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Long-term experimental acidification drives watershed scale shift in dissolved organic matter

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Over the last several decades dissolved organic carbon concentrations (DOC) in surface waters have increased throughout much of the northern hemisphere. Several hypotheses have been proposed regarding the drivers of this phenomenon including decreased sulfur (S) deposition working via an acidity- change mechanism. Using fluorescence spectroscopy and data from two long-term (24+ years at completion of this study) whole watershed acidification experiments i.e. the Bear Brook Watershed in Maine (BBWM) and Fernow Experimental Forest in West Virginia (FEF), we were able to isolate and test for the acidity-change mechanism as a driver of increased DOC. The multi-decadal record of stream chemistry at BBWM demonstrates a significantly lower DOC concentration in the treated compared to the reference watershed. Additionally, at both BBWM and FEF we found significant and sustained differences in stream fluorescence index (FI) between the treated and reference watersheds, with the reference watersheds demonstrating a stronger terrestrial DOM signature. These data, coupled with evidence of pH shifts in upper soil horizons support the hypotheses that declines in S deposition are driving changes in the solubility of soil organic matter and increased flux 31 of terrestrial DOC to water bodies.