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Multidisciplinary approach to evaluating fire-related responses in Pinus pinaster Aiton

Francesco Niccoli, Assunta Esposito, Simona Altieri, Giuseppina Vicario, and Giovanna Battipaglia

University of Campania, Department of Environmental, Biological and Pharmaceutical Sciences and Technologies, Caserta, Italy (giovanna.battipaglia@unicampania.it)

Wildfires are a recurrent event in the Mediterranean Basin and represent one of the main disturbance factors for forests, affecting the ecophysiology and the growth of trees. The impact of fire on trees can involve the canopy, the trunk and the root system. The single or combined effect of these damages can lead to tree mortality or, if the fire does not turn out to be particularly destructive, can reduce tree vigor and trigger a temporary reduction in growth. In the Mediterranean area, the impact of wildfires is relevant and every year more than 35000 fires occurred (95% of which are in France, Italy, Greece, Portugal and Spain) with an increase of their dramatic dimensions in the periods of extreme drought such as summer 2017. In Italy last year in few summer months of 2017 more than 74000 hectares of wooded areas burned and the most affected regions were in Southern Italy. In particular, in July 2017 an extensive wildfire occurred inside the National Park of Vesuvius, where more than 1500 hectares of vegetation, mainly pine woods, were destroyed and where we focus our research activity. The impact of this fire produced a mosaic of burning characteristics with a clear gradient of intensity in relation to environmental and fuel conditions. In this context Pinus pinaster with different levels of damage (high, medium and low) were sampled aiming not only to understand the effects of fire on population of P. pinaster, but also to elaborate a predictive model of pine mortality using a multidisciplinary approach based on percentage of crown scorched or consumed, tree rings and stable isotope.
Tree-rings provide the fire history of a population and they are used to understand how fire affected the growth of the plant, while the stable isotopes of carbon and oxygen allow to detect the ecophysiological processes involved in response to fire. Crown injury has been identified as the primary cause of post-fire mortality in most conifers, but the response to defoliation by fire varies considerably among species.
Preliminary results highlight that P. pinaster mortality is strictly linked to the cambium damage and that even trees with high level of crown scorched could survive. Further, the dendrochronology analyses showed that several individuals experienced and endured higher fire intensity in the past that the one recorded in 2017. These data can contribute to define guidelines to managers making pre-fire or post-fire decisions in pine forest stands in the Mediterranean Basin.