

A scenic landscape photograph of a lake with lily pads, a forested hill, and a small house. The lake is in the foreground, filled with numerous lily pads. The water is calm, reflecting the surrounding greenery and the sky. In the middle ground, a small, rustic house is nestled among trees on the shore. The background is a large, densely forested hill under a cloudy sky.

Microbial community differs under sugar maple vs red oak: Implications for N cycling in the Catskills and Hudson Valley Region

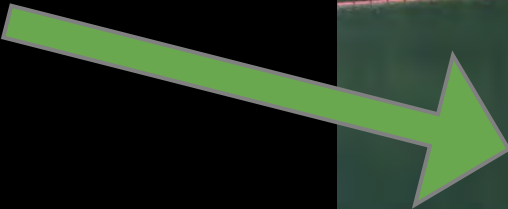
**David Esteban and Lynn Christenson
Vassar College
CERM October 2016**

Why do we spend so much time studying Nitrogen?

atmospheric N deposition -> N saturation, acid rain-> soil acidification



www.jhunewsletter.com

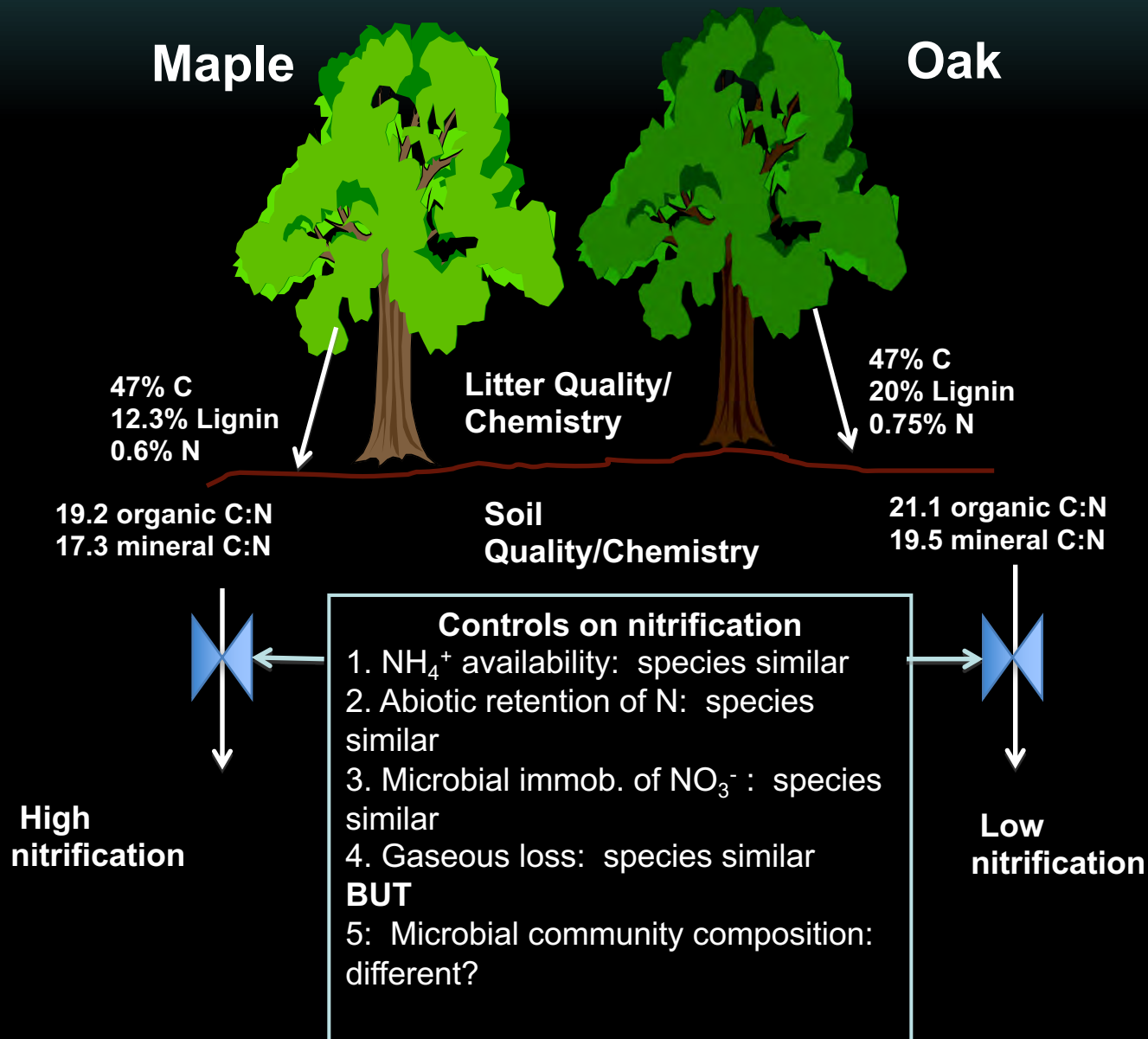


Water quality and nitrate:

- Eutrophication
- Methaeglobinemia
- **EXPENSIVE** to treat

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why do oak forests have lower rates of nitrification compared to maple forests?



