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Aerodynamic conductances in a sparse mixed oak woodland (*Quercus rotundifolia* Lam. and *Quercus suber* L.)

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The study of heat and mass exchange between the vegetation and its local environment plays a central role in the analysis of plant-atmosphere interactions. These studies can be undertaken at different scales, ranging from individual leaves to isolated trees or even the canopy scale. In each of these cases, heat and mass fluxes depend on the use of adequate values of transfer conductances. Within a broader study on interception loss from a sparse cork and holm oak woodland (*montado*) of Southern Portugal, aerodynamic conductances were determined for the boundary layers of both leaves (LBL) and the entire canopy.

LBL conductances for convective heat transfer (g_{bH}) were measured using the heated leaf-replica method and, simultaneously, estimated using physically-based equations. These conductances were then converted in conductances for water vapour (g_{bV}). Under field conditions, measured g_{bH} values ranged between 0.025 – 0.150 ms^{-1} for wind speeds from 0.25 to 4.0 ms^{-1}. These values were systematically higher than those estimated from *formulae*, with a mean ratio between measured and estimated conductances of 1.3. The measured values of g_{bH} are similar to those obtained for leaves with identical dimensions, but are considerably higher than those of larger leaves. The influence of leaf size, aspect (relative to air flow) and inclination on leaf boundary layer conductance was also studied using leaf replicas with 3 different dimensions. All these replicas were positioned adjacent to the tree crown, with a 40º inclination angle, first, and horizontally afterwards. For each combination of these factors, regression models of the type g_{bH} = au^b were adjusted and differences between them were statistically evaluated. Although a fully differentiated model had the highest R^2 (0.82), a simpler model, accounting only for the influence of leaf size, showed an identical predictive capacity (R^2 = 0.80). Therefore, the use of the latter should be preferable whenever the distribution of leaf area per leaf dimension class is known. The overall relationship for the entire data pool (R^2 = 0.72) makes it possible to estimate LBL conductance from wind speed alone, regardless dimension, inclination or aspect of the leaves. Boundary layer conductances from individual leaves were scaled up to the whole tree crown as a sum of parallel conductances over the total leaf area (g_{bVt}).

Based on the logarithmic wind profile, displacement height was estimated from measurements of wind speed at 5 different levels above the canopy. This estimate was then used to find z_0 as the intercept of the regression line adjusted to the log-linear profile ln $(z - d) = f\ (u)$. Estimated values for d and z_0 are 5.89 and 0.83 m, respectively. Aerodynamic conductance for momentum transfer between the level $(d+z_0)$ and z = 27.2 m above the surface may be determined as a function of wind speed, according to g_{aM} = 0.0159 $u\ (z)$. This expression yields values of g_{aM} in the range of 0.016 – 0.159 ms^{-1} for wind speeds from 1.0 to 10.0 ms^{-1}. Assuming an equal distribution for the source/sink of momentum and air humidity, aerodynamic conductance for water vapour (g_{aV}) can be considered identical to g_{aM}, representing the bulk conductance that controls the evaporation flux of intercepted rainfall. Since g_{bVt} only accounts for the water vapour transfer from leaves to the limit of their boundary layers, an additional conductance (g_{ac}), in series with g_{bVt}, is required for the transfer between that limit and the reference level z. All these conductances were estimated and expressed on a per tree basis (m^3s^{-1}), for future inclusion in a single tree evaporation model.