forests

MDPI

Supplemental Material:

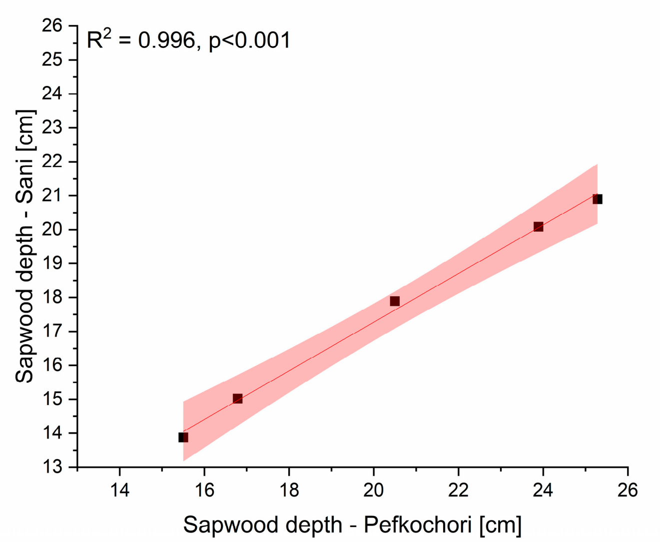

Figure S1: Linear relationship between the sapwood depths of the five (5) studied trees, calculated with the two allometric equations developed from Aleppo pine trees at Pefkochori and Sani, Chalkidiki, Greece. The shaded band represents the confidence level of the regression fit at $p<0.001$.

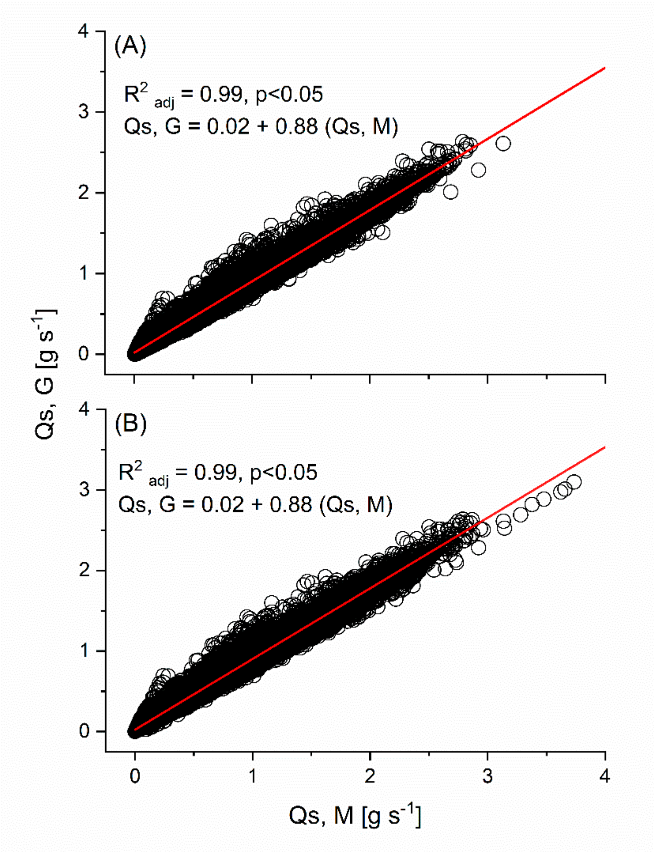

Figure S2: Relationship between the sap flow rates on a sapwood area basis calculated as weighted means [13,46] (Qs, M) of the 3 sapwood depths and by the Gaussian equation (Qs, G) of Ford et al. [27] and Martínez – Vilalta et al. [45] for the dry (A) and the wet (B) period. The Gaussian equation applied was:

$$J(x) = Jmax\ e^{-0.5(\frac{X-Xmax}{\beta})^2}$$

where:

J is sap flux density,
Jmax is maximum sap flux density, estimated as the maximum of the values at the three depths,
X is the depth into the sapwood from the cambium,
β is inversely related to the rate of decrease in sap flux density with depth. It was calculated as the value for which J at the inner end of the sapwood was 10% of Jmax,
Xmax is the depth where maximum sap flow occurs, estimated as $sqrt\ (\beta)$ to account for the likely effect of sapwood depth on Xmax.

