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# The short-to medium-to long-term effects of bench terrace construction for planting eucalypt trees on soil water repellency

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The establishment of monospecific eucalypt plantations has increased considerably over the last half-century. At present, eucalypts are the tree species that are planted most widely across the world, and the common practice of soil mobilization prior to their planting has been associated with negative effects on soil functions such as nutrient and water cycling, carbon sequestration, soil erosion control and soil biodiversity conservation. In Central Portugal, the construction of bench terraces for eucalypt plantations areas has become increasingly common on steep terrain. Bench terrace construction implies the mobilization of large quantities of topsoil and, hence, elevated installation costs that are justified by the advantages in planting, fertilizer application, mechanical and agrichemical weed control and, ultimately, salvage logging and extraction of wood and logging residues. Although terraces are a traditional soil and water conservation technique, the hydrological impacts of bench terracing for forest plantations have been poorly studied. The use of heavy machinery in forests has been reported to increase soil compaction and bulk density and, thereby, decrease soil infiltration capacity and increase runoff generation. At the same time, the flat sections of bench terraces will increase not only infiltration of rainfall but also re-infiltration of run-on, for example from the adjacent risers or diverted forest tracks. In the case of eucalypt plantations, (re-)infiltration patterns may be strongly affected by soil water repellency (SWR), as eucalypts have been widely associated with strong to extreme SWR, especially during dry periods. This study aimed to quantify the short- to long-term impacts of bench terrace construction on SWR in eucalypt plantations along a chrono-sequence. To this end, SWR was measured in-situ, using the Methanol droplet (MED) test, for four different periods of time-since-terracing, i.e. 0, 5, 10 and 17 years after terracing. For each of these periods, three pairs of nearby terraced and non-terraced eucalypt plantations were studied, giving a total of 24 study sites. The MED measurements were done during the dry summer of 2020 (in plain covid-19 crisis conditions). The results showed clear differences in SWR between terraced and non-terraced eucalypt plantations. The median SWR was extreme in all non-terraced sites (MED classes 7 to 8) as opposed to highly variable at the terraced sites, ranging from wettable to strong (MED classes 0 to 6). In the case of the terraced sites, the time elapsed since terrace construction had a major impact. The median SWR was very wettable immediately as well as 5 years after terracing, while it was moderate and strong water repellent 10 and 17 years after terracing.