The Relative Importance of Watershed Hydrology and Forest Harvest as Controls on the Mobilization of Aluminum in the White Mountain National Forest, NH

Christopher Nealen Plymouth State University May 2012

Thesis Abstract:

Over the past half-century, acid deposition has been linked to a decline in stream water quality in the northeastern United States. Along with acid deposition, harvesting timber has been shown to cause aluminum (Al_m), especially inorganic monomeric aluminum, to be released from the soils. This form of aluminum is toxic and has the potential to harm aquatic life and tree health. Our understanding of how watershed hydrology and timber harvests independently and synergistically affect the mobilization of aluminum is poorly understood. This comparative watershed study analyzes monomeric inorganic aluminum in the streams of four recently harvested and four reference (minimally harvested) watersheds in the White Mountain National Forest (WMNF) in northern New Hampshire, USA.

Study Method:

Four recently harvested and four reference watersheds were paired in the WMNF (1) to assess changes in Al_m due to forest harvesting. Eight water samples were collected at varying stream discharge rates from May to October 2011(2). Samples were analyzed for Al_m, major cations and anions,

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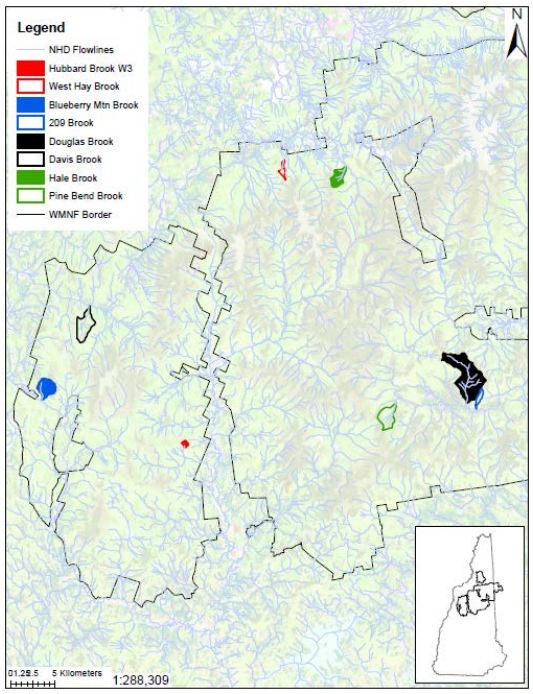

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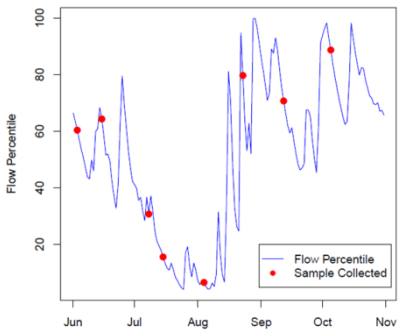

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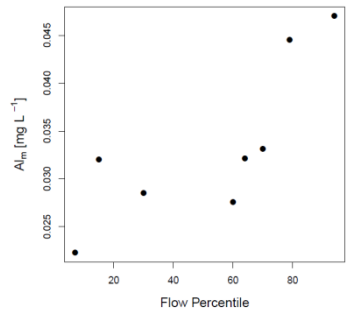

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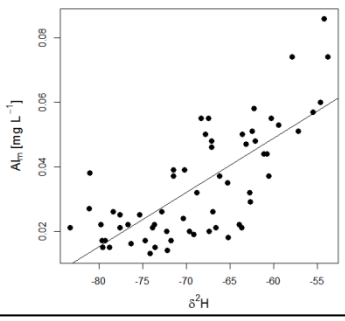

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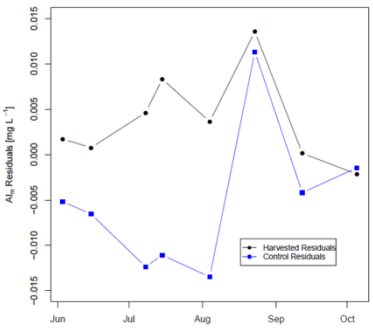

Results:

Al_m concentrations are higher during higher stream discharge rates (3), and variability can be explained by the stable water isotope deuterium (4).

Conclusions:

This study shows the major control on Al_m in streamwater to be the paths by which water flows through a watershed. By modeling streamwater [Al_m] with deuterium, the role of this major control can be removed and other aspects of mobilization can be studied (5). When this primary control on Al_m is removed, there exists a significant difference in the harvested and reference watersheds. This suggests that although the hydrology of the two types of watersheds is the primary control, forest harvest is a secondary contributor to Al_m mobilization. This has implications for how future harvests are managed to preserve water quality.