Early Indications of Soil Recovery from Acidic Deposition in U.S. Red Spruce Forests

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Forty to fifty percent decreases in acidic deposition through the 1980s and 90s led to partial recovery of acidified surface waters in the northeastern United States. However, the limited number of studies that have assessed soil change found increased soil acidification during this period. To evaluate possible changes in soils through the 1990s, soils in six red spruce stands in NY, VT, NH, and ME, first sampled in 1992-1993, were resampled in 2003-2004. There were no indications of recovery in the upper 10 cm of the B horizon, but Oa-horizon pH was higher at three sites at $p < 0.01$, higher at one site at $p < 0.1$, and lower ($p < 0.05$) at the NY site. The increase in pH is likely to be tied to decreases in organic carbon concentrations ($p < 0.05$) that occurred at each of the sites where pH increased (Table 1). The cause of the decrease in organic carbon concentrations is uncertain, but may be related to decreased acidic deposition as well as increased temperature and precipitation that occurred at these sites. The strongest indication of recovery was a decrease in exchangeable Al concentrations in Oa horizons ($p < 0.05$) of 20% to 40% at all sites except NY. However, Ca concentrations did not change except for an increase ($p < 0.05$) at Kossuth ME. The Al decrease can be attributed to decreased deposition of SO42-, which decreased the mobility of Al throughout the upper soil profile. Decreased mobilization of Al within the B horizon lowered hydrologic inputs of Al into the Oa horizon, and as the Oa decomposed and was replaced by organic matter from the Oe, exchangeable Al concentrations in the Oa horizon were further lowered. These data are the first indications in North America of soil recovery from the declining trend in acidic deposition. However, an increase in availability of Ca in the mineral soil from decreased leaching was not apparent. Results indicate a nascent recovery in the Oa horizon driven largely by vegetative processes.

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