

EGU21-7512

<https://doi.org/10.5194/egusphere-egu21-7512>

EGU General Assembly 2021

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Mediterranean forests responses to drought and forest fires: continuous monitoring through the TreeTalker system

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Forests play a key role in mitigating greenhouse gases and fighting climate change. However, numerous environmental stressors threaten the integrity and ecological functionalities of forests. In recent decades, the increase of drought events and fires occurrence is negatively influencing forest health, causing dieback events and higher rates of mortality, especially in the Mediterranean environments.

Studying the mechanisms of plants in response to these events and relating them to the duration and intensity of stress can be the key to understand the vulnerability and sensitivity at individual and regional scale. Currently, most of the available studies are severely limited in time and space, providing information with a relatively poor temporal resolution.

In this context, our research aims to examine the effects of these events on the ecophysiology of *Pinus pinaster* Aiton, a very common conifer species in the Mediterranean environment, through the use of the innovative TreeTalker device (TT+). This instrument is able to monitor multiple physiological and environmental parameters of the tree such as sap flow, the amount of light absorbed by the canopy, meteorological information etc. The study is conducted in Southern Italy, more precisely at the Vesuvius National Park, affected in recent years by severe drought conditions and where a large wildfire occurred in July 2017. To evaluate the incidence of stress conditions, during the spring of 2020, 10 TT+ devices were installed in a pine stand affected by fire (Burned Site -BS) and 10 TT+ devices in a second stand called Control Site (CS) in which plants were not affected by the 2017 fire.

The preliminary monitoring data show interesting information about the hydraulic and stomatal strategies implemented by the trees on both stands according to the variation of the climatic conditions. While in the spring a rather regular sap flow trend was observed in both stands, during the summer months (July, August and good part of September), the trees show a reduction in their stomatal activity during the hottest hours of the day (11 am -15 pm), predictably as a mean to avoid episodes of xylem cavitation and to contrast the high temperatures. In the autumn months of October and November, however, vegetative activity has continued uninterrupted although a

considerable decrease in hydraulic flow was registered. Finally, from the data collected it emerges that the severe reduction of the crown suffered by the plants of the BS has determined a lower absorption capacity of photosynthetic light, exposing these individuals to a greater possibility of carbon starvation.

The monitoring activities will continue for the next few years, allowing to understand better the eco-physiological dynamics leading the individuals of this species to overcome or succumb to stress events and/or extreme climatic conditions.