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Measuring forest floor evaporation from interception in prescribed burned forests in Southern Italy.

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Wildfires are one of the major environmental issue in the Mediterranean area. Prescribed burning (PB) is increasingly used in Europe as a practice to reduce fire risk, through dead fine fuel reduction. Several studies have focused on fire effects on vegetation and soil microbial community, but very few on ecosystem processes involved in water cycle. This study aims to estimate interception by the litter and fermentation layer and the successive evaporation flux in laboratory conditions, using a water balance and 2H and 18O isotopes mass balance calculation, in order to assess PB effects on the hydrology and ecosystem in pine plantations.

PB was carried out in spring 2014 in three pine plantations of Southern Italy, dominated by Pinus halepensis (Cilento, Vallo di Diano e Alburni National Park, CVDANP), P. pinaster (Vesuvio National Park, VNP) and P. pinea (Castel Volturno Nature Reserve, CVNR). A dataset concerning the effects of PB on vegetation structure, floristic composition, microbial biomass and activity in the fermentation layer and 5-cm of soil beneath is available for the same stands. In each plantation, two cores of litter and fermentation layer were sampled in a burned area and in a near unburned area (control), respectively, with a collector to extract an “undisturbed” core. Then, each core was transferred in a lysimeter installed in the Water Lab of Delft University of Technology. In total, three lysimeters were set up and each experiment was carried out in duplicate. The laboratory had constant temperature, and both temperature and relative humidity were recorded every 15 minutes. To simulate rainfall, $\sim$1 litre of tap water was sprinkled uniformly on the lysimeter with a plant spray (equivalent to 32 mm of rain). The precipitation was sprinkled every 3 days for a period of two months. Soil moisture and temperature were measured during the experiment every 15 minutes in the top and bottom of the litter and fermentation layer. Interception water was collected for isotope analysis from every layer with Rhizon soil moisture samplers by applying a vacuum with 5 ml syringes. Samples were collected two times per day (in the morning and in the evening) and at two different depths for each layer ($\sim$4 cm and $\sim$7 cm in litter layer and $\sim$10 and $\sim$15 cm in fermentation layer) until 2 days after rain simulation. Water samples were analysed with laser spectrometry using the liquid water isotope analyser (LGR-LWIA).

The influence of different litter layers and PB on interception and litter layer evaporation was assessed. Then, the evaporation flux measured using the lysimeter was compared with the calculated evaporation flux using the isotopes mass balance. Generally, the preliminary results indicate a slight increase in evaporation flux in burned areas compared to the controls, in P. pinea and P. pinaster stands. By contrast, in P. halepensis stand, a significant decrease in evaporation flux was detected in prescribed burned plot. The isotope mass balance method to measure litter evaporation is promising and could be used in future, in-situ, measurements of evaporation from the litter layer.