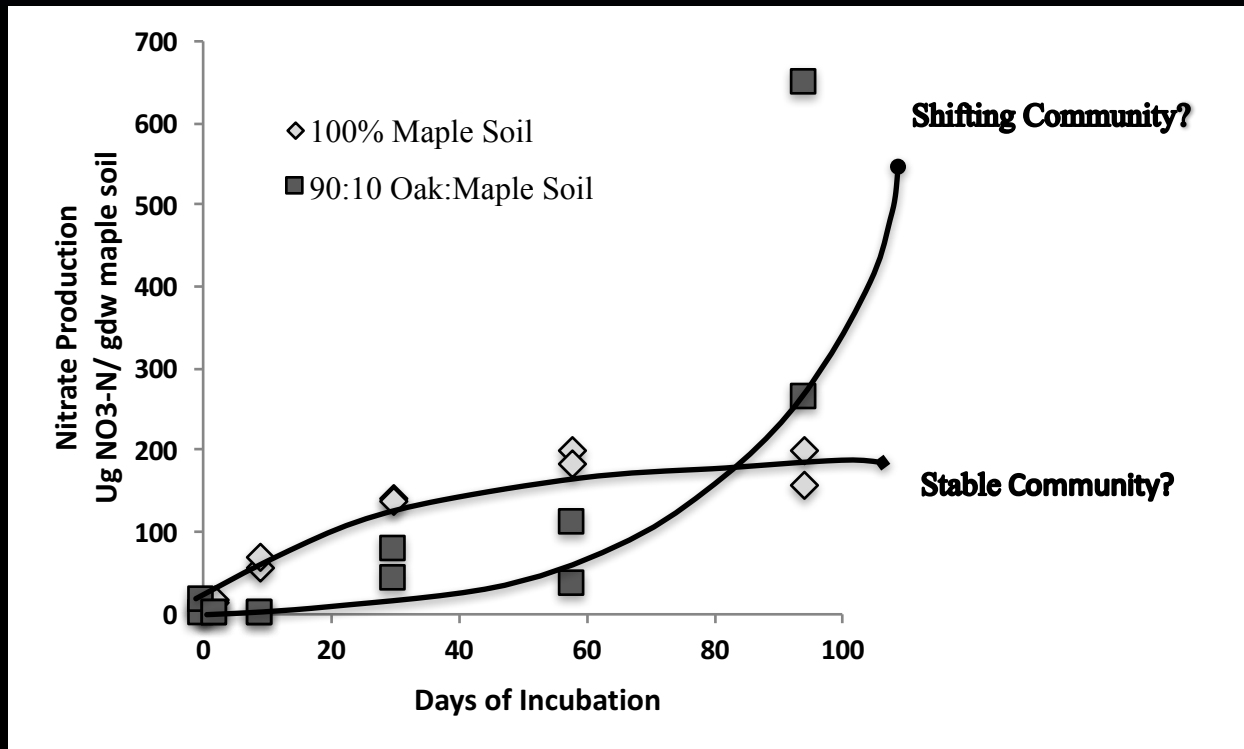


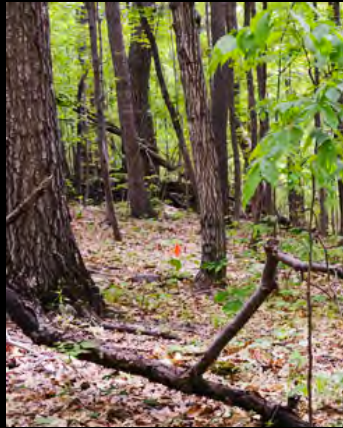
Figure 2: Nitrate production from laboratory soil incubations comparing soils collected under maple dominated forests to oak soils inoculated with maple soils (Lovett unpublished). We hypothesize that microbial community composition drives this response with an 'inhibition' factor present in oak soils. The introduction of reciprocal microbial communities will elucidate the factor(s) responsible for this response.

