

Nutrients Affect Fall Leaf Retention in Northern Hardwood Forests



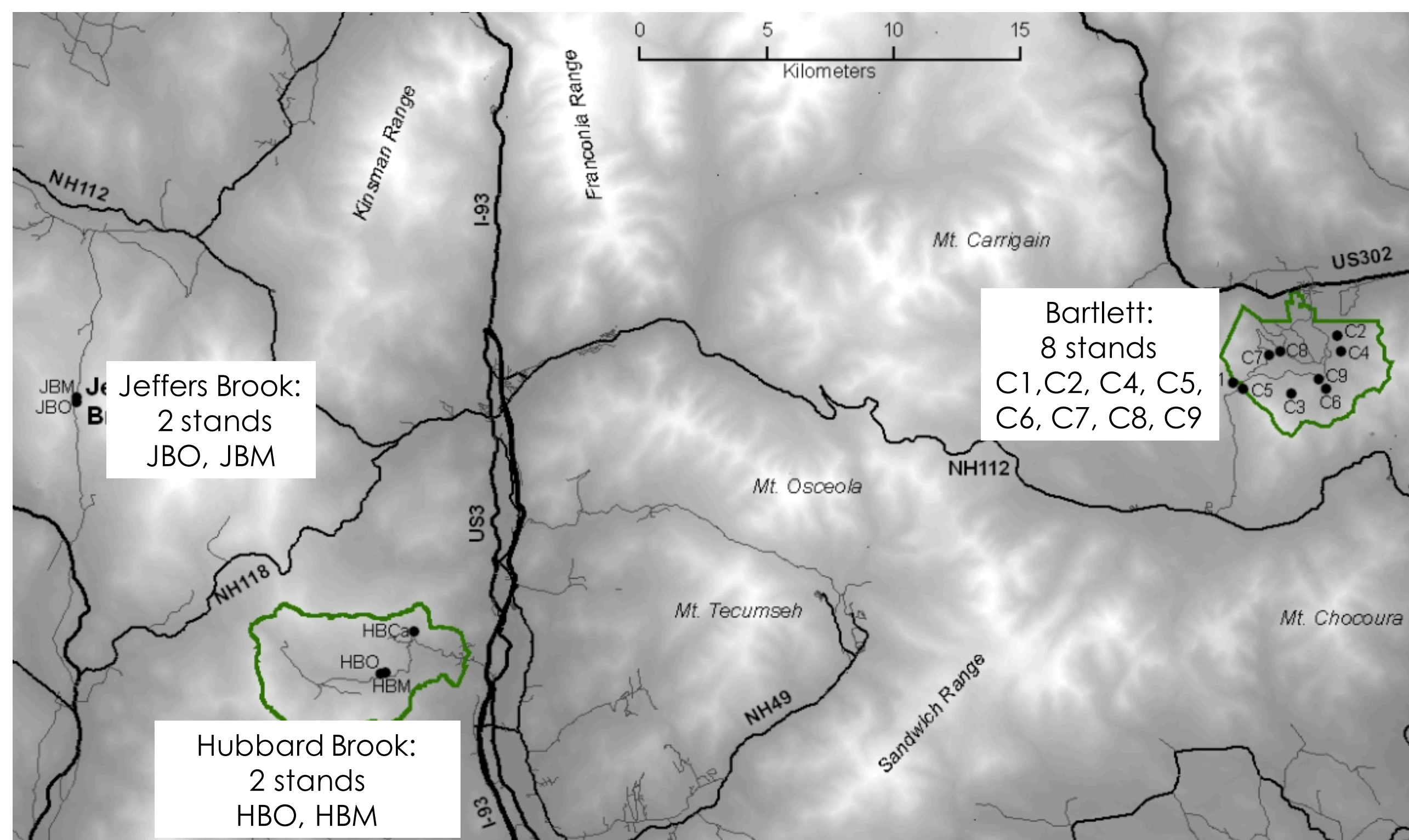
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Introduction

