Organic soils continue to acidify despite reduction in acidic deposition

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Following the Clean Air Act Amendments of 1970 and 1990 acidic deposition in North America has declined significantly since its peak in 1973. Consequently, research has shifted from studying the effects of acidic deposition to the recovery of these aquatic and terrestrial ecosystems. Regional-scale studies have focused primarily on aquatic systems and while many of these ecosystems are showing signs of chemical recovery (increases in acid neutralizing capacity and pH, decreases in sulfate and aluminum concentrations), recovery is slower than expected based on the magnitude of the decline in acid deposition.

Researchers have long suspected that acidification of soils in these watersheds has slowed the recovery of aquatic ecosystems. Unfortunately, very few studies have examined change in soil chemistry. As a result our understanding of how soils have responded to decreases in acidic deposition at the regional scale is limited.

Researchers at Syracuse University sampled soils in 139 watersheds in the northeastern United States in 2001 that had previously been studied as part of the Direct/Delayed Response Project in 1984. The study showed that over the 17-yr interval, median base saturation in the Oa-horizon decreased from 56% in 1984 to 33% in 2001, while effective cation-exchange capacity, normalized to the soil carbon concentration, showed no significant change. The change in base saturation was the result of almost equivalent changes in carbon-normalized exchangeable calcium (CaN) and exchangeable aluminum (AlN). The median CaN declined by more than 50%, from 23.5 to 10.6 cmolc/kgC, while median

AlN more than doubled, from 8.8 to 21.3 cmolc/kgC. This research, to be published in the January-February issue of the *Soil Science Society of America Journal*, was made possible by the financial support of the William M. Keck Foundation.

A somewhat surprising result was that the Central New England/Maine subregion, the subregion that historically has received the lowest inputs of acid deposition of any of the subregions, showed the greatest declines in exchangeable base cations and base saturation. This area also exhibited the greatest increases in carbon-normalized exchangeable acidity (acidityN) and AlN and was the only subregion to experience a statistically significant decrease in pH. Lead author Richard Warby explained, "It is possible that the acidification of soils in this subregion was delayed relative to the other subregions because of the strong regional gradient in acidic inputs from west to east."

The researchers believe that the observed trend in soil acidification is likely to continue until acidic inputs decline to the point where soil base cation pools are sufficient to neutralize them. Warby concluded, "Until then we are likely to see the continued sluggish chemical recovery of surface waters and a continuing threat to the health of forests, with additional declines in base status likely to increase the number of sites exhibiting lower forest productivity and or vulnerability to winter injury."

View the study abstract at
soil.scijournals.org/cgi/content/abstract/73/1/274 .

Source: Soil Science Society of America

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