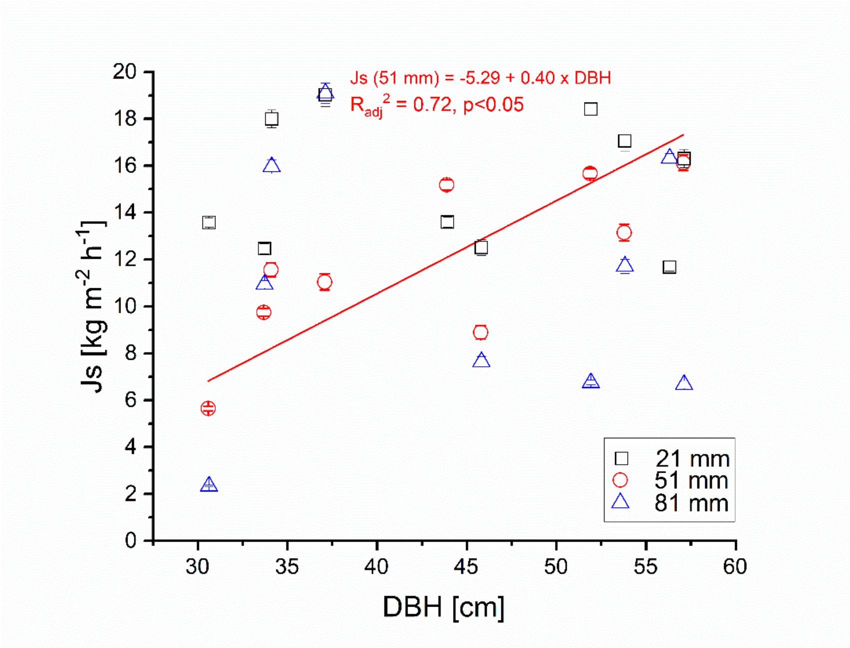

Figure S3: Relationship between sap flux density (Js) at the three studied sapwood depths and diameter at breast height (DBH). Symbols represent mean values of Js, averaged per DOY and tree (n=365), corresponding to the DBH of the studied Aleppo pines during the two study periods (Dry period: July 1st, 2008 – November 30, 2009; Wet period: April 13, 2018 – April 13, 2020). The regression line indicates the significant relationship between Js and DBH which was found only for Js at 51 mm sapwood depth.

Table S1: Multiple stepwise linear regression analysis of the relationships between the diurnal variation of sap flux density (Js) at the 3 sapwood depths (21, 51 and 81 mm) and climatic parameters (vapor pressure deficit - VPD, soil water content - SWC and solar radiation – Rad) during the different seasons (spring, summer, autumn, winter) of the two study periods (Dry period: July 1st, 2008 – November 30, 2009; Wet period: April 13, 2018 – April 13, 2020). The adjusted R^2 and p level of each regression model are presented. The models with the highest R^2 and significance level are indicated with bold, while non-significant models are indicated with n.s.

Dry period

	Spring			Summer			Autumn			Winter		
	Js21	Js51	Js81	Js21	Js51	Js81	Js21	Js51	Js81	Js21	Js51	Js81
VPD	0.897, <0.001	0.960, <0.001	0.922, <0.001	0.949, <0.001	0.953, <0.001	0.964, <0.001	0.983, <0.001	0.990, <0.001	0.978, <0.001	0.920, <0.001	0.949, <0.001	0.953, <0.001
Rad	0.798, <0.001	0.684, <0.001	0.783, <0.001	0.420, <0.001	0.300, <0.01	0.367, <0.01	0.765, <0.001	0.676, <0.001	0.822, <0.001	0.606, <0.001	0.498, <0.001	0.551, <0.001
SWC	n.s.	n.s.	n.s.	n.s.	0.191, <0.05	0.126, <0.05	0.508, <0.001	0.577, <0.001	0.758, <0.001	0.376, 0.001	0.401, 0.001	0.387, <0.001
VPD, Rad	**0.974, <0.001**	**0.980, <0.001**	**0.984, <0.001**	**0.976, <0.001**	0.953, <0.001	**0.964, <0.001**	0.986, <0.001	**0.991, <0.001**	0.979, <0.001	0.933, <0.001	0.947, <0.001	0.954, <0.001
VPD, SWC	n.s.	n.s.	n.s.	n.s.	**0.958, <0.001**	0.963, <0.001	**0.990, <0.001**	0.990, <0.001	0.979, <0.001	0.926, <0.001	**0.954, <0.001**	0.962 <0.001
SWC, Rad	n.s.	n.s.	n.s.	n.s.	0.618, <0.001	0.637, <0.001	0.873, <0.001	0.844, <0.001	0.819, <0.001	0.632, <0.001	0.558, <0.001	0.592, <0.001
VPD, Rad, SWC	n.s.	n.s.	n.s.	n.s.	0.956, <0.001	0.963, <0.001	0.986, <0.001	0.993, <0.001	**0.984, <0.001**	0.945, <0.001	0.952, <0.001	**0.965, <0.001**