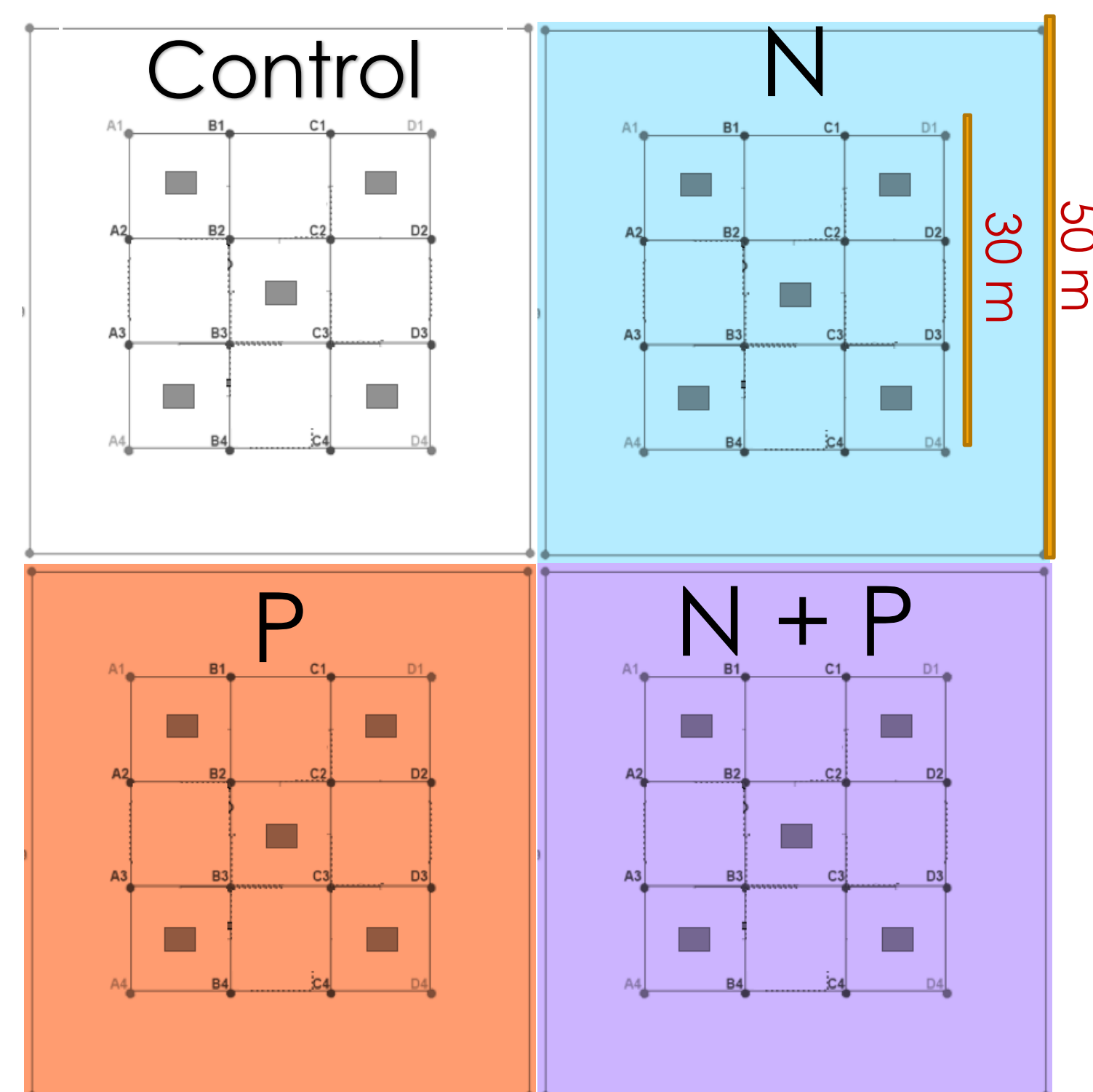
- Acid rain deposition has increased nitrogen availability in northern hardwood forests (1), making phosphorus limitation more likely (2).
- Previous studies have reported both positive and negative effects of N fertilization on leaf lifespan. Where N is not limiting, N addition will delay leaf senescence (3). Our stands are not N limited.

Site Description



12 MELNHE stands at three sites in White Mountains NH, USA.

- Multiple Element Limitation in Northern Hardwood Ecosystems (MELNHE) has stands with plots unfertilized or treated with nitrogen (NH_4NO_3 at 30kg/h/yr), phosphorus (NaH_2PO_4 at 10kg/h/yr), and both N and P in young (~30 yrs), mid-aged (40-60 yrs), and old stands (100+ yrs).



