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Adaptation of the MMF (Morgan-Morgan-Finney) model to Mediterranean forests subject to wildfire and post-fire rehabilitation measures

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The hydrological effects of wildfire are very difficult to predict in Mediterranean forests, due their intrinsic semi-arid climate and soil characteristics. The Morgan-Morgan-Finney (MMF) model has shown generally accuracy and reliability in predicting surface runoff and soil erosion in several environmental contexts. In spite of its ease use and limited input requirements, few applications exist in Mediterranean forests with or without post-fire rehabilitation measures; therefore, its applicability to those conditions may be questionable without purposed verifications.

To fill this gap, the MMF model has been verified at the seasonal and plot scales in areas affected by a wildfire of a Mediterranean forest, with and without post-fire straw mulch treatment. The application of MMF with input parameters set up according to the original guidelines of the model's developers led to poor performance in every soil condition. Subsequently, the model has been adapted to burned soils and Mediterranean climate characteristics, introducing changes in input data for both the hydrological and erosive components (seasonal values of evapotranspiration, reduction of the soil hydrological depth, including soil water repellency effects in burned soils, and modelling erosive precipitation only). By these adaptations, MMF was able to predict seasonal runoff volumes and soil loss with good reliability in all the experimented conditions.

This modelling experiment has shown the capacity of the MMF model to simulate the seasonal hydrological response of the burned and mulched soils of Mediterranean forests. Therefore, the potential applicability of the model is promising as a management tool for predicting and controlling the erosion risk in semi-arid forest ecosystems threatened by wildfire as well as to evaluate the efficiency of post-fire treatments.