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Ecosystem engineering by desert macro-detritivores facilitates microbial litter decomposition

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Litter decomposition in most terrestrial ecosystems is regulated by moisture-dependent microorganism activity, among other things. Decomposition models typically underestimate rates of plant litter decomposition in drylands, suggesting the existence of additional drivers of decomposition. Attempts to reveal these drivers have predominantly focused on abiotic degradation agents, alternative moisture sources, and soil-litter mixing. The role of burrowing animals in promoting decomposition has received less attention despite greatly contributing to plant litter transfer from the harsh desert surface to the moister and nutrient-rich environment belowground. In a previous study in the Negev Desert, we found that macrofauna account for 89% of the litter cleared from the desert surface, and detected elevated nutrient levels near desert isopod (*Hemilepistus reaumuri*) burrows. Here, our goal was to explore how macro-detritivore burrows affect plant litter mineralization dynamics. We introduced ¹³C-labeled litter belowground into (1) isopod burrows and (2) artificial burrows, and aboveground on top of (3) isopod fecal pellet mounds and (4) bare soil crust. We compared the litter mass loss between the four treatments and used cavity ring-down spectroscopy to reveal the in-situ mineralization dynamics. No litter mineralization was evident during the dry summer months both above- and belowground. Following rain events, mineralization rates spiked in all four micro-environments, quickly diminishing aboveground while slowly waning belowground. Total litter mass loss was twofold higher below than aboveground and was significantly higher in isopod burrows compared to artificial burrows. Our findings demonstrate that burrowing macro-detritivores promote litter decomposition in deserts by transferring organic matter to their burrows where favorable climatic conditions and a nutrient-enriched environment foster microbial activity. Thus, attempts to resolve the dryland decomposition conundrum should not be limited to exploring factors that allow decomposition under harsh desert surface climatic conditions, but focus on the role that animals play in facilitating decomposer-friendly environments to which they translocate plant litter.