Geophysical Research Abstracts
Vol. 19, EGU2017-13426, 2017
EGU General Assembly 2017

Distinct effects of water use efficiency increase on growth in Scots pine and sessile oak in the Mediterranean Basin

Elisabet Martínez-Sancho (1), Isabel Dorado-Liñán (2), Emilia Gutiérrez-Merino (3), Michael Matiu (1), Ingo Heinrich (4), Gerhard Helle (5), Annette Menzel (1,6)

(1) Ecoclimatology, Department of Ecology and Ecosystem Management, Technische Universität München, Freising, Germany, (2) Departamento de Silvicultura y Gestión de los Sistemas Forestales, CIFOR-INIA, Madrid, Spain, (3) Departament d'Ecologia, Universitat de Barcelona, Barcelona, Spain, (4) Department 5: Geoarchives, GFZ – German Research Centre for Geosciences, Potsdam, Germany, (5) Section 5.2 Climate Dynamics and Landscape Evolution, GFZ – German Research Centre for Geosciences, Potsdam, Germany, (6) Institute for Advanced Study, Technische Universität München, Garching, Germany

Drought is one of the main drivers of species distribution in the Mediterranean Basin, which will be exacerbated by climate change. The increase of atmospheric CO_2 concentrations (*Ca*) has been related to enhanced tree growth and intrinsic water use efficiency (iWUE). However, in the Mediterranean Basin this 'fertilizing' effect should compensate the potential drought-induced growth reduction to maintain forest productivity at a comparable level. This is particularly relevant for temperate species reaching their southern distribution limits and/or the limits of their climatic niche in this region.

We investigated tree growth and physiological responses of Scots pine (*Pinus sylvestris* L.) and sessile oak (*Quercus petraea* (Matt.) Liebl.) stands located at their southern distribution limits using annually resolved tree-ring width and $\delta^{13}C$ chronologies for the period 1960-2012. The selected stands were sampled in Spain, France, Italy, Slovenia, Bulgaria, and Romania. Wood cores were extracted at each site and tree-ring width and $\delta^{13}C$ were measured. Basal area increment (BAI) was calculated as a surrogate of secondary growth and ^{13}C discrimination (Δ), leaf intercellular CO_2 concentration (*Ci*) and iWUE were estimated from $\delta^{13}C$ values. The temporal trends of BAI, Δ, *Ci* and iWUE, as well as in climatic variables (i.e. temperature, precipitation and potential evapotranspiration derived from CRU TS3.23 dataset) were calculated per site for the study period.

Our specific objectives were (i) to test if rising atmospheric CO_2 concentrations and changes in climate may have induced shifts in tree growth and ecophysiological proxies; (*ii*) to determine whether and how changes in iWUE are related to radial growth rates; and (*iii*) to assess site-specific physiological adjustments to increased atmospheric CO_2 concentrations over the studied period.

Preliminary results showed a generalized increase in *Ci*, and consequently in iWUE, at all study sites. Scots pine stands displayed a significant decreased in BAI likely induced by summer droughts, leading to a negative relationship between iWUE and BAI. In addition, most of the pine stands kept a constant *Ci*/*Ca* over the study period. Sessile oak stands displayed positive growth trends over the study period and correlations of BAI with summer drought were lower and scarcer. Oak stands located in the eastern part of the Mediterranean Basin displayed a positive relationship between iWUE and BAI whereas this relationship was negative for the western stands. The *Ci* from most of the oak sites followed the *Ca* trends over time. However, oak sites with higher water availability displayed positive trends in the *Ci*/*Ca* ratio indicating a weak stomatal response.