Methods

Vassar Farm and
Ecological Preserve



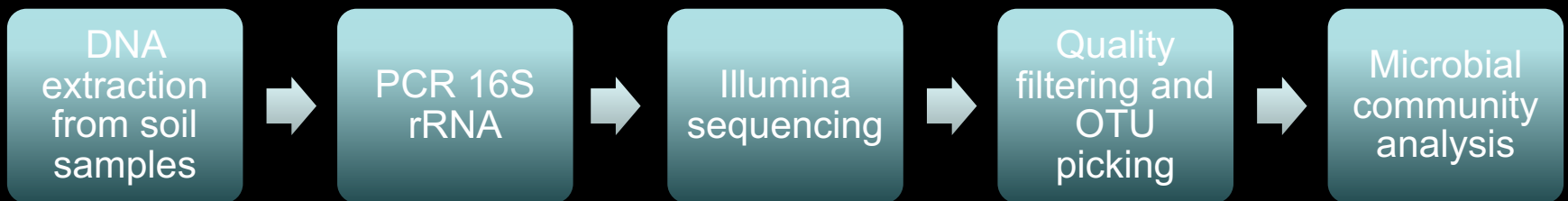
Cary Institute of
Ecosystem Studies



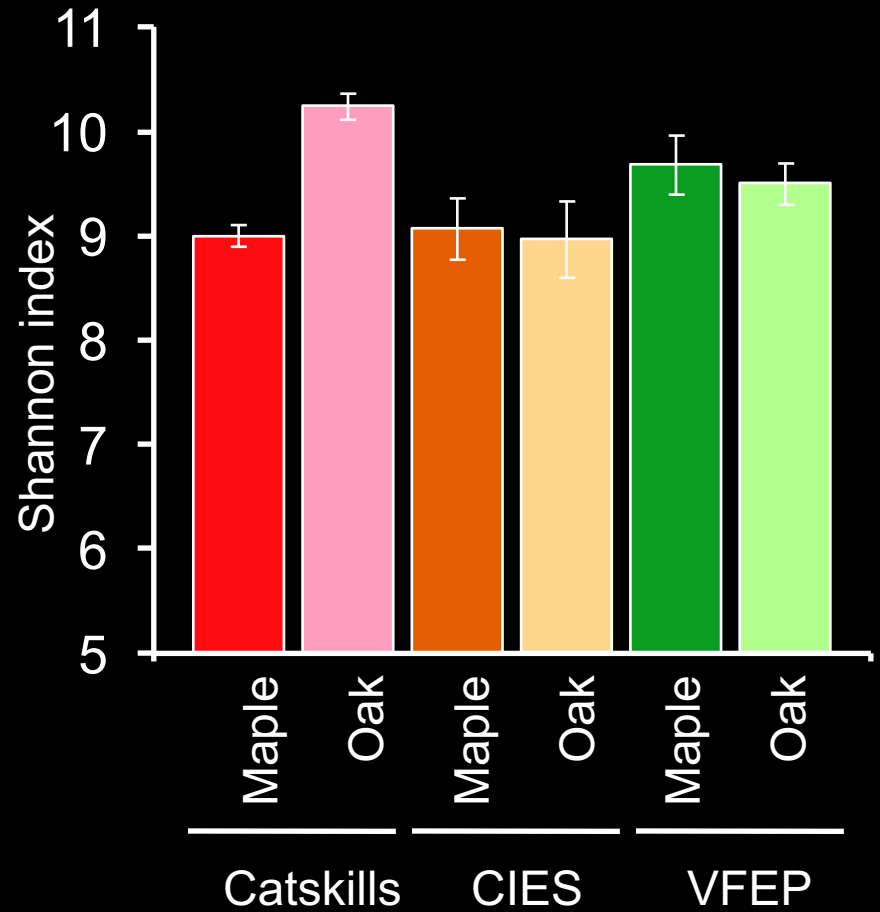
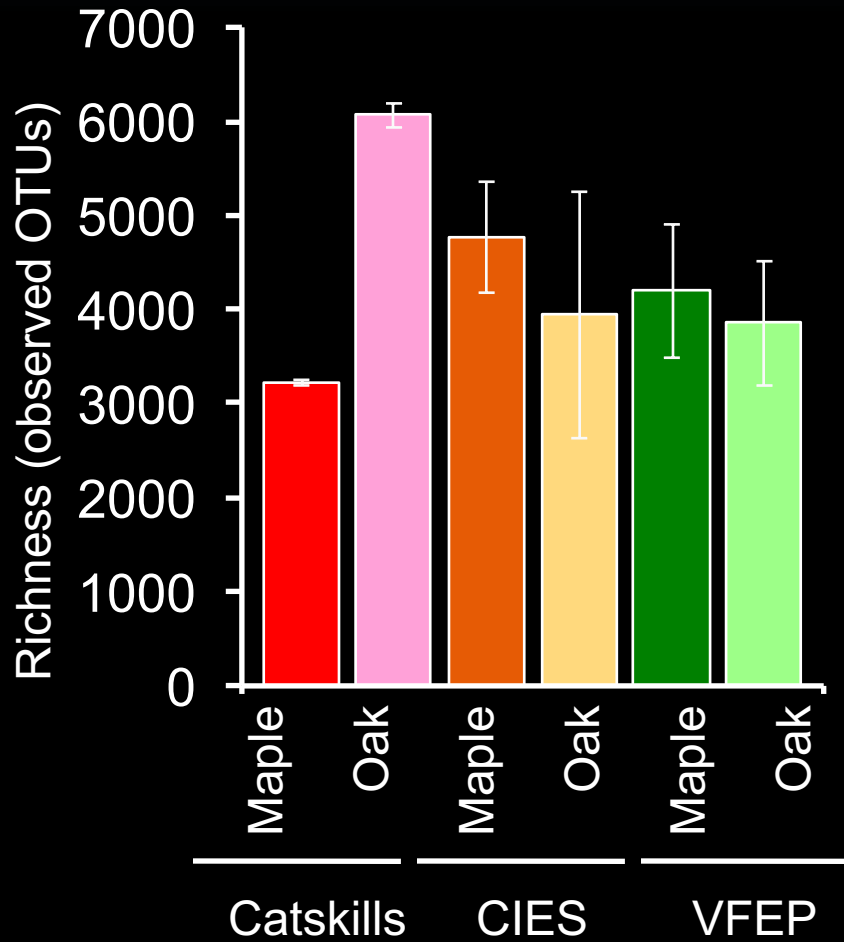
Catskills sites:
Diamond Notch
Knappe Brook



