Highlights:

Establishment of Calcium Silicate Treatment Plots on the Forests at Hubbard Brook, Bartlett, and Jeffers Brook

by Mark Green, Plymouth State University and U.S. Forest Service, December 6, 2011

Introduction

During the fall of 2011, plots in six stands of the MELNHE project were treated with calcium in the form of wollastonite ($CaSiO_3$). The stands are in the Bartlett Experimental Forest (BEF), Hubbard Brook Experimental Forest (HBEF), and Jeffers Brook area. Adding Ca plots to the experiment was motivated by the established importance of Ca to the ecological functioning of forests in the White Mountains (Federer et al. 1989, Likens et al. 1996, Hamburg et al. 2003), including the recently-described increase in whole-watershed transpiration after the wollastonite experiment at the HBEF (Green et al., in preparation).

Wollastonite Application

The application of wollastonite was coordinated by Mark Green with the close assistance of Joseph Molloy (graduate student at Plymouth State University). The 8200 lbs of wollastonite for all sites was applied by hand, which was only possible by having a large team assist with material transport and field application. The team included: Matt Bartley, Kristin Brandt, June Hammond Rowan, Travis Ingram, On Lee Lau, Christina Maki, Chris Nealen, Rachel Neugarten, Clint Parrish, Matt Vadeboncoeur, and Geoff Wilson.

At BEF, wollastonite was applied in young, mid-aged, and old stands (sites C6, C1, C8). At HBEF, wollastonite was applied in an old stand near the base of W2 and W3. At Jeffers Brook, wollastonite was applied in a mid-aged and old stand. All the treatment plots were 50 m x 50 m (0.25 ha) except for the mid-aged stand at Jeffers Brook, which was 30 m x 30 m.

In each case, wollastonite was applied at a rate of 1000 kg Ca/ha (2900 kg wollastonite/ha), selected to be close to the rate applied to Watershed 1 at HBEF in 1999 (3500 kg/ha, standard deviation 1500 kg/ha). Powdered wollastonite was supplied in 50-lb bags. We carried these bags to the plots in backpacks from the closest road. First, one bag was applied to each 10 m x 10 m subplot with a shovel. The target application rate was achieved by adding the requisite additional fractions of bags to each subplot, focusing on spots that were under-covered with the first set of bags.

The HBEF plot was treated on October 7th. Two of the plots at BEF were treated on October 21, and C8 was treated in three days between October 22 and 27. The Jeffers Brook plots were treated on November 11.

Instrumenting the Ca Plots

Tree sap flux density and soil moisture will be monitored to assess whether Ca fertilization changes forest hydrology. Soil moisture will be measured on all Ca treatment plots and the associated control plots. Sapflow will be monitored only in the old stands (Ca treatment and control), due to limitations in equipment and laor.

Sapflow was measured in summer 2011 on the Ca control and treatment plots using homemade Granier-style sensors (Granier 1987). Sensors were removed in the fall and will be reinstalled each spring for the next four years. Sapflow measurements were coordinated by Jordan Christ, a graduate student at Plymouth State University advised by Michele Pruyn.

Soil moisture sensing began in the fall of 2011. Moisture sensors were installed at the center of each Ca treatment plot at three depths: 10, 30, and 50 cm. The control site moisture sensors are installed at the same depths, except instead of being in the center of the plot, they are in the 10 m buffer.

Ongoing Hydrological Monitoring

Now that the wollastonite has been applied, the focus of the project is on measuring the response to treatment. Our sapflow and soil moisture measurements will continue for at least the next four years, hopefully longer. Sapflow will be measured from March to October each year. Soil moisture will be measured throughout the year to monitor impacts on moisture due to changed ecosystem dynamics because of Ca fertilization.

References

Federer, C. A., J. W. Hornbeck, L. M. Tritton, C. W. Martin, and R. S. Pierce. 1989. Long-term depletion of calcium and other nutrients in Eastern US forests. Environmental Management 13:593-601.

Granier, A. 1987. Evaluation of transpiration in a Douglas-fir stand by means of sap flow measurements. Tree Physiology 3:309 -320. doi: 10.1093/treephys/3.4.309.

Hamburg, S. P., R. D. Yanai, M. A. Arthur, J. D. Blum, and T. G. Siccama. 2003. Biotic Control of Calcium Cycling in Northern Hardwood Forests: Acid Rain and Aging

Forests. Ecosystems 6:399-406. doi: 10.1007/s10021-002-0174-9.
Likens, G. E., C. T. Driscoll, and D. C. Buso. 1996. Long-term effects of acid rain: Response and recovery of a forest ecosystem. Science 272:244-246.

• Return to main page •

Page Updated 02/21/2012 12:37:17 -0500