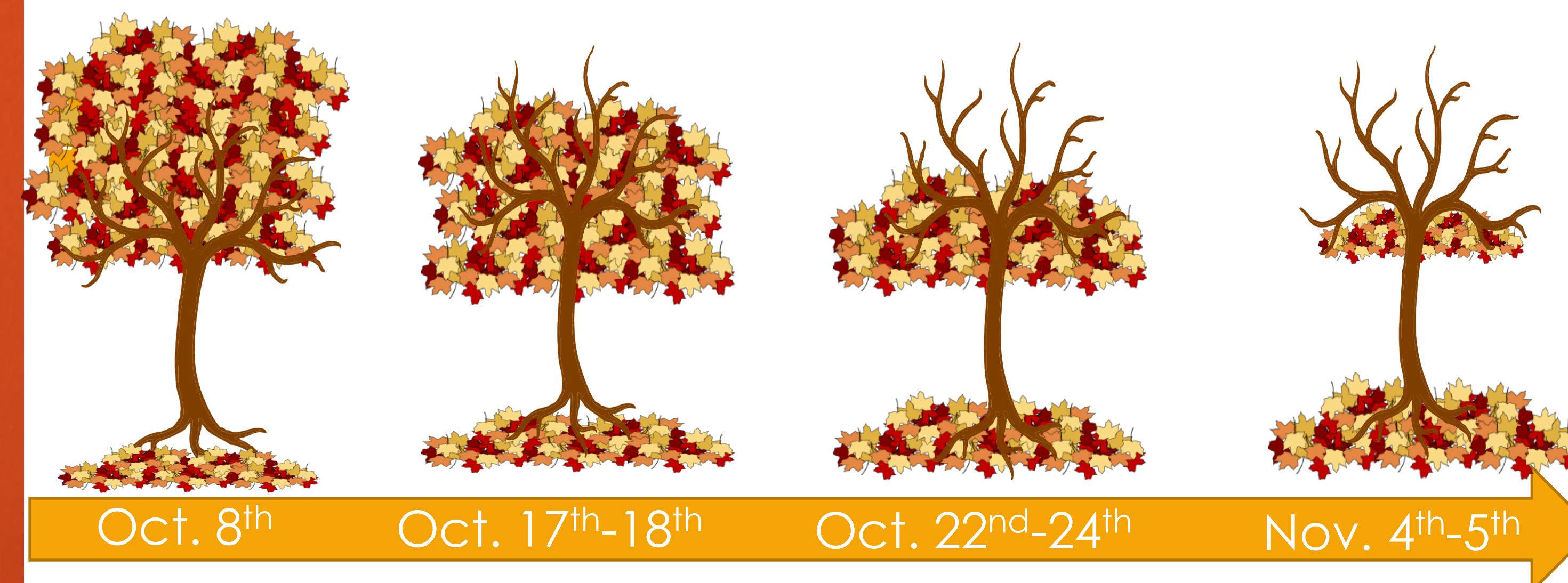
Litter traps in plots shown by solid gray squares

Questions

- How does the addition of N and P increase the time leaves are retained by hardwood trees?
- Does the addition of N and P change fall leaf retention among different forest age classes?

Methods

- Leaf litter was collected three to five times from five systematically placed traps (0.234 m²) in each plot.
- Dry mass was estimated for leaves that had not yet been dried (some were frozen for sorting by species) using moisture content from another stand at the same site.
- The mass of litter falling at each collection date was divided by the total mass of the basket to describe the litterfall as a fraction of the total.
- The fraction of leaves fallen and the fraction of leaves still in the canopy at each collection period were analyzed with a randomized complete block factorial design analysis of variance in SAS.



