Role Of Geographic Scale In Likelihood Of Microbial Driven Variation In Litter Decomposition

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Project Goals:

The LANL SFA program in Microbial C Cycling aims to inform climate modeling and enable carbon management in terrestrial ecosystems. To achieve these aims, our program develops and uses community genomics approaches to discover microbiological processes that control carbon storage and release in temperate biome soils.

Abstract

In terrestrial ecosystems, stochasticity in the assembly of surface litter decomposer communities is widely believed to shape community composition. The compositional variation may drive functional variation, resulting in different patterns of carbon flow from decomposing litter. Is this important for climate feedbacks? The importance depends foremost on 1) the magnitude of functional variation and 2) the likelihood of substantial functional variation to occur within ecosystems.

Here, we examined the likelihood of microbial driven variation in surface litter carbon (C) flow as a function of geographic scale. Our null hypothesis is that stochastic assembly of decomposer communities creates only minor functional variation (e.g. *a few* percent difference in carbon flow). Consequently, *substantial* functional variation among decomposer communities is likely to be found only among communities over large geographic scales (e.g. >100km), where climate and ecosystem gradients can create persistent functional differences between distant microbial communities.

We performed a test of this hypothesis with a collection of over 400 soil samples from locations representing varied geographic scales (meters to 1000km). We suspended the soil microbial communities suspended in water, transferred aliquots to laboratory microcosms with sterile plant litter, and measured carbon flow (CO_2 and DOC) arising from 45 days of decomposition. We present the likelihood of substantial functional variation among communities as a function of the original distance between the communities, ranging from <1cm (replicate microcosms derived from the same gram of soil) to >1000km.

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