Samples collected from oak and maple dominated stands

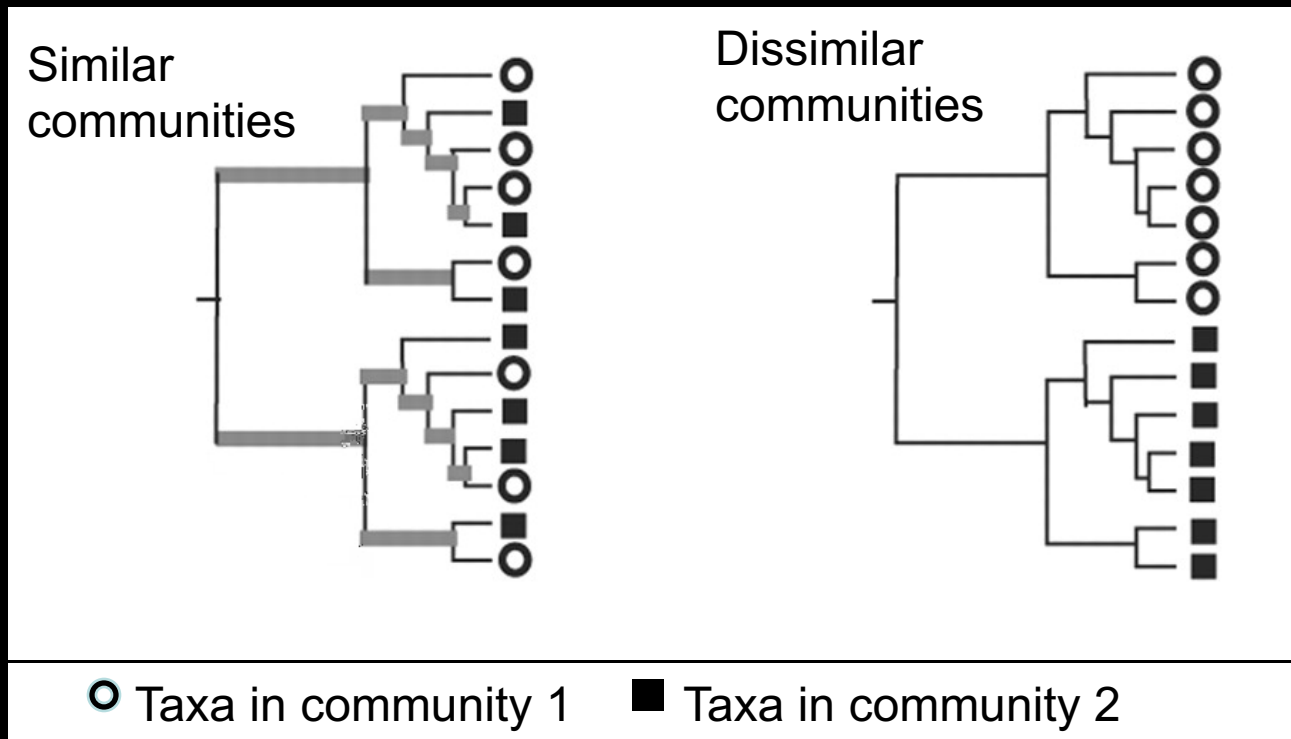


Diversity of soil