Dung beetles as hydrological engineers: Effects of tunnelling on soil infiltration

ABSTRACT

Soil infiltration capacity determines the partitioning of precipitation into infiltration and overland flow and is therefore an important soil hydrological characteristic. Water infiltration through soil is facilitated by macropores created by roots and soil macrofauna. In clay-rich soils, such as those of the tropical forests of Sabah, Malaysian Borneo, most infiltration occurs via these preferential flow pathways. We evaluated the effects of dung beetle tunnelling on infiltration and macropore creation (depth and width of the flow pathways) in tropical forest soils in Sabah. Using mesocosms, we applied three treatments (i) soil-only, (ii) dung-only, (iii) dung + dung beetles, and measured saturated hydraulic conductivity (i.e., the steady-state infiltration rate) after 0, 5 and 10 days, and assessed depth and width of infiltration pathways by applying a blue dye tracer. The steady-state infiltration rate increased in the presence of dung beetles, though differences among treatments were only statistically significant after 10 days. After 5 days of dung beetle presence, infiltrated water had reached a greater depth than the control mesocosms without beetles. However, there were no differences in the width of infiltration pathways among treatments. These results reveal the important, but under studied roles of dung beetles on soil hydrological functioning, that may have consequences for nutrient cycling and plant productivity. Further, our findings indicate that the novel application of an established hydrological method—blue dye tracer—can provide interesting and reliable results for macrofauna–soil interaction studies.