



Effects of drought on ecosystem carbon and water fluxes in an evergreen Mediterranean oak woodland

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We compared carbon and water fluxes between the vegetation and the atmosphere and tree transpiration (measured by the eddy covariance technique a sap flow method respectively) in an evergreen oak woodland (savannah-like) ecosystem with ca. 21 % tree crown cover in Portugal. The ground vegetation consists of grazed pasture dominated by herbaceous annuals, which die-out by the end of spring, some drought deciduous graminea and a few shrubs (*Cistus* sp.). Between 2003 and 2006 the woodland was a weak sink for carbon: NEE between -140 and -28 g C m⁻² year⁻¹ (Pereira et al. 2007). Droughts contribute to most of the inter-annual variability in water yield and terrestrial carbon sequestration. The effects of drought could be evaluated during the dry year of 2005. In southwest Iberia the rainy season (winter-spring) of that year was the driest of the last 140 years (i.e., 28% of the long-term average), but rainfall in 2006 was above normal (808 mm). The ecosystem evapotranspiration was 159 mm, i.e., 20% of annual rainfall in the normal year but it was 149 mm in the dry year (2005). As compared to annual rainfall it increased to 34% in the dry year and the potential water yield of that year decreased to 44% of the value in the normal year (2006). Ecosystem evapotranspiration could be partitioned between the herbaceous cover and the trees. The former showed a strong dependence on rainfall and water availability of the upper soil layers. Conversely trees had appreciable transpira-

tion rates during dry periods, being less dependent on current rainfall, as they reached groundwater or large deep soil reservoir. During the year trees transpired, in average, 56% of total ecosystem evapotranspiration, even if their crowns covered 21% of the whole area. Seasonally, tree transpiration amounted to 100% in summer evapotranspiration (2005) but decreased to 70 to 30% of total ecosystem evapotranspiration. The whole ecosystem water use efficiency WUE_{eco} (GPP/ET) was near 8 gCL^{-1} in the normal year of 2006 and lower (5.3 gCL^{-1}) in the dry 2005. This was the contrary of what happened in a nearby closed canopy eucalypt plantation with 10 and 13 gCL^{-1} in 2006 and 2005. In the oak woodland a large proportion of GPP resulted from carbon assimilated by its annual vegetation component, which was strongly affected by the shortage of rain in winter.

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