Do litter inputs or the microbial community drive nutrient cycling across a cropping rotational gradient?

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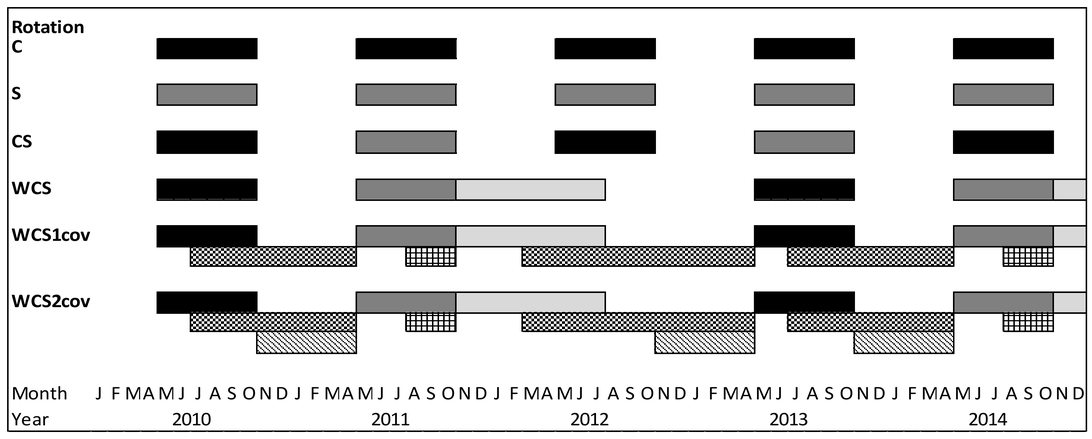
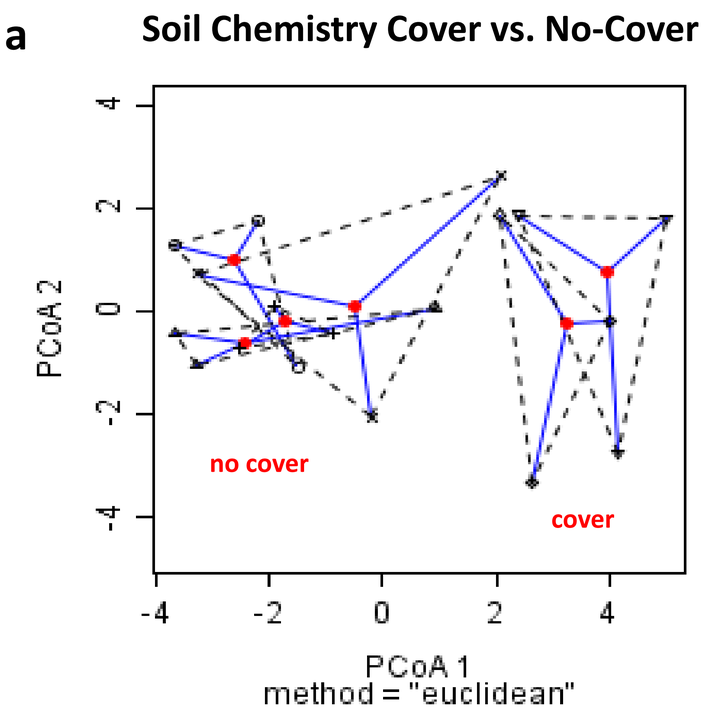
Introduction