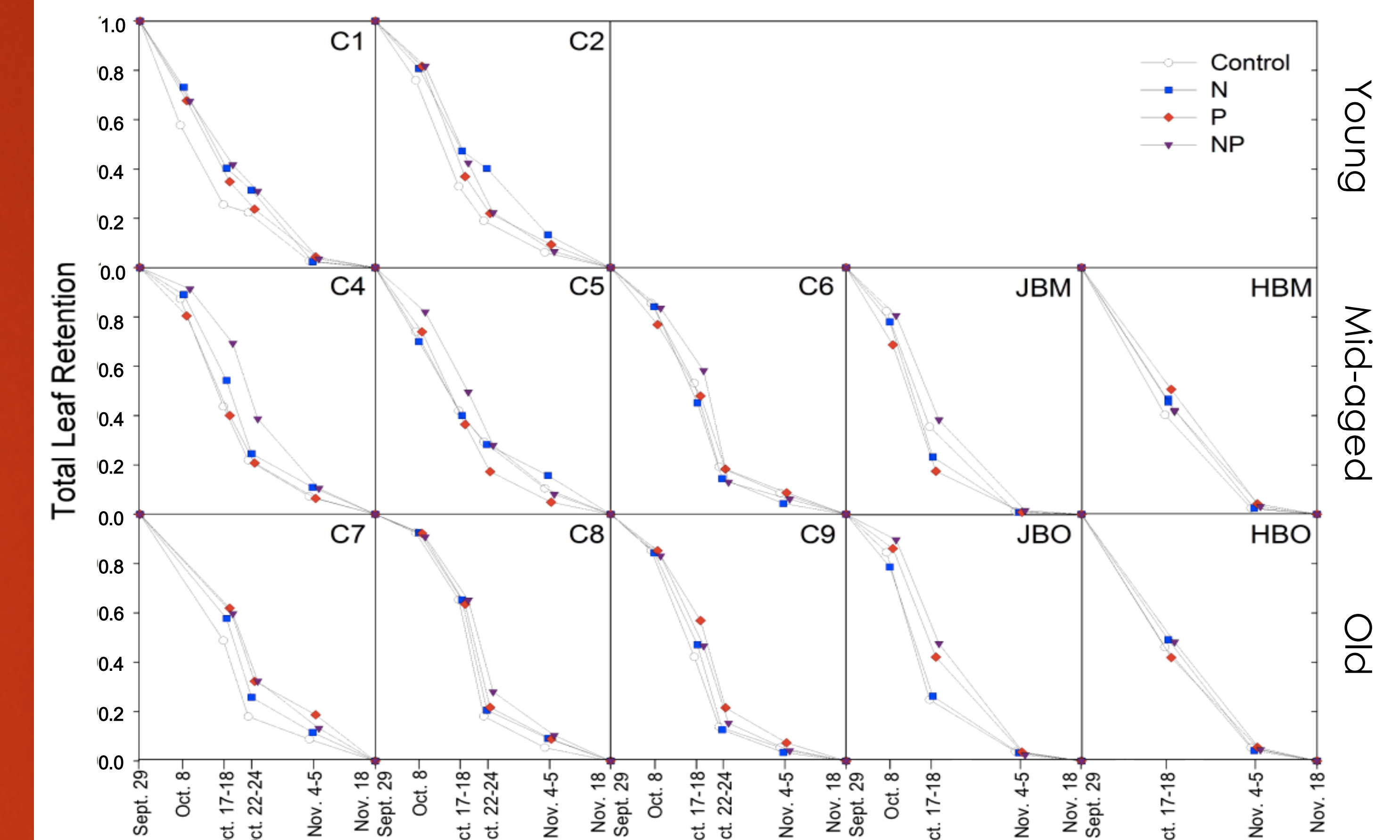
Acknowledgments

- Cindy Sosa, Melany Fisk, Dan Hong, Gretchen Lasser, Adam Wild and Grace Lockwood for collecting leaf litter
- Yanai Lab High School Crew and Shoestring 2017 Summer Crew for drying leaf litter
- Shan Shan and Yang Yang for statistical help

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 2- Gradowski, T., & Thomas, S. C. 2006. Phosphorus limitation of sugar maple growth in central Ontario. *Forest Ecology and Management*, 226(1-3): 104-109.
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Results

N and P treated trees retain more leaf mass later in autumn.



Oct. 8th

- N-treated trees retained 3% more leaf mass than non-N-treated trees ($p=0.04$)
- Old stand trees retained 15% more leaf mass than young stand trees ($p=0.06$)

Oct. 17th-18th

- N-treated trees retained 12% more leaf mass than non-N-treated trees ($p < 0.01$)
- P-treated trees retained 9% more leaf mass than non-P-treated trees ($p=0.7$)

Oct. 22nd-24th

- N-treated trees retained 20% more leaf mass than non-N-treated trees ($p=0.02$)

Nov 4th - 5th

- Leaf retention was not significantly altered by fertilization or stand age

Discussion

- Increased nutrient availability may enable trees to extend their growing season by retaining their leaves longer.
- Added nutrients may allow trees to reduce their dependence on nutrient resorption from leaves(3).
- This evidence demonstrates that increased nitrogen from pollution entering forested areas could lead to a delay in leaf abscission in deciduous forests.
- To further investigate stand age differences, we plan to sort the litter by species to examine the effects of nutrient additions on leaf retention of different successional species.