Outline

Frontiers in Environmental Science | Soil Processes (or the sustainable part of Frontiers)

~ Experiment performed with the intention of characterizing the microbial community and plant available nitrogen of soils amended with fertilizers available for use in organic agriculture. Understanding the bacterial community structure during decomposition and nutrient release of organic plant materials and compost and the associated soil nutrient profile will provide bacterial targets to be used as biological soil amendments intended to improve nutrient cycling in organic production systems.

We want to leverage an abundant natural resource (soil and bacteria) to improve crop production and ecosystem services/health in agroecosystems. We will do this first by characterizing the microbial (bacterial) community of agricultural soils under sustainable (organic) management. We will utilize bacterial characteristics to design biostimulants and bioaugmentations for soils that will improve soil fertility management in sustainable agroecosytems.

Introduction (4 – 10 paragraphs)

* Drawbacks of mineral fertilizers in agroecosystems
  + Water quality
  + Climate change (fossil fuel use)
* Green manures and compost (organic amendments) as alternative fertilizers
* Challenge facing: timing of nutrient release, microbial mediated component particularly not well characterized
  + C:N ratio impact on microbial response and nutrient release
  + C:N ratios below 25:1 (mineralization)
* Understanding nutrient release from organic amendments over time and the coupled bacterial community dynamics will improve our understanding of soil ecology in organic agroecosystems as well as contribute to the development of biological soil amendments
* ~~Ecological classification (slow vs. fast growers) who is likely to be responding to each amendment? Linked to treatment or time? (See Fierer et al. 2007, “Toward and ecological classification of soil bacteria”)~~ (better in discussion)
* **Do OTUs transfer from amendment to soil and persist? (little available research)**

Questions/Objective

* Characterizing the microbiome of organic amendments and baseline soils, and their change through combination
* Does this change come from the amendment or because the soil is changing?

Materials & Methods

* Highlight: controlled, replicated, broad (analyses)

Results

* How much does the soil microbiome/nutrients change
  + from amendment?
    - NMDS of all amendments and basesline soils and time
    - Line charts of nutrients
    - Line chart of diversity index
  + Per amendment / soils?
    - Barchart of phylogeny – fingerprint
    - Line charts of nutrients
  + What is the biggest factor in the changes we observe? (quantify the explanatory variables)
* Who is present? Distinction of transferers and responders.
  + Define Responders and specifically early and late responders
    - Early = first group of days identified by hierarchical clustering per treatment
    - Late = second group of days identified by hierarchical clustering per treatment
    - Clustering results – is this different for the amendments?
    - Defining what a “responder” and “persistor” is
      * Responder = > 2 LFC compared to previous time point + control
      * Persistor = native OTUs that persist from day 7 into either early or early and late groups, have this for top 20 most abundant from day 7 reference into each incubated treatment.

[***/home/jflater/Documents/incubation\_manuscript/code/core\_heatmap.html***](code/core_heatmap.html)

* + - * Alien = OTU originating from amendment and not present in control soil samples that can be detected in incubated microcosms with said amendment.
    - Outputs: Early and late natives and aliens
      * # of OTUs that are early / late natives and aliens

Table with # of aliens for each treatment and what period of the incubation they were detected, early/late or throughout.

Note: heatmaps not on rarefied object but cluster was which generated the table, should I rarefy the heatmap as well? It’s comparing samples across time within a treatment using bray curtis-distance...I think maybe rarefy?

* + - * Bar chart of OTUs with LFC > 2 compared to reference for each treatment, faceted by group in which OTUs were detected from clustering.
      * Is there a pattern of responders and persistors?

The phylogenetic characterization of these guys [phylogenetic tree / heatmap of the early and late native and aliens per amendment] ← still working on getting graphlan to work

Can we label the OTUs as slow or fast growing?

Discussion

* Timing of responses (microbial and chemical)
  + Microbes early vs. late, treatments clustered with hclust
* Specificity of amenments
  + Increase in inorganic N
  + Not much change in alpha diversity
* Origin stories of the response
  + Primarily enriched
  + Aliens are present at low abundance
* ecological class: slow (oligotrophic) and fast (copiotrophic) growing bacteria, differences between treatments? Time?

Conclusion

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