Introduction

- Microbes regulate major biogeochemical cycles (Nemergut et al., in press).
- The factors that directly impact microbial community assemblies and extracellular enzyme activity (EEA).
- Two microbial assembly processes are: neutral, or stochastic, and niche-based, or deterministic.
- The relationship between microbial community assembly and EEA in response to burn events was analyzed by comparing unburned plot samples and burned plot samples in order to further our knowledge of microbial community assemblies and biogeochemical processes.
- This study draws on samples from the Fourmile Canyon Fire, which occurred in September 2010 in the Rocky Mountain Front Range adjacent to Boulder, Colorado in steep, rugged terrain (Graham et al. 2012).

Methods

- Each treatment, October 2010 burned plots and January 2011 unburned and burned plots, had 8 samples.
- DNA extractions were conducted for 16S rRNA genes and microbial metagenomics were inferred by 16S rRNA phylogenics using PICRUSt.
- Fluorimetric assays measured potential NAG and BG enzyme activity.
- Soil moisture, pH, and total carbon and nitrogen for all samples; ammonium, dissolved organic nitrogen (DON), and dissolved organic carbon (DOC) were only measured for 16 week samples.
- Correlations, ANOVAs, and linear stepwise regressions were conducted using the R statistical platform (R Development Core Team 2011).

Results

- Figure 3. Map showing the extent of the Fourmile Canyon fire in relation to Gold Hill that occurred in September 2010. Soils were sampled near the southeastern edge of the Fourmile Fire (40.039N, 105.3891W) on the eastern slope of the Colorado Front Range (Ferrenberg et al. 2013). (http://www.denverpost.com/news/ci_16021847)

Discussion

- For October 2010 burned, microbial models significantly predicted NAG activity, suggesting stochastic assembly. Because actinobacteria and NAG enzymes assist in carbon cycling, this phyla may be particularly important to understanding post fire carbon cycling.
- A shift occurred from 4-week samples to 16-week samples as edaphic models significantly predicted NAG activity in January 2011 burned samples, suggesting edaphic predictors are more important than microbial predictors in carbon cycling here.
- January 2011 unburned samples were significantly predicted by edaphic and microbial models. This could be interpreted as the edaphic factors driving the microbial enzyme activity.

Conclusion

- Post fire, microbial community assembly began stochastically and progressed into assembling deterministically.
- Ferrenberg et al. (2013) hypothesized that over longer time scales, the environment will become less harsh and neutral processes will become the more important factor in structuring community assembly.
- The data presented here show that microbial community diversity is more important to predicting EEA shortly after disturbance, correlating with a shift in stochastic to deterministic microbial community assembly processes.
- The relationship between microbial community assembly processes and EEA is vital in understanding the implications for the future biogeochemical cycling following an environment disturbed by fire.

References


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