Photopriming of leaf litter for microbial degradation varies by litter type in an arid ecosystem

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Abstract

Litter decomposition in arid systems is faster than predicted and decay patterns are near linear rather than exponential. Recently, litter breakdown by solar radiation (photodegradation) has been found to be a significant driver of mass loss in arid systems. The optical properties of leaf litter vary among different plant growth forms, and could influence the effectiveness of photodegradation. Photopriming (increase in labile C) makes organic compounds more accessible to microbes and should be the least for evergreens, intermediate in grasses, and highest in forbs. The experiment was conducted in the lower Sonoran Desert (Phoenix, AZ, USA). We used a randomized block design involving 12 litter types or species (four species by plant group) x 3 radiation treatments (Full sunlight, NoUV and NoUV+blue) x 6 collection times x 8 replicates. Contrary to our hypothesis, photopriming was most consistently observed in forb litter and highly variable among evergreen and grasses. Four species presented a strong increase in CO2 emission (respiration) under full sunlight potentially revealing a microbial stimulation (i.e. increase in labile compounds under full sunlight). In contrast, the other 8 litter types gave highest respiration rates under NoUV or NoUV-Blue wavelengths. This later result could reveal a decrease in inhibitory effects of UV or UV+Blue wavelengths on microbial communities. Microbial DNA from litter was extracted and 16S (primers 799F and 1193R) and ITS (ITS1 and ITS2) genes were targeted and sequenced (miseq) to analyze the bacterial and fungal communities. These metagenomics data are currently being analyzed and interpreted.

Keywords: Arid lands, photopriming, CO2 emission, litter decomposition

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