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Emergency firebreaks: the post-fire erosion impact in mountainous areas of North-Central Portugal

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Firebreaks are now perceived as crucial for managing wildfire propagation in fire-prone regions. In present-day Portugal, one of the countries most affected by wildfires worldwide, bulldozers are deployed during fire events to rapidly construct emergency firebreaks, locally enhancing firefighters' response capabilities. Often driven by emergency needs, these firebreaks are created on steep forested terrain without any prior planning and are typically abandoned after the wildfire has been extinguished, i.e., without any efforts to control soil erosion.

The impacts of these firebreaks on hillslope hydrology and associated soil erosion are poorly understood, and to the best of our knowledge, no studies have specifically addressed this issue. The present research aimed to fill this gap by investigating the impact of one such emergency firebreak on soil erosion during the immediate post-fire period and assessing the effectiveness of pine needle mulch application as a potential mitigation technique. The studied firebreak was created in a terraced Maritime Pine plantation, involved the scraping-off of the topsoil layer and compacting it with the bulldozer tracks and was very steep, with an overall slope angle of 37%.

At the study site, three pairs of geo-textile bounded plots, each 8 meters long and 2 meters wide (16 m^2), were installed immediately following a wildfire that occurred at the end of September 2024 in the Caramulo Mountains, north-central Portugal. At the bottom of each plot, sediment fences were used to collect sediments at rough monthly intervals. Rainfall was measured using automatic and totaliser rain gauges, while ground cover evolution over time was tracked using near-vertical photographs taken manually during each field visit.

Preliminary results revealed substantial soil erosion from the firebreak, with median sediment losses of 31 $Mg \cdot ha^{-1}$ during the first four post-fire months. The occurrence of rills was

observed within the first month, highlighting the high erodibility of these firebreaks, and are now being monitored by terrestrial laser scanning. These preliminary findings point to an urgent need for monitoring soil erosion of firebreaks on steep terrain and starting to apply and evaluate erosion mitigation measures.

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