

Diurnal water relations of beech (*Fagus Sylvatica* L.) trees in the mountains of Italy

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Abstract

Trees live in oscillating environments. Daytime light and warm periods alternate with night darkness and cooler temperatures. The adaptation of a tree is explained by its accommodation to such diurnal cycles. These diurnal pulses were monitored and simulated on computer. Summer measurements in Abetone (1230 m above sea level) included continuous registration of air temperature, relative humidity, wind speed, solar radiation and precipitation. Soil water contents were approximated from water balance. The response of a beech tree was measured as diurnal cycles of the twig water potential, stomatal conductance and sap water flow reflecting transpiration rate. All these measured output variables were simulated by a soil-plant-atmosphere-continuum (SPAC) model. Additional diurnal responses of the tree were calculated, such as leaf to air temperature difference, Bowen ratio and pool of water content in the tree. The evaluation of the adaptation was related to the recurrent cycles in diurnal loops, as the time-dependent relationship between the twig water potential and the sap water flow. The daily value of transpiration was 1.3 mm at the end of August. Results from simulation indicate that the model behaves correctly and can be used as a research tool for generating new scientific hypotheses.

Keywords: Beech; Italy; 'transpiration; Modelling; *Fagus Sylvatica* L