Barnes, PB, HL Throop, DB Hewins, ML Abbene, SR Archer. 2012. Soil coverage reduces photodegradation and promotes development of soil-micorbial films on dryland leaf litter. Ecosystems 15:311-321

ABSTRACT

Litter decomposition is a central focus of ecosystem science because of its importance to biogeochemical pools and cycling, but predicting dryland decomposition dynamics is problematic. Some studies indicate photodegradation by ultraviolet (UV) radiation can be a significant driver of dryland decomposition, whereas others suggest soil-litter mixing controls decomposition. To test the influence of soil coverage on UV photodegradation of litter, we conducted a controlled environment experiment with shrub (*Prosopis velutina*) leaf litter experiencing two UV levels and three levels of coverage with dry sterile soil. Under these conditions, decomposition over 224 days was enhanced by UV, but increasing soil coverage strongly and linearly diminished these effects. In a complementary study, we placed *P. glandulosa* leaf litter in different habitats in the field and quantified litter surface coverage by soil films. After 180 days nearly half of the surface area of litter placed under shrub canopies was covered by a tightly-adhering film composed of soil particles and fungal hyphae; coverage was less in grassy zones between shrubs. We propose a conceptual model for the shifting importance of photodegradation and microbial decomposition over time, and conclude that 1) soil deposition can ameliorate the direct effects of UV photodegradation in drylands and 2) predictions of C losses based solely on UV effects will overestimate the importance of this process in the C cycle. An improved understanding of how development of the soil-litter matrix mediates the shift from abiotic (photodegradation) to biotic (microbial) drivers is necessary to predict how ongoing changes in land cover and climate will influence biogeochemistry in globally-extensive drylands.
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