microbial communities



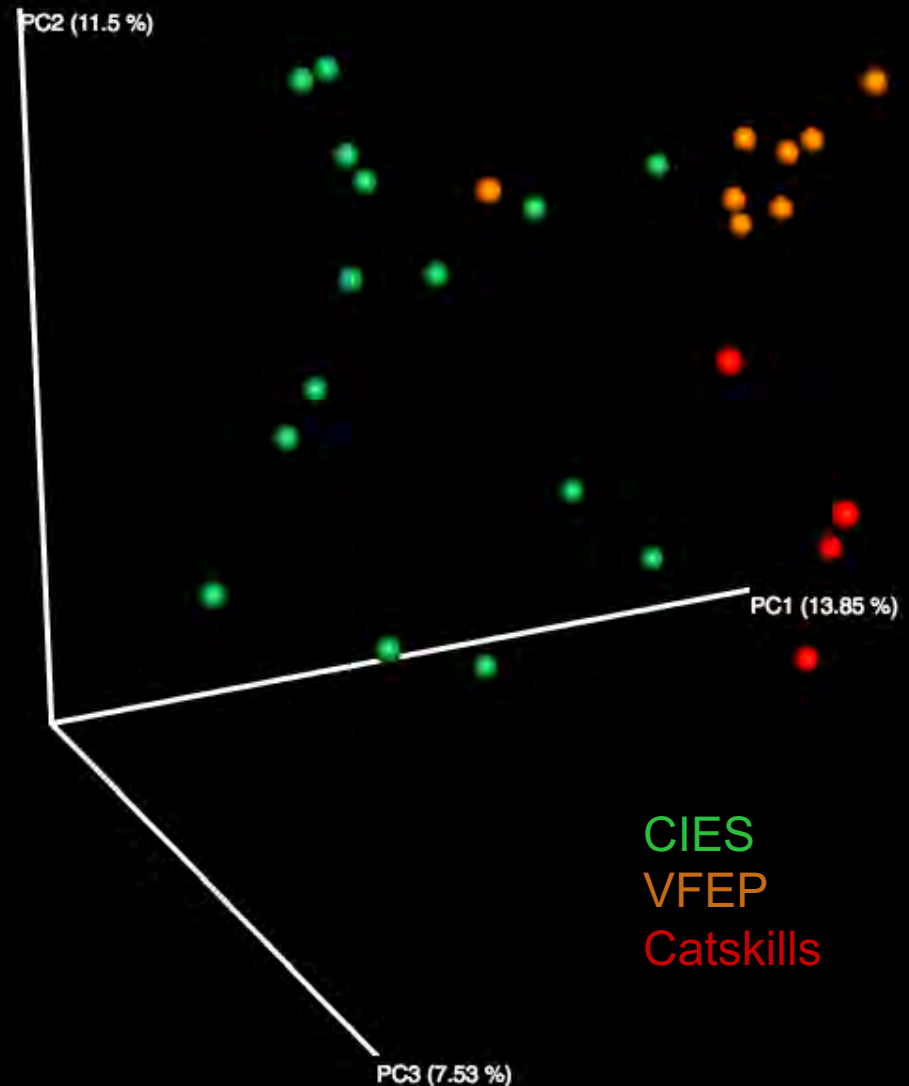
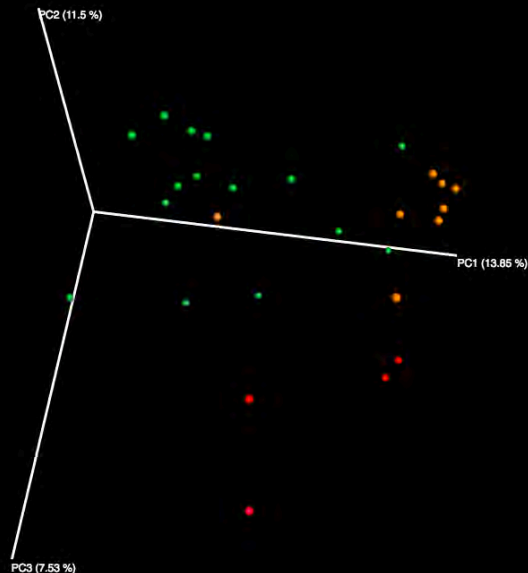
UniFrac

