How do microarthropods impact soil carbon sequestration during litter decomposition in a tallgrass prairie?

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Soil microarthropods are commonly understood to accelerate the process of litter decomposition in temperate ecosystems. However, it is unknown how microarthropods affect the litter decomposition process in ways that may change the relative amount of carbon (C) mineralized and lost as CO_2 vs. that stored in the soil as soil organic matter (SOM). The acceleration of litter decomposition by microarthropods could increase the loss of litter C as CO_2 from the ecosystem, or it could increase the amount of litter C transformed into long-term stabilized SOM products of decomposition. In order to examine how microarthropods impact the soil microbial community involved in litter decomposition, soil CO_2 efflux, and SOM formation we incubated 13C and 15N labeled leaf litter (Andropogon gerardii) in a native tallgrass prairie in Kansas, USA, and applied a naphthalene treatment to suppress microarthropods. Over the first two years of decomposition, we traced the decomposing litter C, both with microarthropods and with naphthalene suppressant, into CO_2 fluxes, bulk soil, the microbial community using phospholipid fatty acid biomarkers (PLFA), and soil microarthropods. We found that the presence of microarthropods reduced microbial biomass, in particular the abundance of fungi and gram-negative bacteria, but increased microbial litter-C utilization. Litter C loss as CO_2 varied throughout the two year period and soil C incorporation does not appear to be different between the microarthropod suppression and the control. These results provide new insight into the role of microarthropods in controlling the incorporation of litter C into microbial biomass, which is important for longer term carbon sequestration in soils. This understanding of how soil biodiversity impacts soil carbon sequestration can provide insight into our ability to accurately model terrestrial ecosystem C cycling under changing global conditions.