Community-level leaf traits with forest succession and nutrient addition

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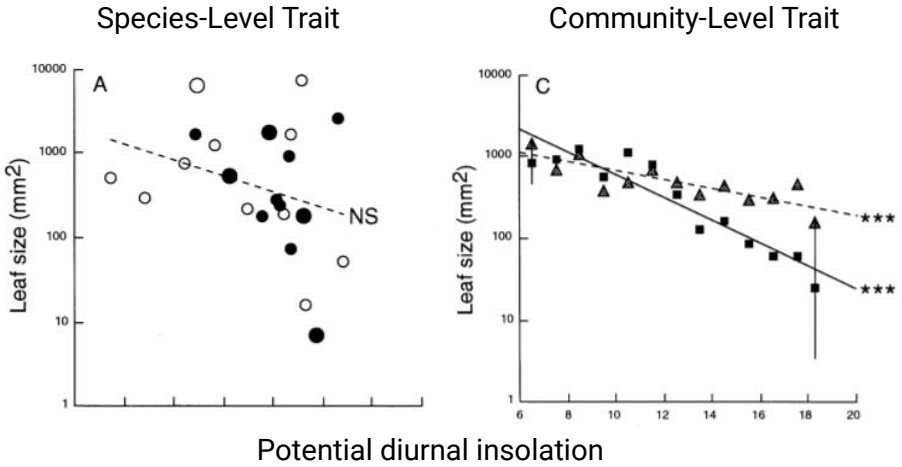
Why measure community-level traits and functional diversity?

- **Functional composition**
  (community-weighted mean trait value):
  - Relate community properties to environment

- **Functional diversity**
  (e.g., functional dispersion):
  - Relate biodiversity to ecological function

- **Community-level functional changes over time in overstory due to changes in:**
  1. Proportion of biomass
  2. Trait plasticity



Figures from Ackerly *et al.* (2002)

Hypotheses

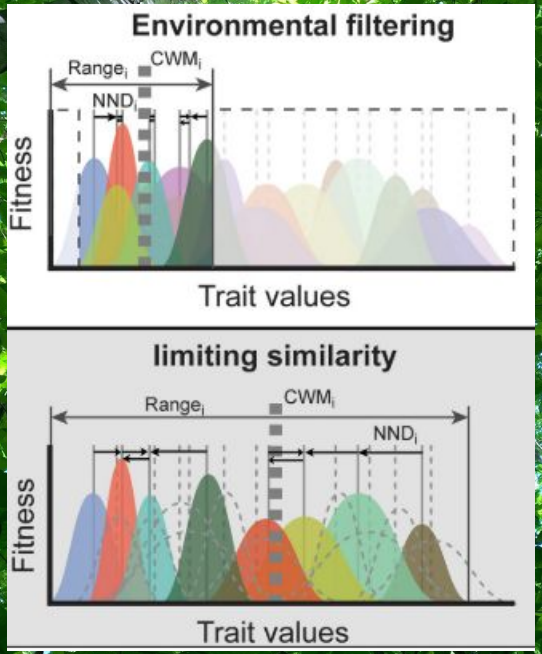
Functional composition:

- Community-weighted trait values relate to environmental conditions

Functional diversity:

- *Decreases* if community assembly driven more by restrictive environmental conditions (“environmental filtering”)

- *Increases* if community assembly driven by more competitive interactions (“limiting similarity”)



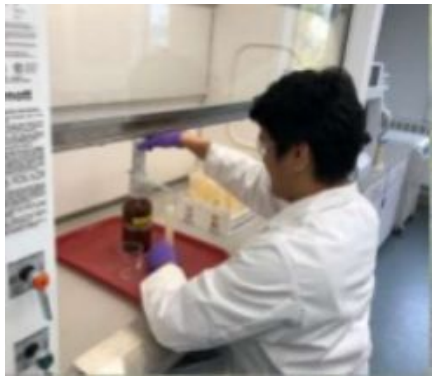
Luo *et al.* 2016

Preliminary Data Analysis

- Trait values:
  - Pre-treatment foliar chemistry (2008-10)
    - See *et al.* (2015)
  - Post-treatment foliar chemistry (2014-16):
    - Hong *et al.* in review
    - Gonzales & Yanai (2019)

