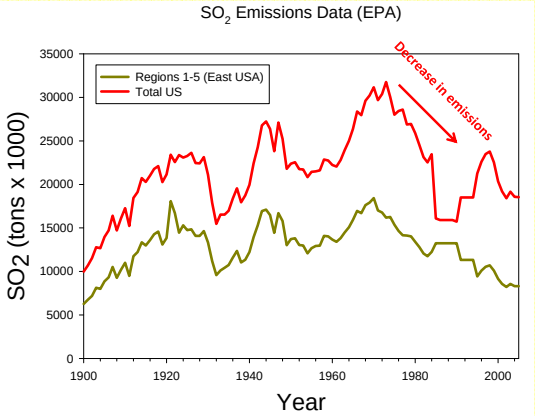
Watershed Sulfur Biogeochemistry in the Adirondacks: Shift from Atmospheric Deposition Dominance to Climatic Regulation

by

Myron J. Mitchell, Patrick J. McHale, Geoffrey Millard and Charlotte Demers

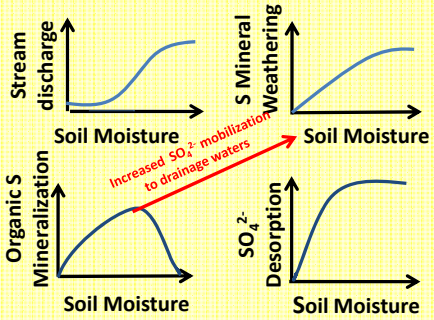
SUNY, College of Environmental Science and Forestry, Syracuse, New York 13210

Watershed S budgets in the northeast US were once dominated by atmospheric emissions and deposition that decreased from the mid-1970s. This temporal change in emissions has resulted the concomitant decrease in sulfate concentrations in surface waters.
What has happened to S stored in soil during the period of high input?

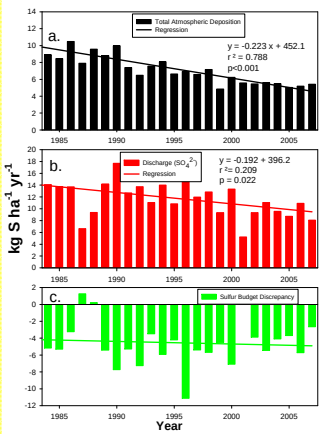


In the northeast U.S. as S deposition has decreased, the climate has changed including increasing **precipitation and discharge**.

This increased wetness accelerates the release of S stored in the soil:



Sulfur budget of Arbutus Watershed in the Adirondacks. What causes annual variation beyond changes in deposition?

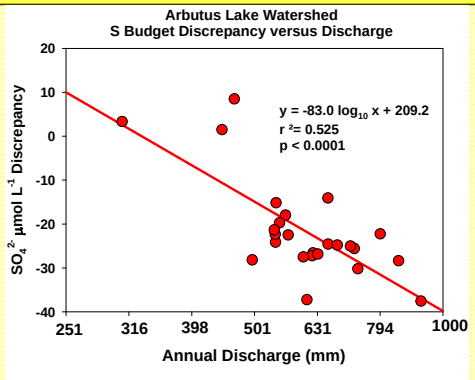


Major Findings

- **Internal soil sulfur sources are becoming increasingly important as sulfur atmospheric deposition decreases.**
- **Soil sulfate mobilization from previously stored sulfur delays recovery from acidification.**
- **Delay is amplified by increased precipitation associated with climate change.**

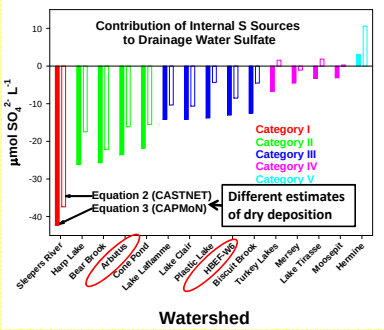
Increased moisture has resulted in increased release of S from the Arbutus Watershed in the Adirondack Mountains of NY even when the discharge x concentration relationship is normalized.

Increasing contribution of internal S sources

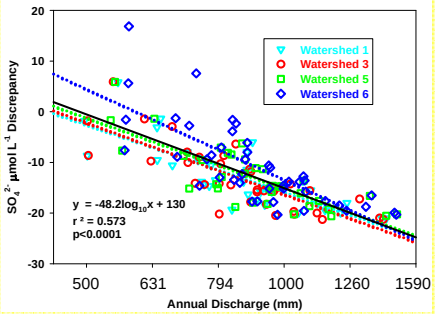


The same relationship between discharge and the release of S from soils was found at Hubbard Brook in New Hampshire (Mitchell and Likens, 2011).

A comparative study of watersheds in southeastern Canada and the northeastern US revealed that those watersheds which had been subject to high levels atmospheric S inputs have internal S sources that are contributing to sulfate concentrations in surface waters (Mitchell et al., 2011). Sulfur budget discrepancy estimates are normalized to discharge.



Increasing contribution of internal S sources



References

Mitchell, M.J. and G.E. Likens. 2011. Watershed Sulfur Biogeochemistry: Shift from Atmospheric Deposition Dominance to Climatic Regulation. Environmental Science and Technology 45:5267-5271

Mitchell, M.J., G. Lovett, S. Bailey, F. Beall, D. Burns, D. Buso. T. A. Clair, F. Courchesne, L. Duchesne, C. Eimers, D.Jeffries, S. Kahl,, G. Likens, M.D. Moran, C. Rogers, D. Schwede, J. Shanley, K. Weathers and R. Vet. 2011. Comparisons of Watershed Sulfur Budgets in Southeast Canada and Northeast US: New Approaches and Implications. Biogeochemistry103:181-207

Acknowledgements

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