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Water stability of aggregates in relation to water-repellent characteristics in an Eucalyptus (*Eucalyptus grandis*) forest soil

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Soil water repellency is a phenomenon that reduces the rate of wetting, leading water to remain on the soil surfaces for prolonged periods. It primarily affects the infiltration rates and hydrological balance in soils, which can be related to the slaking and stability of soil aggregates. Eucalyptus plantations generally cause water repellency in underlying soils. The aim of this research is to examine the stability of soil aggregates in a Eucalyptus plantation forest in upcountry Sri Lanka, in relation to water repellency in soil. Water repellency was measured using the water drop penetration time (WDPT) test in the soil depths of 0–5, 5–10, 10–15, 15–20, and 20–25 cm. Stability of soil aggregates were measured by wet sieving apparatus for 5 min. (1.3 cm stroke; 34 oscillations/min).

The surface layer (0–5 cm) of soil showed the highest WDPT (> 3600 s) showing an extremely repellent level. The 5–10 cm depth was strongly repellent (WDPT = ~100 s), whereas 10–15, 15–20, and 20–25 cm depths were slightly repellent (WDPT = 1–60 s). The percentage of water stable aggregates (%WSA) was highest (88%) in 0–5 cm layer and gradually decreased with increasing soil depth showing strong negative linear correlation (R^2= 0.98). The %WSA of 5–10, 10–15, 15–20 and 20–25 cm soil depths were 86%, 84%, 82%, and 78%, respectively. Decreasing %WSA with increasing soil depth might be related to decreasing soil water repellent conditions, as water repellency reduces wetting of soil aggregates and the pressure build up within aggregates. We observed a strong positive linear correlation (R^2= 0.84) between the %WSA and soil water repellency as given by log WDPT. Although the %WSA was >75% in all tested soil depths, we observed onsite evidence of soil erosion. Water repellent conditions are known to lower the cohesiveness of soils, and to keep the surfaces of soil aggregates dry. This may make small soil aggregates easily detachable even beneath a water film. Water drops hitting the soil might cause detaching of much larger amounts of sediment from hydrophobic soil than from hydrophilic. As the slope of the area is very high, there are possibilities of extreme catastrophic consequences of establishing Eucalyptus in this kind of landscape. The experiment was carried out in the wet season. Further studies are required to determine the seasonal pattern of these phenomena.

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