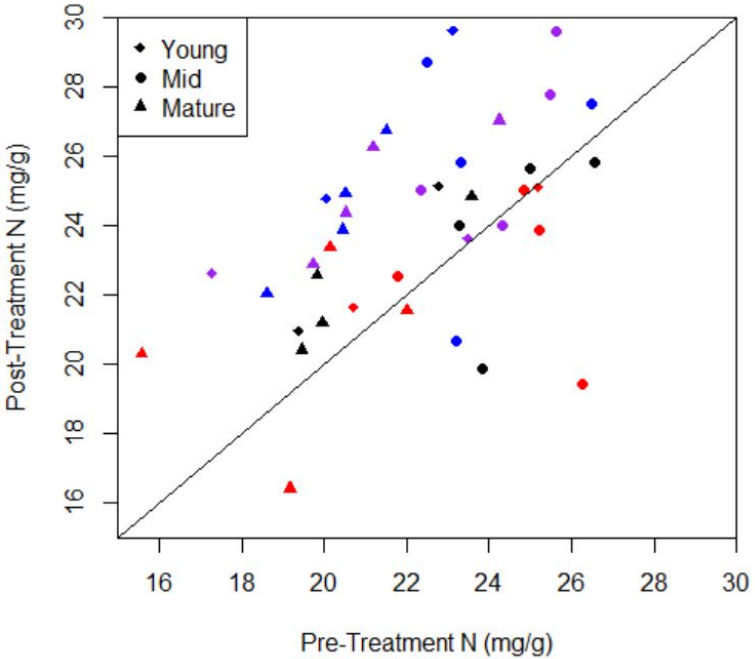
- Proportion of biomass per species:
  - Basal area from 2011 inventory (pre)
  - Basal area from 2015 inventory (post)

- Compared community-weighted means and functional dispersion (i.e., weighted standard deviation) of foliar N and P