- Phylogenetic metric for community similarity
- Fraction of tree branches that are unique to one community or the other

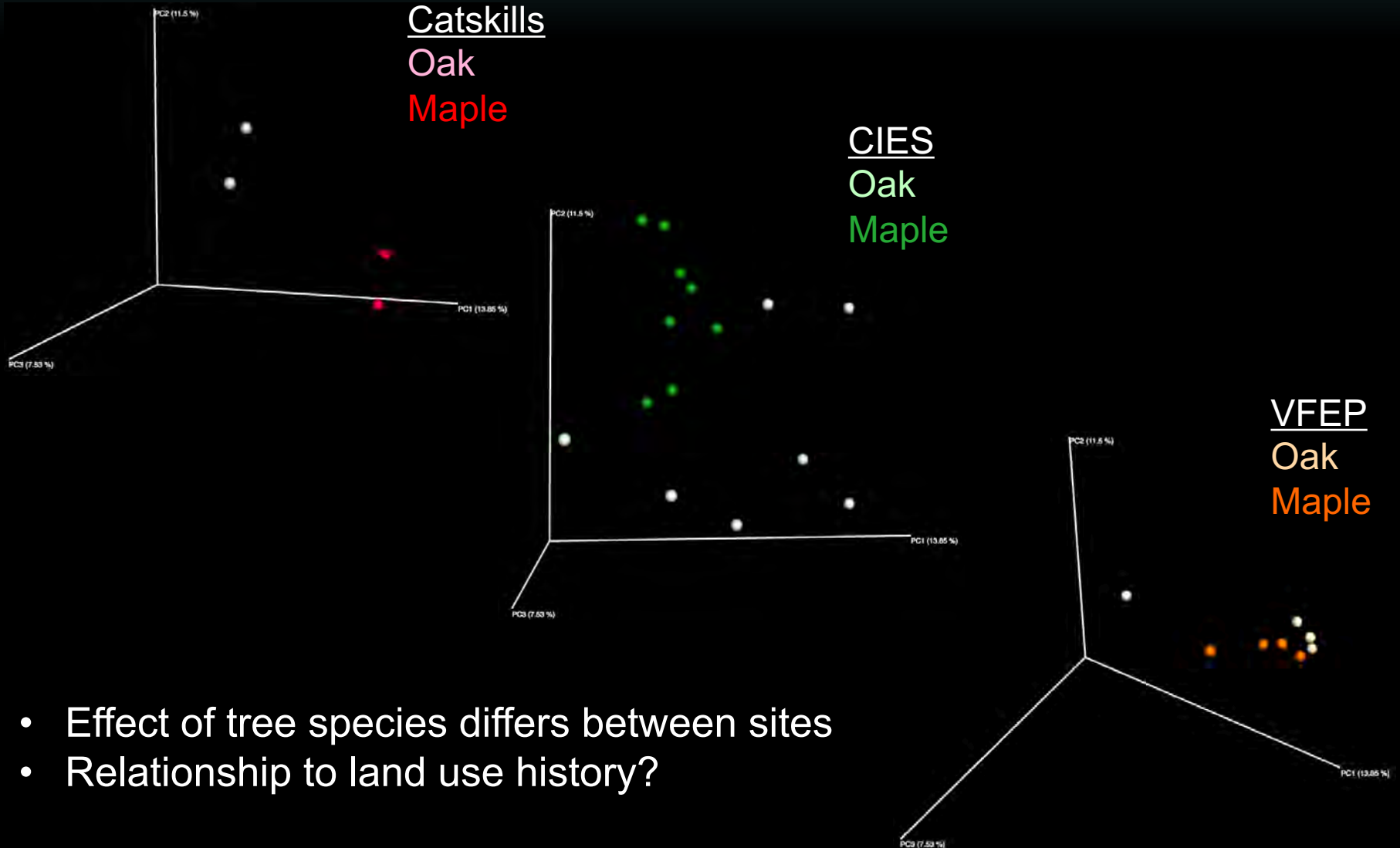


Microbial communities cluster by site

- UniFrac: phylogenetic approach to assess community similarity
- Multidimensional scaling (PCoA)