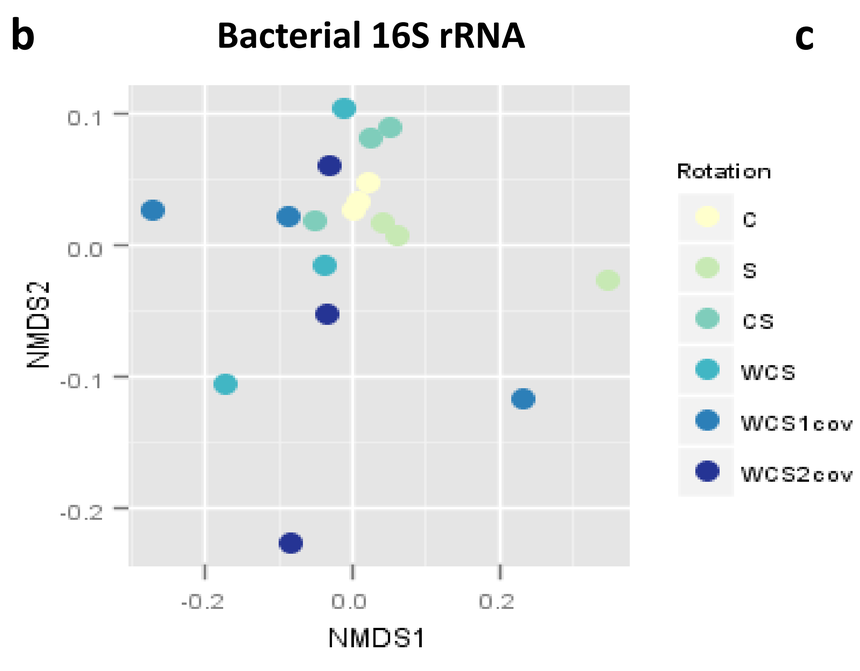
At the KBS-LTER Biodiversity Gradient greater crop productivity in cover crop systems is linked to rapidly cycling fractions of soil organic matter, and increased soil microbial diversity. Labile organic matter appears to fuel this system, but the microbial community is the engine for SOM mineralization. We want to test whether substrate quality or the microbial community has a greater influence on mineralization across the gradient. Using a reciprocal inoculation approach we want compare the efficiency of SOM mineralization when sterile soils from simple rotations are exposed to the microbial community from complex rotations and vice versa. We expect no 'home field advantage' for the community under simple rotations. Instead, we anticipate microbial communities from diverse crop rotations will be both better and more efficient at mineralizing SOM from less diverse rotations.

KBS-LTER Biodiversity Gradient: Treatments were established in 2000 in four randomized blocks (each plot 9m x 27m). No fertilizer is applied and weeds are controlled mechanically



