Sources of stream sulfate at the Hubbard Brook Experimental Forest : long-term analyses using stable isotopes

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Sulfur deposition in the northeastern U.S. has been decreasing since the 1970s and there has been a concomitant decrease in the SO42- lost from drainage waters from forest catchments of this region. It has been established previously that the SO42- lost from drainage waters exceeds SO42- inputs in bulk precipitation, but the cause for this imbalance has not been resolved. The use of stable S isotopes and thr: availability of archived bulk precipitation and stream water samples at the Hubbard Brook Experimental Forest (HBEF) in New Hampshire provided a unique opportunity to evaluate potential sources and sinks of S by analyzing the long-term patterns (1966-1994) of the delta(34)S values of SO42-. In bulk precipitation adjacent to the Ecosystem Laboratory and near Watershed 6 the delta(34)S values were greater (mean: 4.5 and 4.21, respectively) and showed more variation (variance: 0.49 and 0.30) than stream samples from Watersheds 5 (W5) and 6 (W6) (mean: 3.2 and 3.7; variance: 0.09 and 0.08, respectively). These results are consistent with other studies in forest catchments that have combined results: for mass balances with stable S isotopes. These results indicate that for those sites, including the HBEF, where atmospheric inputs are less than or equal to 10 kg S ha(-1) yr(-1), most of the deposited SO42- cycles through the biomass before it is released to stream water. Results from W5, which had a whole-tree harvest in 1983-1984 showed that adsorption/desorption processes play an important role in regulating net SO42- retention for this watershed-ecosystem. Although the isotopic results suggest the importance of S mineralization, conclusive evidence that there is net mineralization has not yet been shown. However, S mass balances and the isotopic result are consistent with the mineralization of organic S being a major contributor to the SO42- in stream waters at the HBEF.

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