Geophysical Research Abstracts
Vol. 20, EGU2018-10665, 2018
EGU General Assembly 2018


# Plastic responses in xylogenesis affect tree-ring growth and forest productivity under Mediterranean climate fluctuations

Veronica De Micco (1), Angela Balzano (2), Katarina Čufar (2), Enrica Zalloni (1), and Giovanna Battipaglia (3)

(1) Department of Agricultural Sciences, University of Naples Federico II, Portici (Naples), Italy (demicco@unina.it), (2) Department of Wood Science and Technology, University of Ljubljana, Biotechnical Faculty, Ljubljana, Slovenia (Angela.Balzano@bf.uni-lj.si, Katarina.Cufar@bf.uni-lj.si) , (3) Department of Environmental, Biological and Pharmaceutical Sciences and Technologies, University of Campania "L. Vanvitelli" (previous Second University of Naples), Caserta, Italy

There is increasing awareness on the need to apply a multi-disciplinary approach to study tree behaviour under a climate change scenario, to reach an integrated management of forests for water saving in arid and semi-arid ecosystems, such as the Mediterranean. In Mediterranean environments, increasing risk for drought stress and heat waves are forecasted in the near future, which will have a severe impact on wood formation. Decreased wood production is expected due to drought stress leading to the decrease in productivity of Mediterranean forests, with negative consequences on related ecosystem services such as carbon sequestration. However, plants' response in wood growth is species-specific: the different plasticity in wood formation can be considered the base for different success in interspecific competition, thus guiding vegetation dynamics. More specifically, many Mediterranean species show peculiar patterns of cambial activity leading to the formation of intra-annual-density-fluctuations (IADFs) in tree rings. IADFs are "positive structural anomalies" useful to face intra-annual variations in temperature and water availability, especially when they are developed as additional bands of wood. Therefore, tree rings with IADFs not only are "more efficient" wood sectors, capable of modulating water flow to maintain high conductivity when water is available while preventing embolism phenomena during water shortage, but are also often related to high biomass production under limiting conditions.
We have analysed interspecific differences in cambial production and functional wood traits in long tree-ring series in Mediterranean species (Pinus spp., Arbutus unedo and Q. ilex) with intra-annual resolution. Wood anatomical traits have been linked with climatic parameters as well as with stable isotopes of carbon (d13C) and oxygen (d18O), to reach a better understanding of wood formation coupled with eco-physiological behaviour.
We were able to detect the periods of IADF formation and environmental factors triggering them. Through this multidisciplinary approach, it was possible to draw hypotheses on the occurrence of seasonal limitations in cell enlargement and cell differentiation due to water deficit or carbon availability. Moreover, we highlighted the different sensitivity to environmental fluctuations recorded in wood anatomy of the various species that should be taken into account in forest management.