Geophysical Research Abstracts
Vol. 20, EGU2018-10037, 2018
EGU General Assembly 2018

Multidisciplinary tree ring approach to evaluate water use efficiency and growth of Mediterranean species in response to drought.

Giovanna Battipaglia (1), Enrica Zalloni (2), Angela Balzano (3), Paolo Cherubini (4), and Veronica De Micco (2)

(1) University of Campania "L. Vanvitelli", Department of Environmental, Biological and Pharmaceutical Sciences and Technologies, Caserta, Italy (giovanna.battipaglia@unicampania.it), (2) University of Naples Federico II, Department of Agricultural Sciences, Portici (Naples), Italy, (3) University of Ljubljana, Biotechnical Faculty, Department of Wood Science and Technology, Ljubljana, Slovenia, (4) WSL-Swiss Federal Research Institute, CH-8903 Birmensdorf, Switzerland

The occurrence of long and severe summer drought periods, forecasted for the Mediterranean basin, is expected to affect cambial activity and wood formation, thus altering tree growth and vegetation dynamics and affecting forest productivity. To cope with drought conditions, Mediterranean species show a high plasticity in their wood functional traits that allow to achieve a trade- off between the needs to maintain high conductivity, when water is available, while preventing embolism phenomena during severe periods of drought. In such a context, it is important to understand the strategies in water utilisation exploited by different Mediterranean tree and shrub species in response to variation in climate conditions.
Here, we analyse interspecific differences in intrinsic water use efficiency (WUEi) and the ratio of photosynthesis to stomatal conductance in long tree-ring series of Mediterranean species (e.g., oak, pines) with different growth strategies and different forest management, using a multidisciplinary approach where the analyses of xylogenesis and wood anatomical traits are coupled with tree ring stable isotopes of carbon and oxygen at intra-annual scale.
Our results indicate consistent differences in WUEi in the analysed species, largely determined by leaf structure and differences in stomatal conductance control. Further, each species showed different aptitude to form Intra annual density fluctuations (IADFs), considered as a strategy of trees to adjust wood anatomical traits to short-term variations in temperature and/or precipitation patterns. The occurrence of IADFs was found to reflect the more anisohydric/isohydric physiological reactions to the varying environmental conditions of each species: an increased stomatal conductance was associated to a safer wood at the IADFs level in species such as Quercus ilex while a tighter stomatal control was associated to a more efficient wood at IADFs level in species such as Pinus pinea.
The combination of different kinds of data resulted to be extremely useful to characterise with intra-annual resolution the plant ecophysiological strategies under drought stress, offering new perspectives in the interpretation of physiological and ecological processes. Our findings can be used to predict the response of Mediterranean ecosystems to climate change and help in decision-making for a focused forest management.