DOES CHRONIC N ADDITION INCREASE P LIMITATION IN NORTHEASTERN U.S. FOREST SOILS?

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Objective

Investigate evidence for P limitation of N cycling in ambient and N-enriched forest ecosystems.

Hypothesis

Chronic N addition has shifted the N:P relationship towards P being a limiting resource in the N-enriched ecosystem.
**Long-term N treatment**: 24 years of \((\text{NH}_4)_2\text{SO}_4\) addition (rate 25.2 kg ha\(^{-1}\) yr\(^{-1}\)) in WB (ongoing).

**P treatment**: one-time application of NaH\(_2\)PO\(_4\)·H\(_2\)O (dose: 100 kg ha\(^{-1}\)) on June 1\(^{st}\), 2012, in both watersheds.
Response in Extractable P after P Addition During the 2012 Growing Season

\[ dP = (+P \text{ plots}) - (\text{no P plots}) \]

- Early June
- Late October

Pooled Forest Type

<table>
<thead>
<tr>
<th>Day</th>
<th>EB</th>
<th>WB</th>
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<td>Day 1</td>
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<td>Day 14</td>
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<td>Day 34</td>
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<td>Day 63</td>
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<td>Day 129</td>
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Reference

Treated

EB WB EB WB EB WB EB WB EB WB
P-noP PO4 (mg/kg)
0
50
100
150
200

Day 1       Day 14           Day 34        Day 63       Day 129
Response in Extractable NH$_4^+$-N After P Addition During the 2012 Growing Season

$\text{dN} = (+P \text{ plots}) - (\text{no P plots})$
Phosphatase and N-Acetylglucosaminidase (NAG) Response Ratio in the O horizon by Watershed

Response ratio:
Enzyme activity in a P treated sub-plot divided by the mean enzyme activity of the control sub-plots by date and by watershed.
Conclusions

• P addition increased availability of P in the O horizon in both watersheds.
• Availability of P decreased during the growing season most probably due to biotic immobilization/uptake.
• Evidence of net response of N cycling to P treatment, especially in the treated watershed, but the relation between the role of mineralization, immobilization, and uptake remains to date undefined.
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