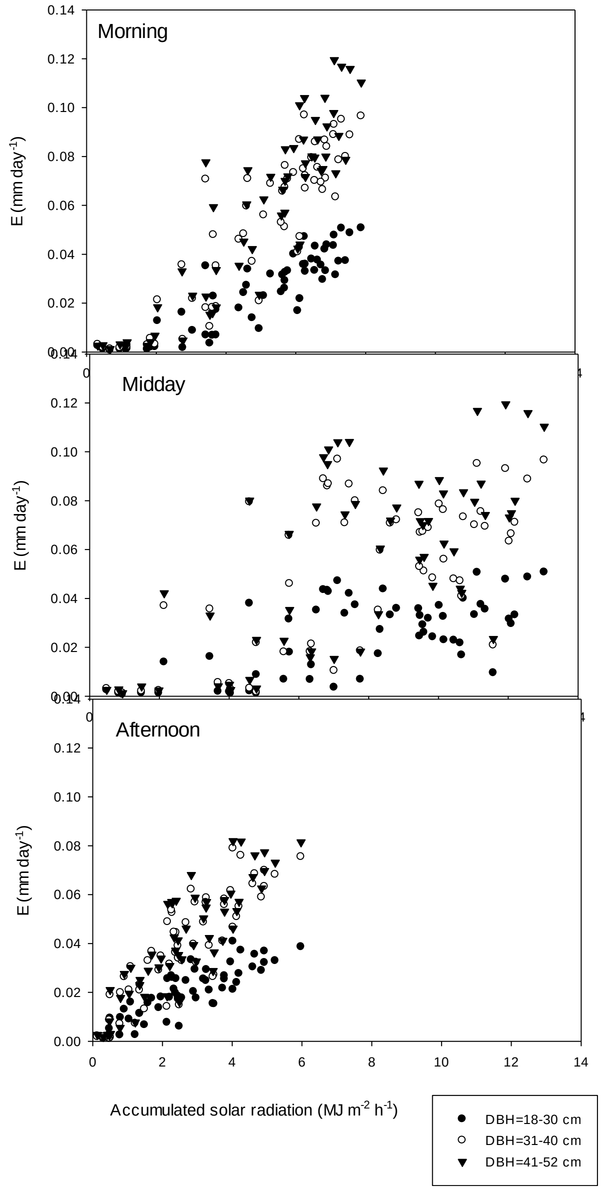
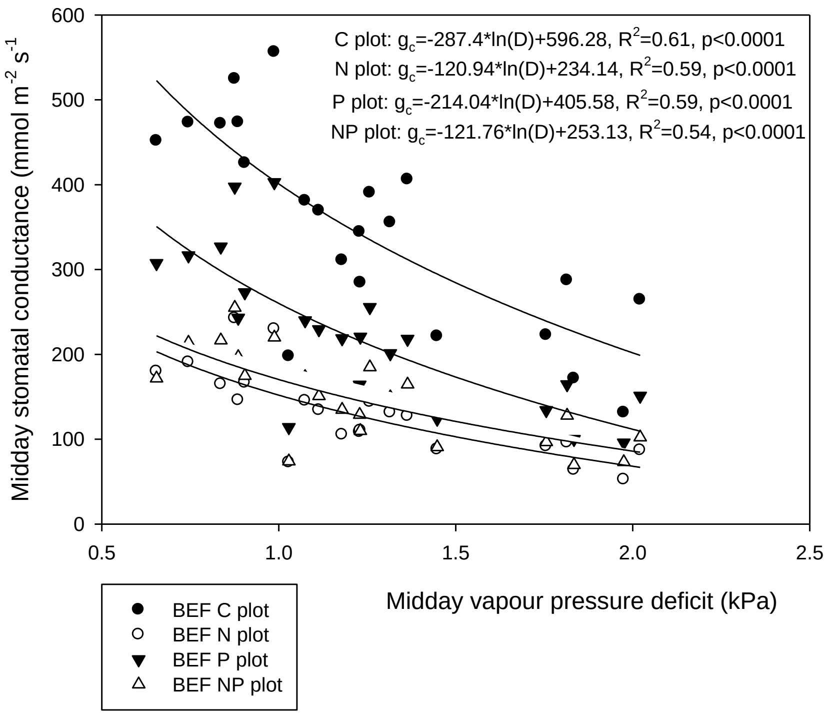


