



Cork oak physiological responses to precipitation changes: results of a 3-yr field experiment.

Cathy Kurz Besson (1), Raquel Lobo do Vale (2), and the Portuguese MIND Team

(1) Instituto Dom Luiz, Centro de Geofísica, Universidade de Lisboa, Lisbon, Portugal (cathybesson@gmail.com/+351 217500807), (2) Instituto Superior de Agronomia, Departamento Florestal, Universidade Técnica de Lisboa, Lisbon, Portugal (raquelvale@isa.utl.pt/+351 213645000)

Cork oak is a Mediterranean species covering about 2.3 Mha in Europe, with half of its distribution area located on the Iberian Peninsula. In Portugal, the species is cultivated as evergreen woodlands agro-systems in one of the most critical part of the country regarding water availability and climate change. The expected increase in the length of the dry season may lead to severe water deficits that could jeopardise the sustainability of the agro-system and have a serious impact on its biodiversity and associated economy. The study aimed to measure Cork oak physiological responses to precipitation change, in order to better predict its vulnerability under climate change.

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The study took place in a montado area from southern Portugal showing a Mediterranean mesothermic humid climate with hot and dry summers. Water availability was experimentally manipulated from 2003 to 2005 in the experimental area through 3 treatments: Dry, Wet and Ambient with 80, 120 and 100% of the total annual precipitation, respectively. Twenty-seven *Quercus suber* L. trees (3 trees*3 treatments*3 replicates) were monitored during 3 years in order to follow leaf water potential (Ψ_L), carbon assimilation (A), stomatal conductance (gs), sap flow (E), phenology (stem diameter and branch length increment, litterfall) as well as meteorological conditions and soil moisture responses to water availability.

Significant effects of the treatments were frequently detected on soil water content at 0.1 and 0.2m depth from winter until late spring 2004, and in most of the measurements performed in 2005. For lower depths measured in 2005, the significance appeared mostly in spring and summer periods. Though less frequent due to a higher variability, significant treatment effects were found in tree sap flow especially during the summer drought periods where a clear drop of E could be observed in trees from the Dry area. In spite of the significant differences in soil moisture and tree transpiration observed between the Wet and other treatments, no significant treatment effect could be detected for most of the physiological parameter measured, except on the 1st of July 2005, one week after the last 13mm irrigation provided to the Wet areas. This late water addition had a huge significant positive impact on Ψ_L , A, gs and E, as well as on stem diameter increment of trees from the Wet areas. For each of these variables, the treatment effect was quantified and will be presented. The impact of two consecutive dry years (2004 and 2005) on cork oak physiological responses will also be evaluated and discussed.