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The permanent breakdown of soil water repellency – not just a physical process.

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Soil Water Repellency (SWR) hinders water infiltration that is becoming increasingly problematic around the world as drying climate causes drying soils. Lower water infiltration decreases productivity of agricultural soils and increases erosion in both natural and agricultural soils. As the issue becomes increasingly prevalent SWR breakdown becomes increasingly important for land management. To better understand how SWR breaks down, a laboratory experiment was conducted to determine the relationship of SWR breakdown and physical and microbial factors. In this experiment soil was sterilised, by gamma irradiation, and breakdown was compared with unsterilized soil and sterilised soil to which lipase-producing microbes (Bacillus subtilis) were added. These soils (4 x 4 x 3 cm cores) were excavated at different times (during the 18 day experiment) to test for repellency and soil water content over time. The water content of soil treated with microbes reached 0.33 cm3cm-3 at the end of the 18 day experiment, while the sterile soil only reached 0.06 cm3cm-3. Similarly the potential water repellency of the microbial treated soil went from severe (MED= 2.6) to low repellency (MED= 0.3), while the sterile soil remained severely repellent (MED= 3.1). The natural soil showed some increases in water content at the end of the experiment (0.11 cm3cm-3) and a decrease in repellency (moderate repellency; MED= 1.1). Our results show that any breakdown relying only on physical processes was not permanent, which has also been observed in field experiments. Furthermore, increases in soil water content occurred only at lower repellency, suggesting that repellency breakdown had to occur before the water content was increased. Soil sampled from 1 – 2 cm depth had higher persistence of repellency than layers above or below, also consistent with observations in the field. This suggests that the variation of SWR with depth is something that is due to the breakdown process and not the re-establishment at drying.