RESULTS: plots structure



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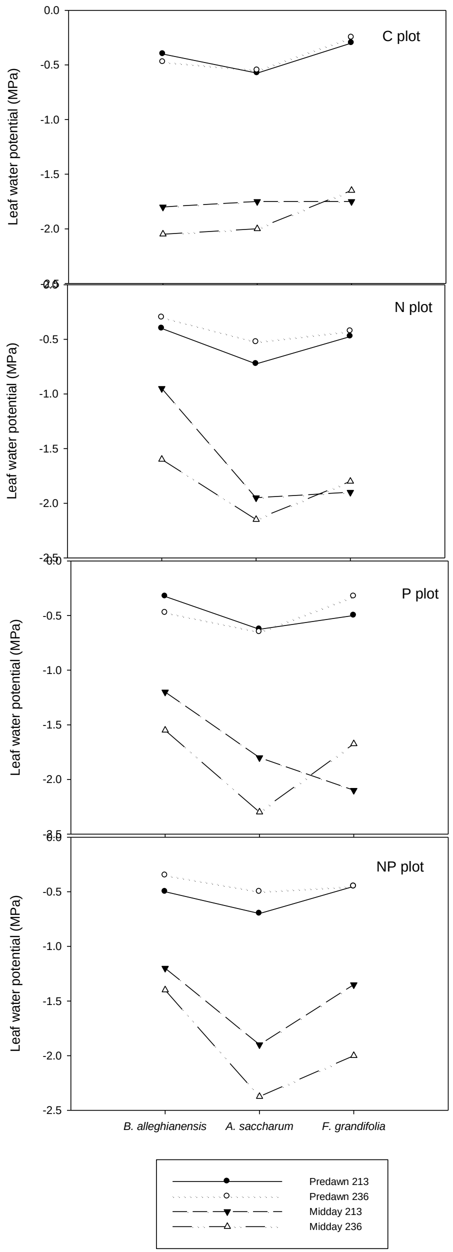

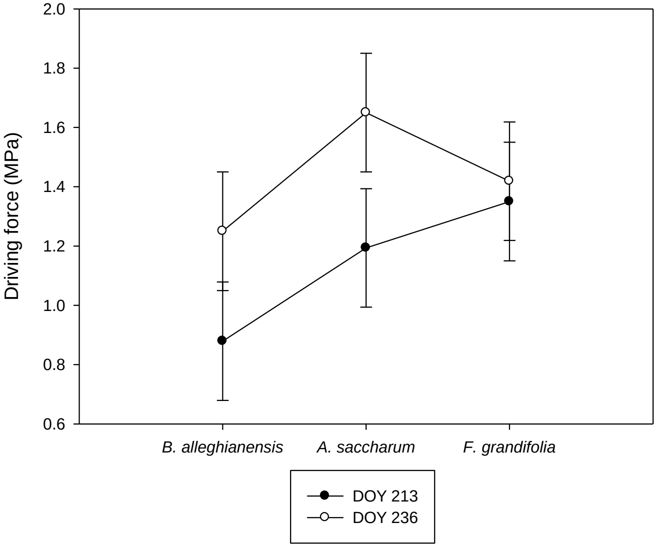

CONCLUSIONS

Tree size main driver of sap velocity and whole tree water use

Tree size determines the canopy position and access to light, having a direct effect on sap velocity. Sap velocity and tree water use closely tied to solar radiation

Total plot transpiration controlled by sap velocity differences and local forest characteristics such as stem density, tree size distribution and sapwood area.

No nutrient effect found in our work. Lack of short-term effects in the scientific literature make us think that long-term effects are possible and future research is still needed.