



# Project Impacts

NSRC-FUNDED RESEARCH FINAL REPORT

## *Calcium Deficiency as a Limitation to Tree Growth and Carbon Storage in the Northern Forest*

PROJECT AWARD YEAR AND TITLE:

**2008**

*Calcium Depletion as a Limitation to Tree Growth and Carbon Sequestration within the Northern Forest*

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Continued inputs of acid deposition are depleting calcium from forest soils. Calcium is an important structural component of tree cell walls, and it controls aspects of the formation and breakdown of carbohydrates within trees. Considering these functions, likely consequences of tree calcium deficiencies include reductions in structural carbon gains (woody growth/biomass) and alterations in spring sugar levels that fuel woody growth and leaf formation and are the foundational basis for the maple syrup industry. Additionally, aluminum in soil is released by acidic inputs, which competitively inhibits calcium uptake and can be toxic to plants.

To test the hypothesis that soil calcium depletion and increased soil aluminum may be reducing tree growth and carbon sequestration (storage) in the Northern Forest, NSRC researchers evaluated the growth and physiology of sugar maple and American beech trees in a long-term calcium- or aluminum-addition study at Hubbard Brook Experimental Forest in New Hampshire. Researchers measured soil enzymes, root nutrients and injury, above-ground woody growth, leaf enzymes and nutrients, and leaf and shoot carbohydrates.

In general, sugar maple trees had a positive response to calcium addition (e.g., increased radial growth) and a negative response to aluminum treatment (e.g., increased root damage). In contrast, beech experienced no benefit from calcium addition and showed a recent positive response (e.g., increased growth) to aluminum addition. Different responses between sugar maple and beech to changes in soil nutrition could favor beech over sugar maple if acidic inputs continue to deplete calcium and increase the availability of aluminum.