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Soil Moisture Variability in Newly Implemented Agricultural Bench Terraces in Tigray Region, Ethiopia

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Abstract

The effectiveness of radical bench terracing in reducing drought risk is dependent on its correct implementation. However, it is still not clear how proper or improper terracing implementation can impact the landscape capacity of holding soil moisture. In addition to this, the spatial patterns of Soil Water Content (SWC) within the same terraced hillslope are understudied. The present work analyses the variability of SWC in four newly implemented terraced hillslopes in Tigray Region, Northern Ethiopia. In all sites, terraced areas show SWC significantly higher than non-terraced ones, with the lowest part of the terraced hillslope more humid than the others. A Multiple Linear Regression (MLR) analysis highlighted significant dependency of SWC from the date of sampling, the position in the terraced slope, and its significant positive correlation with the percent of Water Stable Aggregates (WSA). Since high soil disturbance can induce low soil aggregates stability, this result shows how low soil disturbance can significantly increase SWC of radical terraces. Overall, the results of the present study testify the good performances of bench terraces in Northern Ethiopia in terms of soil water conservation and can represent a guideline for informing future terracing implementation in some arid and semi-arid agricultural areas of the world.

Keywords: Drought risk, Dry stone walls, Terracing, Terracing implementation, Soil water content

Runoff and soil erosion after prescribed fire and mulching with fern in Mediterranean forests

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Abstract

Prescribed fire is a valid tool to prevent damage by widlfires in Mediterranean forests. However, the soil left bare after burning may expose hillslopes to runoff and soil erosion in the short term. Mulching with straw has been widely experimented as soil conservation measure in the "window of disturbance" after fire. However, the use of straw can be expensive due to transport costs and furthermore may introduce alien species in forest. In contrast, fern is a native plant species and widely available inside in more humid forests locations. Until now, no experiences are found in literature about the hydrological effects of fern in Mediterranean forests. This study has evaluated surface runoff and soil erosion after prescribed fire in small plots installed in three forest stands (*Quercus frainetto*, *Pinus pinaster*, and *Castanea sativa*) of Southern Italy. Six plots were burned with low-intensity fire, of which three were treated with fern mulching; other three unburned plots were considered as control. Precipitation, runoff volumes and sediment concentrations were monitored throughout one year after fire (June 2019-May 2020). For the seven erosive events measured in this monitoring period, in the burned plots runoff and erosion was higher compared to control up to October, and, subsequently, the hydrological response of the burned soil returned to the pre-fire level, except for the oak forest. In pine and chestnut stands, mulching was effective in reducing runoff and erosion of burned soils until the control values or slightly higher; in the oak forest, the pre-fire erosion rates was not recorded, but mulching was able to noticeably reduce soil loss due to fire.

Keywords: Hydrological monitoring, Soil loss, Low-intensity fire, Soil conservation practices