Wet period

	Spring			Summer			Autumn			Winter		
	Js21	Js51	Js81	Js21	Js51	Js81	Js21	Js51	Js81	Js21	Js51	Js81
VPD	0.976, <0.001	0.925, <0.001	0.979, <0.001	0.956, <0.001	0.929, <0.001	0.980, <0.001	0.802, <0.001	0.850, <0.001	0.856, <0.001	0.902, <0.001	0.907, <0.001	0.920, <0.001
Rad	0.724, <0.001	0.823, <0.001	0.737, <0.001	0.772, <0.001	0.881, <0.001	0.751, <0.001	0.576, <0.001	0.599, <0.001	0.534, <0.001	0.425, <0.001	0.453, <0.001	0.464, <0.001
SWC	n.s.	0.126, <0.01	0.072, <0.05	0.278, <0.001	0.276, <0.001	0.221, <0.001	0.324, <0.001	0.207, 0.001	0.251, <0.001	0.278, <0.001	0.294, <0.001	0.308, <0.001
VPD, Rad	**0.985, <0.001**	0.974, <0.001	0.990, <0.001	0.965, <0.001	0.984, <0.001	0.983, <0.001	0.797, <0.001	0.865, <0.001	0.910, <0.001	0.981, <0.001	0.968, <0.001	0.979, <0.001
VPD, SWC	0.980, <0.001	0.947, <0.001	0.983, <0.001	0.976, <0.001	0.951, <0.001	0.986, <0.001	0.850, <0.001	0.840, <0.001	0.853, <0.001	0.900, <0.001	0.906, <0.001	0.920, <0.001
SWC, Rad	n.s.	0.950, <0.001	0.911, <0.001	0.770, <0.001	0.879, <0.001	0.745, <0.001	0.601, <0.001	0.625, <0.001	0.589, <0.001	0.471, <0.001	0.502, <0.001	0.518, <0.001
VPD, Rad, SWC	n.s.	**0.983, <0.001**	**0.993, <0.001**	**0.978, <0.001**	**0.986, <0.001**	**0.986, <0.001**	**0.857, <0.001**	**0.870, <0.001**	**0.913, <0.001**	**0.982, <0.001**	**0.970, <0.001**	**0.982, <0.001**

Table S2: Multiple stepwise linear regression analysis of the relationships between mean weighted sap flow on a sapwood area basis (Qs) and climatic parameters (vapor pressure deficit - VPD, soil water content - SWC and solar radiation – Rad) during the two study periods (Dry period: July 1st, 2008 – November 30, 2009; Wet period: April 13, 2018 – April 13, 2020). Regression models were tested including all days of each study period (whole period), only days with VPD > 0.7 KPa or only days with SWC>20 %. The adjusted R^2 and p level of each regression model are presented. The models with the highest R^2 and significance level are indicated with bold, while non-significant models are indicated with n.s.

	Dry period			Wet period		
	Whole period	VPD> 0.7 KPa	SWC>20%	Whole period	VPD> 0.7 KPa	SWC>20%
VPD	n.s.	n.s.	0.066, p<0.05	0.313, <0.001	n.s.	0.397, <0.001
Rad	**0.162, <0.001**	0.162, <0.01	**0.200, <0.001**	**0.470, <0.001**	0.178, <0.001	**0.579, <0.001**
SWC	n.s.	**0.497, <0.001**	n.s.	n.s.	0.526, <0.001	n.s.
VPD, Rad	n.s.	**n.s.**	0.198, <0.001	0.469, <0.001	n.s.	0.557, <0.001
VPD, SWC	n.s.	n.s.	n.s.	n.s.	n.s.	0.456, <0.001
SWC, Rad	n.s.	0.446, <0.001	n.s.	n.s.	**0.605, <0.001**	n.s.
VPD, Rad, SWC	n.s.	n.s.	**n.s.**	n.s.	n.s.	n.s.

References

13. Poyatos, R.; Llorens, P.; Gallart, F. Transpiration of montane Pinus sylvestris L. and Quercus pubescens Willd. forest stands measured with sap flow sensors in NE Spain. Hydrol. Earth Syst. Sci. 2005, 9, 493-505, doi:10.5194/hessd-2-1011-2005.

27. Ford, C.R.; McGuire, M.A.; Mitchell, R.J.; Teskey, R.O. Assessing variation in the radial profile of sap flux density in Pinus species and its effect on daily water use. Tree Physiol. 2004, 24, 241–249, doi: 10.1093/treephys/24.3.241.

45. Martínez-Vilalta, J.; Vanderklein, D., Mencuccini, M. Tree height and age-related decline in growth in Scots pine (*Pinus sylvestris* L.). Oecologia 2007, 150, 529-544, doi:10.1007/s00442-006-0552-7.

46. Hatton, T.J.; Vatchpole, E.A.; Vertessy, R.A. Integration of sap flow velocity to estimate plant water use. Tree Physiol. 1990, 6, 201-209, doi:10.1093/treephys/6.2.201.