BOOK OF
ABSTRACTS

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Integrated approach for monitoring the vulnerability of Mediterranean oak forests affected by drought-induced dieback: evidences and research avenues

T5.23 Monitoring patterns and processes in natural forests to assess their contribution to climate-change mitigation

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Abstract: Rising aridity, mostly driven by higher temperatures and reduced water availability, will undermine the health status of many forest ecosystems. If climate warming proceeds at its current rate, the resilience of many seasonally dry Mediterranean forests will be threatened by altering their structure and impairing their functions. However, our understanding of vegetation-climate couplings is still partial, as we need data on responses at multiple temporal and spatial scales. In this context, we aimed to forecast oak forest responses to climate stressors, particularly during post-drought dieback episodes when tree vulnerability is exacerbated, through a combined, multiproxy approach. We focused on several oak species differing in drought tolerance but showing dieback events since the early 2000s. For all species, coexisting healthy and unhealthy trees were sampled, and analysed using dendrochronology, wood anatomy, stable isotope technique, non-structural carbohydrates, and pathology. We also explored how remote-sensing indices of vegetation activity and radial growth responded to drought. Our results pointed to changes in wood anatomy and growth related to major mortality mechanisms such as hydraulic failure and carbon starvation. In addition, we also modeled the probability of tree death as a function of tree size. We also pointed out that the resistance of oaks to droughts is strongly determined by the ability of their root system to extract water from the soil. We demonstrated that the effects of climate extremes such as droughts on vegetation can be detected either in terms of canopy greenness or radial growth reductions, thus hinting at the opportunity to combine remotely sensed data as a stand-level indicator of vegetation stress and to scaling up information from tree to stand levels using tree-ring data. Finally, our findings provided new insights on how trees showing ongoing dieback may keep their vital activities by changing their phenological performance, leading to potential implications on the global carbon and water balances of forest ecosystems.