

Interactive climate change drivers promote root suppression of litter decomposition in a semi-arid grassland

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Abstract

Plant roots exert critical controls over microbial decomposition, but climate change factors may alter these effects. Yet, the direction and magnitude of interactive climate change effects, as well as the underlying mechanisms, remain unclear. Here we show evidence from a field experiment demonstrating that climate change factors strengthen root controls over litter decomposition in a semi-arid grassland. While plant roots significantly increased soil microbial biomass, they suppressed microbial activities, C-cycling enzymes and litter decomposition. Both precipitation reduction and warming reduced decomposition regardless of the root presence, but precipitation increase stimulated decomposition only in the absence of roots, suggesting that plants outcompete microbes for water and constrain microbial activities. Together, warming-enhanced plant competition for water, combined with N-suppression of microbes, may provide a unique mechanism through which moderate increases in precipitation, warming and N inputs interactively enhance root controls over microbial decomposition, thereby facilitating soil C sequestration in the water-limiting grasslands.

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