World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:12, No:03, 2018

Variation of Litter Chemistry under Intensified Drought: Consequences on Flammability

Authors : E. Ormeno, C. Gutigny, J. Ruffault, J. Madrigal, M. Guijarro, C. Lecareux, C. Ballini

Abstract : Mediterranean plant species feature numerous metabolic and morpho-physiological responses crucial to survive under both, typical Mediterranean drought conditions and future aggravated drought expected by climate change. Whether these adaptive responses will, in turn, increase the ecosystem perturbation in terms of fire hazard, is an issue that needs to be addressed. The aim of this study was to test whether recurrent and aggravated drought in the Mediterranean area favors the accumulation of waxes in leaf litter, with an eventual increase of litter flammability. The study was conducted in 2017 in a garrigue in Southern France dominated by Quercus coccifera, where two drought treatments were used: a treatment with recurrent aggravated drought consisting of ten rain exclusion structures which withdraw part of the annual precipitation since January 2012, and a natural drought treatment where Q. coccifera stands are free of such structures and thus grow under natural precipitation. Waxes were extracted with organic solvent and analyzed by GC-MS and litter flammability was assessed through measurements of the ignition delay, flame residence time and flame intensity (flame height) using an epiradiator as well as the heat of combustion using an oxygen bomb calorimeter. Results show that after 5 years of rain restriction, wax content in the cuticle of leaf litter increases significantly compared to shrubs growing under natural precipitation, in accordance with the theoretical knowledge which expects increases of cuticle waxes in green leaves in order to limit water evapotranspiration. Wax concentrations were also linearly and positively correlated to litter flammability, a correlation that lies on the high flammability own to the long-chain alkanes (C25-C31) found in leaf litter waxes. This innovative investigation shows that climate change is likely to favor ecosystem fire hazard through accumulation of highly flammable waxes in litter. It also adds valuable information about the types of metabolites that are associated with increasing litter flammability, since so far, within the leaf metabolic profile, only terpene-like compounds had been related to plant flammability.

Keywords : cuticular waxes, drought, flammability, litter
Conference Title : ICACCA 2018 : International Conference on Agroforestry, Climate Change and Adaptation
Conference Location : Madrid, Spain
Conference Dates : March 26-27, 2018