

Multi-Scale Assessment of the Extent and Effects of Calcium Depletion in Forest Soils of the Upper Delaware River Basin

Peter Murdoch, Rakesh Minocha

Abstract

The U.S. Geological Survey and the U.S. Forest Service have been testing collaborative monitoring strategies in the northern Delaware River Basin through a set of issue-focused parallel studies. In this study, the effect of soil calcium on tree condition and calcium concentrations in nearby streams were assessed using plot-scale, watershed-scale, and regional sampling approaches. Long-term records at research watersheds in the Catskill Mountains indicate a downward trend in stream calcium concentrations during the 1980s and 1990s. An experimental clearcut of a forest in a calcium-poor soil in the Catskill Mountains resulted in a significant stream export of soil calcium in the 2 years following harvest, and export remains elevated above pre-cut concentrations 6 years after harvest. Analysis of tree foliar chemistry indicates that tree health was negatively correlated with elevation and soil base-cation saturation at this experimental watershed. A survey of water quality in the nearest, forested first-order stream to the USFS Forest Inventory and Analysis (FIA) plots in the Delaware basin revealed a band of low-calcium streams that extends from the eastern Catskills south to the Delaware Gap region, then west to the western Pocono Mountains. Calcium concentrations in soils collected at FIA plots in the Delaware Basin indicate a similar regional pattern. The combination of intensive and extensive data collection, and integration of the forest-, soil-, and water-sampling programs of the USGS and USFS is providing a regional picture of the extent of soil calcium depletion and its effects in the upper Delaware River Basin.

Keywords: calcium depletion, acid rain, integrated science