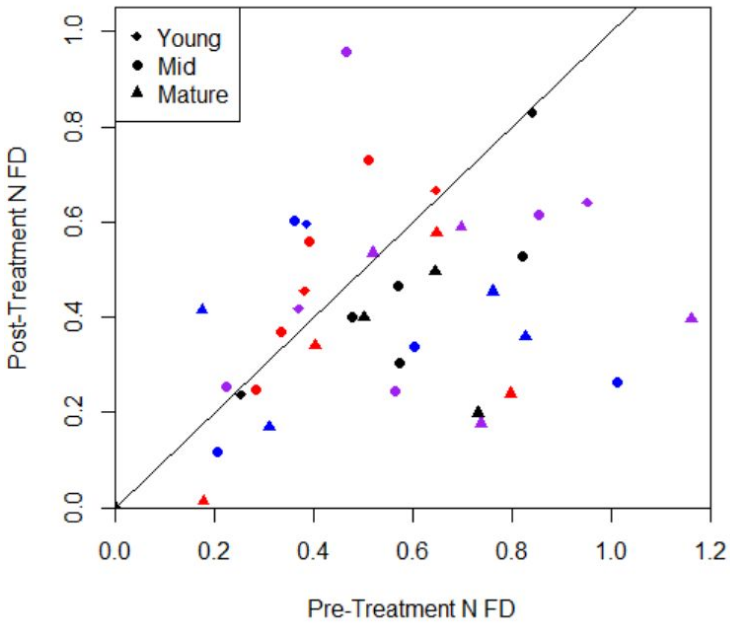


Foliar N : Increased Mean in N and N+P Plots

Community-Weighted Mean



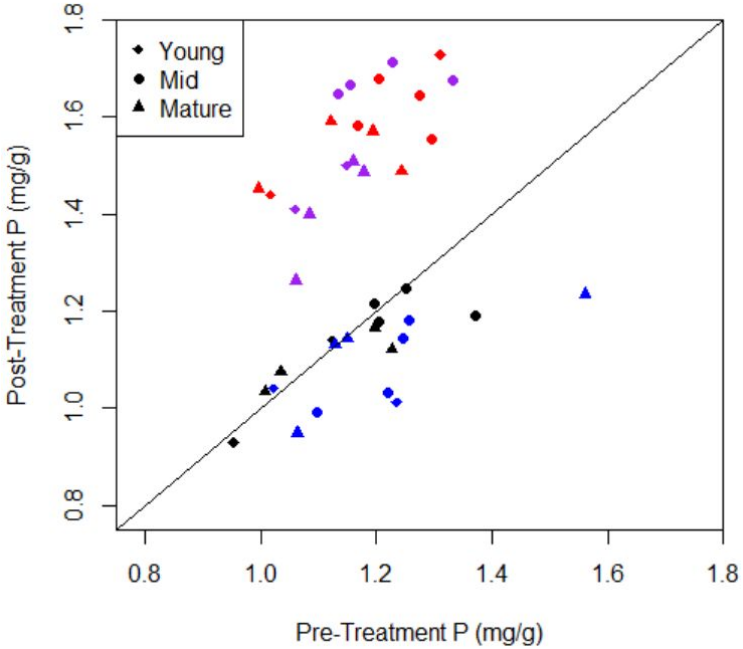
Functional Dispersion



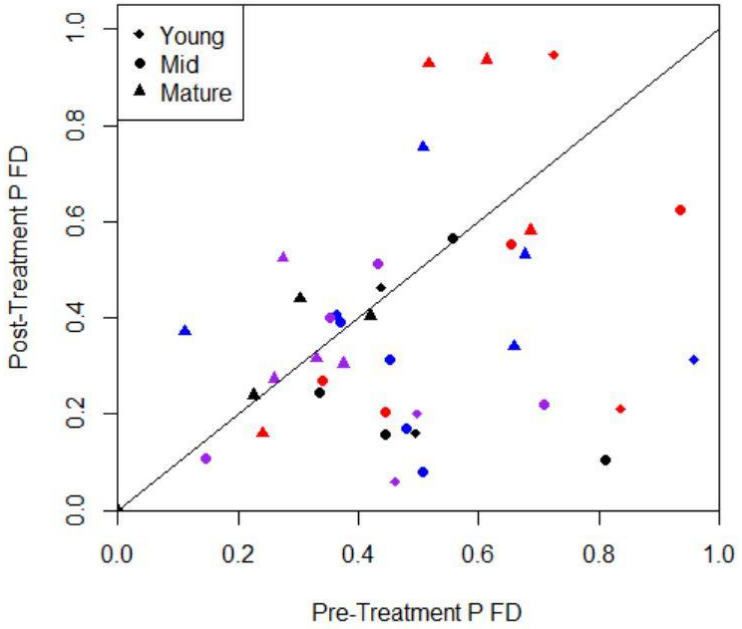
Control N P N+P

Foliar P: Consistent with P Limitation

Community-Weighted Mean



Functional Dispersion



Control N P N+P

Next Steps

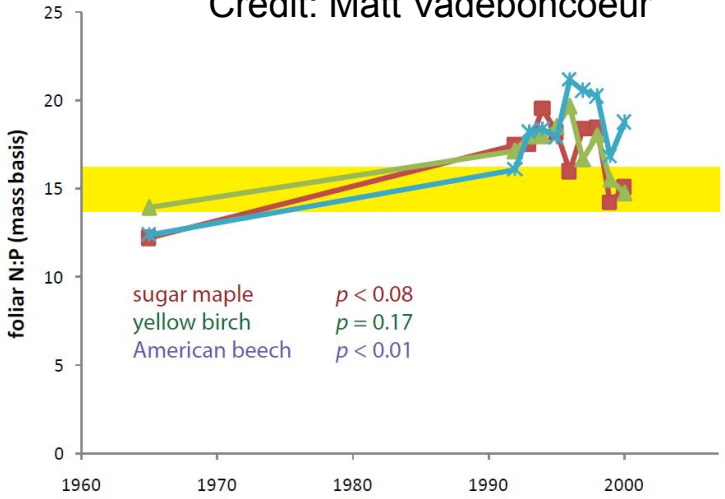
- Re-analyze existing data using proportion of litterfall biomass instead of basal area
- Collect foliage in summer 2021 and 2022
- Add new traits:
  - Specific leaf area
  - Leaf dry matter content
  - Stomatal density
  - Sapwood density
- Determine extent to which community-level characteristics are influenced by trait plasticity vs. changes in proportion of biomass

Leaf litter sorted by high school students

Next Project: Invitation to Collaborate

- In search of data sets to analyze regional changes in N:P over time
- Criteria
  - Plant tissue (leaves, roots, litter) or forest-floor samples with N and P concentration data
  - Long-term data with at least 3 data points spanning at least one decade anytime between 1965 and 2021)
  - Regional (ideally New Hampshire, northern forest region in general welcome)

Foliar N:P in W6 from 1965 - 2003
Credit: Matt Vadeboncoeur



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Thank You!

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LTER NETWORK

NSF

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