

The drought of 2003 in Western Europe: consequences on forest ecosystems functioning.

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In order to assess the drought intensity in 2003 and its effects on the European forests functioning, a daily water balance model was implemented in intensively monitored sites. This model (BILJOU) estimated the water fluxes and the temporal variation of soil water content in the root zone. Water stress intensity indices and duration were calculated from the estimated day-to-day soil water deficit. We used climate and flux data – when available - from 12 European sites, most of them belonging to the Carboeurope network. We first assumed “constant” physiology and soil condition, i.e. a unique set of stand and site parameters was used, that allowed at calculating a “potential” water stress. Among all the investigated sites, water stress intensity and duration varied to a large extend, from wet to exceptionally dry condition. Water stress duration ranged from 20 to 128 days during the vegetation period according to the sites. A map showing the geographical distribution of water stress intensity was drawn.

In 9 sites, carbon and water flux were measured in 2002 and 2003 by the eddy covariance method. Their temporal variation were analysed and the annual carbon and water balances were calculated. Soil water content depletion in summer provoked water and carbon fluxes decrease in the second half of June till end of October in most sites. This flux reduction occurred when relative extractable water in the soil decreased below 40%. On the whole year, the decrease in net ecosystem exchange (NEE) was not very large, ranging from 0 to 150 g C m⁻², because both gross assimilation and ecosystem respiration were reduced by drought. In some sites, a clear effect of drought development on circumference growth was evidenced via an earlier growth cessation than usually observed.

Besides the direct impact of the year 2003 drought on fluxes and tree growth, the differed effects, due to leaf area index decrease, variation in rooting, carbohydrate reserves decrease, can not yet be evaluated.