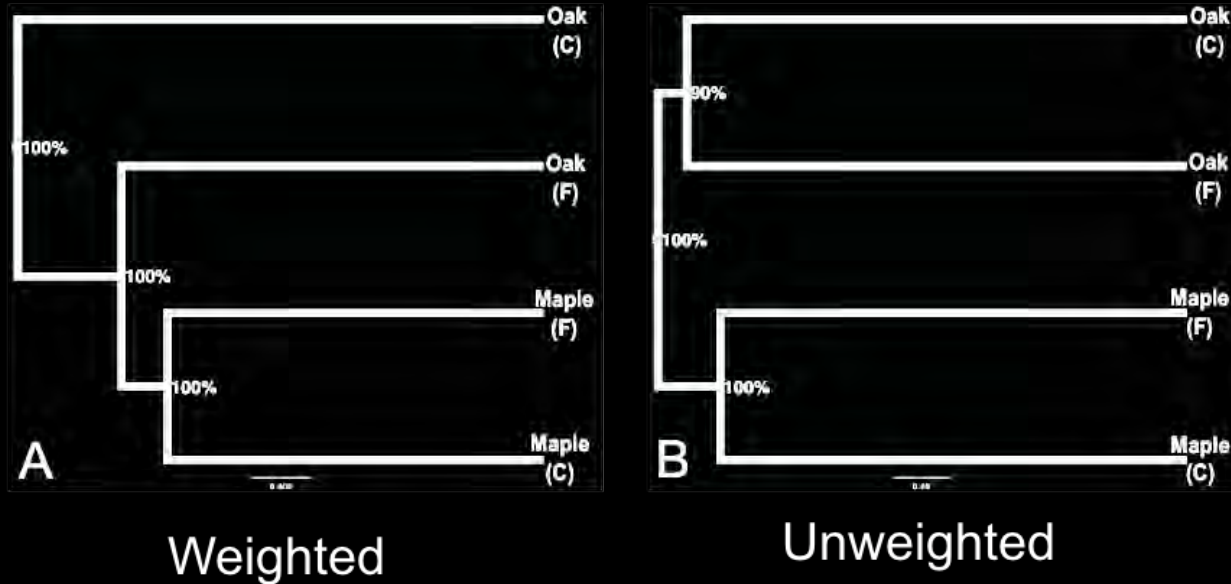


Effect of dominant tree species



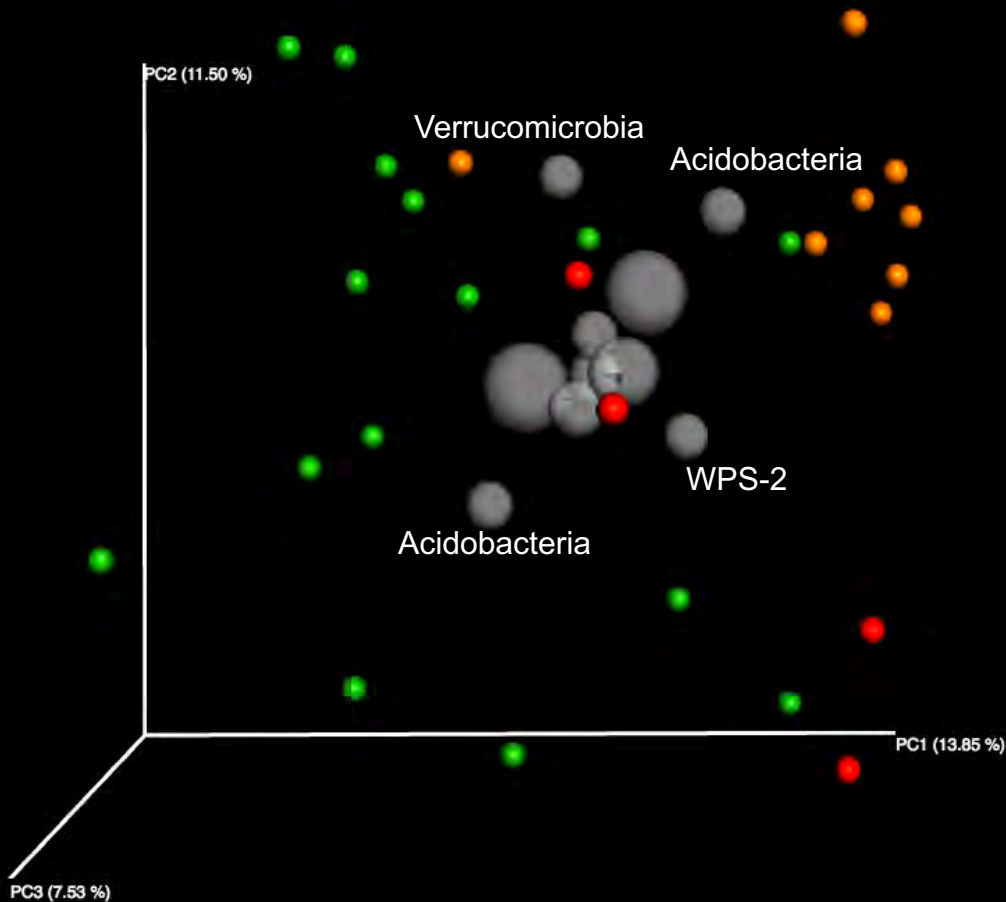
- Effect of tree species differs between sites
- Relationship to land use history?

