

Hewins, DB, SR Archer, GS Okin, RL McCulley, HL Throop. 2012. Soil-litter mixing accelerates decomposition in a Chihuahuan Desert grassland. *Ecosystems*: In Press

Abstract: Decomposition models typically under-predict decomposition relative to observed rates in drylands. This discrepancy indicates a significant gap in our mechanistic understanding carbon and nutrient cycling in these systems. Recent research suggests that certain drivers of decomposition that are often not explicitly incorporated into models (e.g., photodegradation and soil-litter mixing; SLM) may be important in drylands, and their exclusion may, in part, be responsible for model under-predictions. To assess the role of SLM, litterbags were deployed in the Chihuahuan Desert and interrelationships between vegetation structure, SLM, and rates of decomposition were quantified. Vegetation structure was manipulated to simulate losses of grass cover from livestock grazing and shrub encroachment. We hypothesized that reductions in grass cover would promote SLM and accelerate mass loss by improving conditions for microbial decomposition.

Litter mass decreased exponentially, with the greatest losses occurring in concert with summer monsoons. There were no differences in decay constants among grass cover treatments. A significant, positive relationship between mass loss and SLM was observed, but contrary to expectations SLM was independent of grass cover. This suggests that processes operating at finer spatial scales than those in our grass removal treatments were influencing SLM. Shifts in litter lipid composition suggest increased bacterial contribution to decomposition through time. SLM, which is seldom included as a variable controlling decomposition in statistical or mechanistic models, was a strong driver of decomposition. Results are discussed in the context of other known drivers of decomposition in drylands (e.g. UV radiation and climate) and more mesic systems.