


SPECIAL ISSUE PAPER

Drought and irrigation affect transpiration rate and morning tree water status of a mature European beech (*Fagus sylvatica* L.) forest in Central Europe

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Abstract

Severity and frequency of recurrent droughts is likely to be amplified by recent climate changes and may adversely affect large areas of temperate forests. This study addresses the ecophysiological responses of a mature beech forest in Central Europe (Slovakia, 450 m a.s.l.) exposed to drought during the growing seasons of 2012–2014. Sap flow and stem circumference changes of European beech (*Fagus sylvatica* L.) were measured in two contrasting treatments (drought vs. irrigation). Limited water availability reflected in the morning tree water status (morning stem contraction, ΔW) significantly reduced transpiration. Trees stressed by drought in the years 2012 and 2013 showed remarkably lower values of morning ΔW than those in the irrigated group. This suggests (a) lower water potential of the stem-conducting tissues and (b) increased use of internally stored water to maintain daily transpiration. Additionally, morning ΔW showed a close relationship with soil water potential, particularly in the nonirrigated trees. Potential evapotranspiration (*PET*) explained less variability in the transpiration of the control stand than that of the irrigated stand. The use of a simple analysis of covariance model comprising morning ΔW and *PET* interaction significantly increased the explained variability in transpiration in the control stand. Morning ΔW of mature beech trees seems to be a useful and easily obtainable non-invasive bioindicator of their ability to reduce and regulate transpiration in relation to atmospheric evaporative demands in response to drought.

KEYWORDS

drought, European beech, irrigation, morning tree water status, transpiration

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