Results





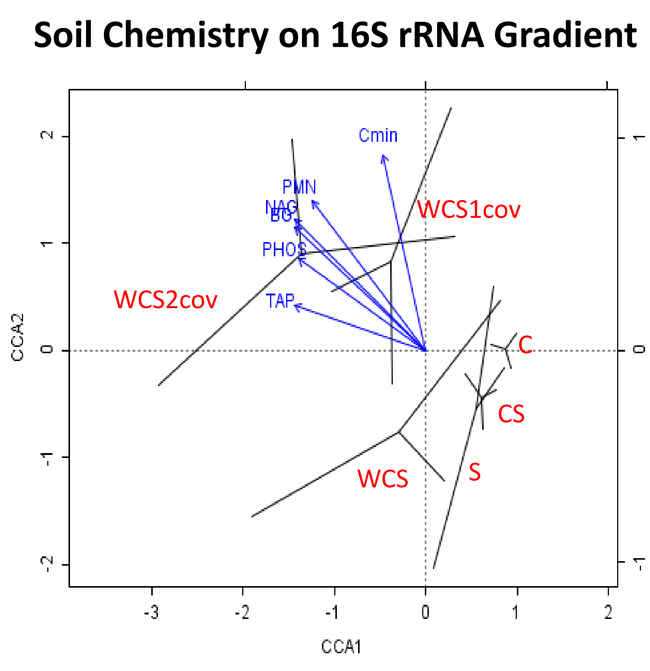


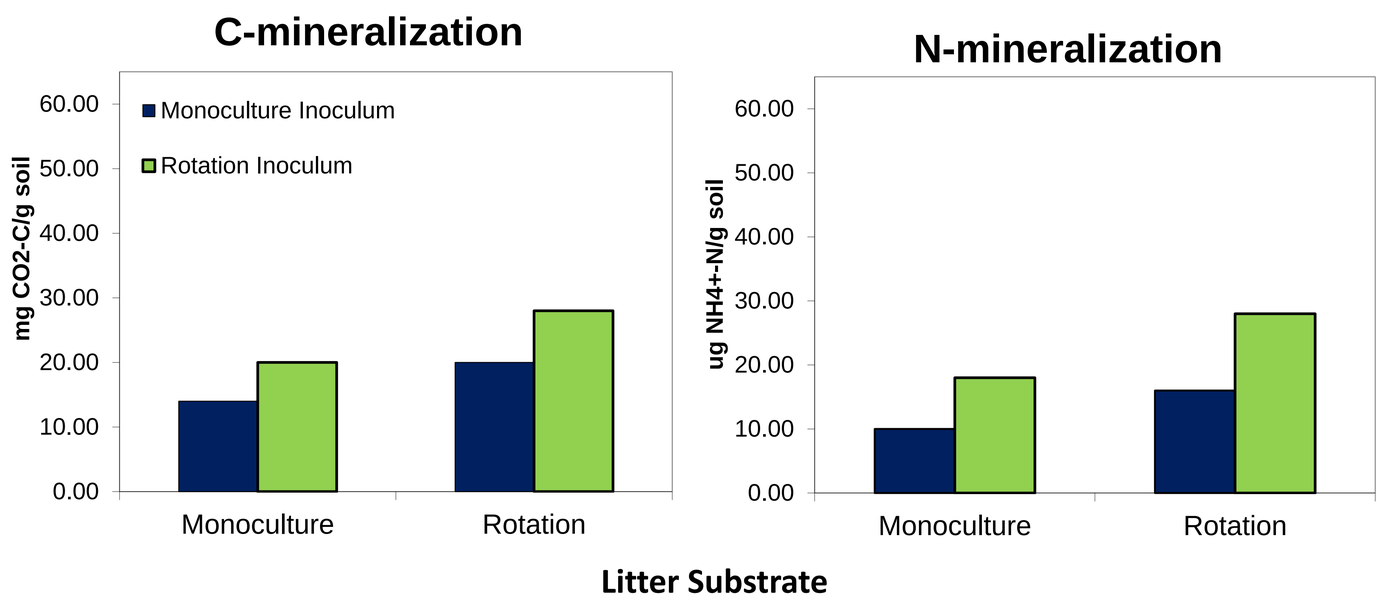
Figure 1. There is clear separation between 'cover' and 'no cover' treatments when analyzing 15 different soil chemical factors – six soil enzymes, total C and N, trace gas flux, potentially mineralizazable nitrogen (PMN), DEA, ammonium and nitrate, POXC, Cmin (short term C mineralization), here PCoA forces grouping by centroid between treatments. (a) 16S rRNA analysis from 454 pyrotagged sequences (b) shows greater heterogeneity in more diverse plots, and cover cropped treatments are significantly more diverse than non-covers. Across the gradient, four soil enzyme measures and short term mineralizations (C and N) are significantly correlated with the structure of the bacterial community (c).

Conclusions and Future Directions

- Labile SOM serves as an ideal fuel for nutrient cycling, but the microbial community is the engine which mineralizes nutrients. A microbial community adapted to heterogeneous substrates might be expected to more efficiently mineralize SOM.

- Inoculating sterile soil substrates or litter from simple rotations with microbial communities from complex rotations and vice versa, which would have a greater effect on mineralization?

- ***The microbial community from a diverse crop rotation will be better and more efficient at mineralizing soil N from less diverse rotations. The community adapted to the less resource rich environment will not mineralize resources as efficiently.***



Acknowledgments

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