Prepared in cooperation with the

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Whole-Ecosystem Restoration through Liming of Honnedaga Lake Tributary Watersheds

The primary goal: to determine the effectiveness of applying lime to calcium depleted watersheds to accelerate recovery from acid rain.

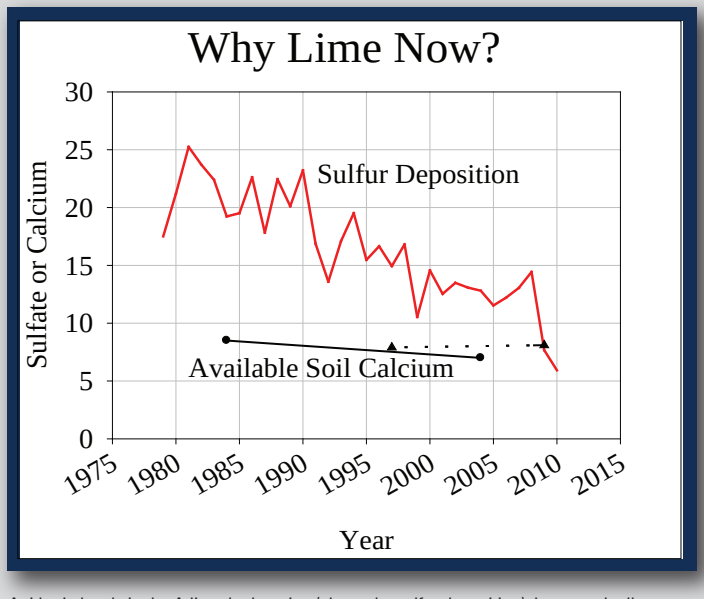
Summary

Acid rain levels in the Adirondack region have substantially declined and recovery from acid rain is underway. However recovery is being limited by the depletion of soil calcium that occurred over past decades. Not only is calcium needed for neutralizing acidity, it an essential nutrient for terrestrial and aquatic ecosystems. However, recovery of soil calcium has not yet been observed.

Whole-ecosystem restoration through watershed liming, possibly combined with in-stream liming, may provide a practical option for stimulating recovery of certain acid-sensitive, high-value natural resources. Information from past liming efforts, however, is insufficient for determining the degree of success that could be achieved with liming under contemporary levels of acid rain and soil-calcium depletion. To evaluate this treatment approach, lime is being applied aerially to an entire watershed and also directly to the channels of two streams outside the limed watershed.

The study is being conducted in the Honnedaga Lake watershed in the southwestern Adirondack region, where acid rain effects on soils and surface waters are among the most severe in the eastern U.S. The effects are being monitored through measurements of soil and soil-water chemistry, tree growth and regeneration, soil fauna, stream chemistry, aquatic invertebrates and brook trout.

In an accompanying study, the effects of the lime application on mercury bioaccumulation is also studied. [The Effects of Watershed and Stream Liming on Mercury Dynamics at Honnedaga Lake] The Adirondack region is considered a "hot spot" where high levels of mercury bioaccumulation have been measured in fish and birds. Mercury released into the environment through the



Acid rain levels in the Adirondack region (shown by sulfur deposition), have markedly decreased, but the availability of calcium in the soil has not yet increased in response. Addition of lime to the watershed has the potential to accelerate recovery by increasing availability of calcium. Under the current low levels of acid rain, the benefits of watershed liming are expected to persist as calcium is incorporated into the terrestrial ecosystem.

Honnedaga Lake Watershed

Shallow soils, high preprecipitation and low levels of natural calcium have made the Honnedaga lake watershed vulnerable to calcium depletion from acid rain.

burning of coal is transported in association with dissolved organic carbon, which is expected to increase from the liming. However, liming will also ameliorate acidic conditions that favor the mobilization and transport of mercury. Therefore, effects of liming on the mobilization of mercury are uncertain.

Related Publications

(Lawrence et al. 2008, Long et al. 2009, Lawrence et al. 2011, Beier et al. 2012, Lawrence et al. 2012)

References

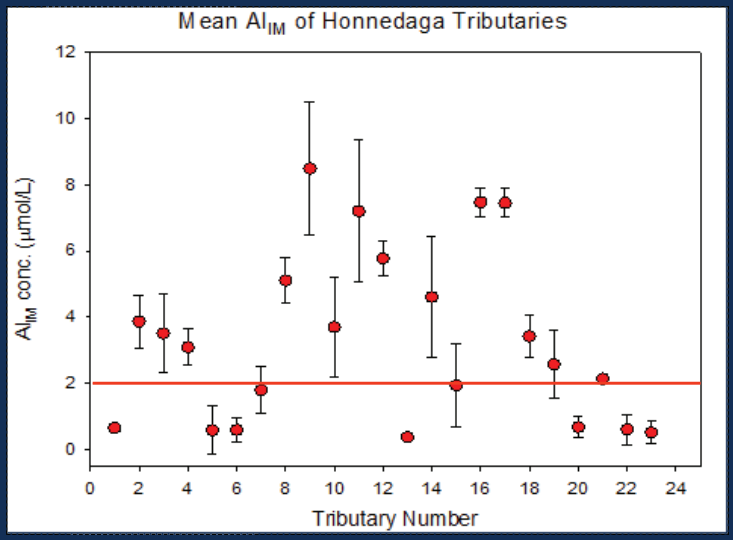
Beier, C. M., A. M. Woods, K. P. Hotopp, J. P. Gibbs, M. J. Mitchel, M. Dovciak, D. J. Leopold, G. B. Lawrence, and B. P. Page. 2012. Changes in faunal and vegetation communities along a soil calcium gradient in northern hardwood forests. Canadian Journal of Forest Research 42:1141-1152.

Lawrence, G. B., K. M. Roy, B. P. Baldigo, H. A. Simonin, S. B. Capone, J. S. Sutherland, S. A. Nierswicki-Bauer, and C. W. Boylen. 2008. Chronic and episodic acidification of Adirondack Streams from Acid Rain in 2003-2005. Journal of Environmental Quality 37:2264-2274.

Lawrence, G. B., W. C. Shortle, M. B. David, K. T. Smith, R. A. F. Warby, and A. G. Lapenis. 2012. Early indications of soil recovery from acidic deposition in U.S. red spruce forests. Soil Science Society of America Journal 76:1407-1417.

Lawrence, G. B., H. A. Simonin, B. P. Baldigo, K. M. Roy, and S. B. Capone. 2011. Changes in the chemistry of acidifed Adirondack streams from the early 1980s to 2008. Environmental Pollution 159:2750-2758.

Long, R. P., S. B. Horsley, R. A. Hallet, and S. W. Bailey. 2009. Sugar maple growth in relation to nutrition and stress in the Northeastern United States. Ecological Applications 19:1454-1466.



Soil calcium levels are insufficient to prevent the mobilization of toxic forms of soil aluminum (Al_{im}) under current levels of acid rain. Concentrations of toxic Al in most Honnedaga Lake tributaries exceed the threshold of 2.0, which causes

In October 2013, 150 tons of pelletized limestone was applied by helicopter to a 30 ha subwatershed of Honnedaga lake.

Maidenhair Fern

Moccasin Flower

Plaintain-leaved Sedge

Sugar Maple

Basswood

Canada Mayflower

Adirondack trees and plants with a high calcium demand are either reproducing poorly or absent in the Honnedaga watershed.

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