Effect of fertilizer on Catskills soils



Fertilization makes oak soil communities more maple-like due to changes in relative abundance of microbes

Differences are not driven by the most abundant taxa



10 most abundant genera

Verrucomicrobia genus

3 Acidobacteria genera

Gemmataceae genus

Rhodospirillaceae genus

Sinobacteraceae genus

Actinobacteria genus

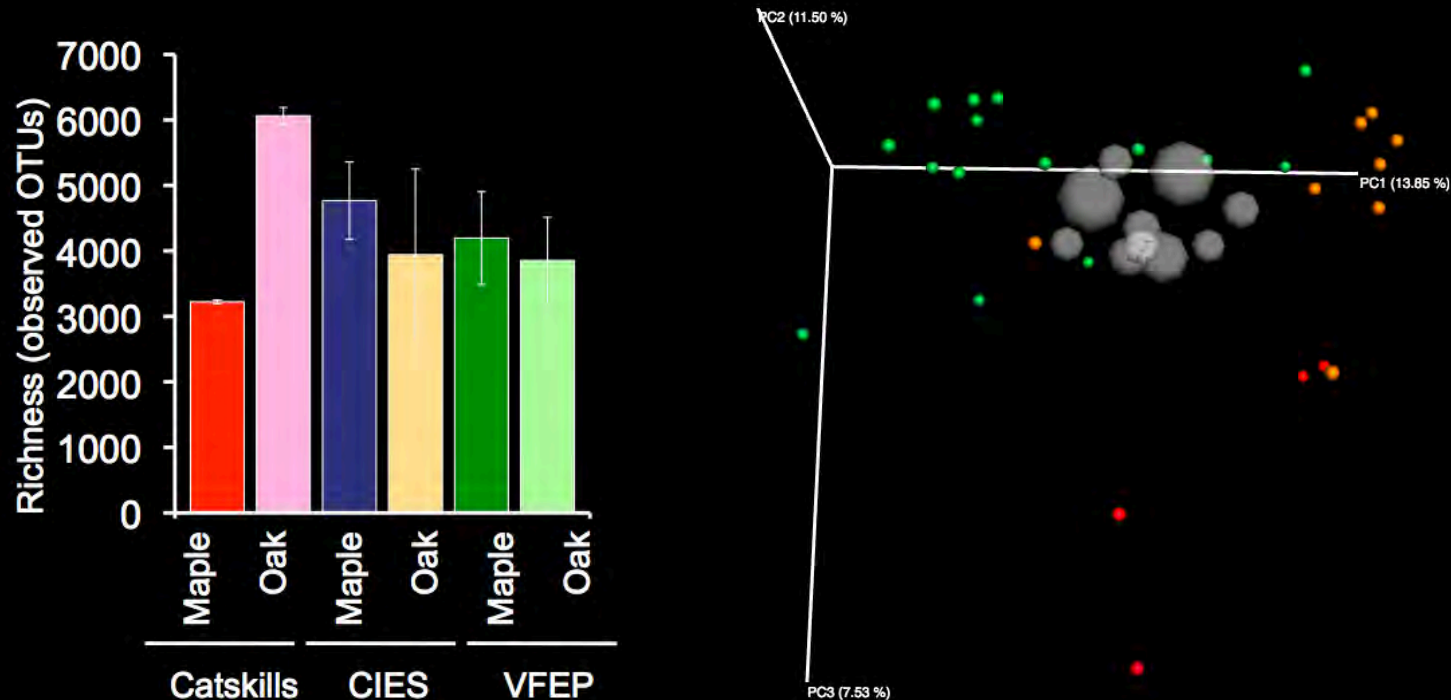
WPS-2 genus

CIES

VFEP

Catskills

A role for rare taxa in community structure



- Difference in Catskill oak soils driven by large number of unique rare taxa

Questions and Conclusions

- Do differences in microbial community explain differences in nitrate export in maple vs oak soils?
- Differences in microbial community by:
 - Site
 - Fertilizer treatment
 - Dominant tree species at certain sites
Catskills > CIES > VFEP
- Interaction between tree species and land use history?
 - VFEP more recently agricultural land: not enough time to see differences?
 - CIES Oak sites less disrupted than maple sites

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Catskill Denitrifiers

