Radial Growth and Tree-Ring Chemistry of Three Deciduous Tree Species growing Along a Multiple-Stress Gradient

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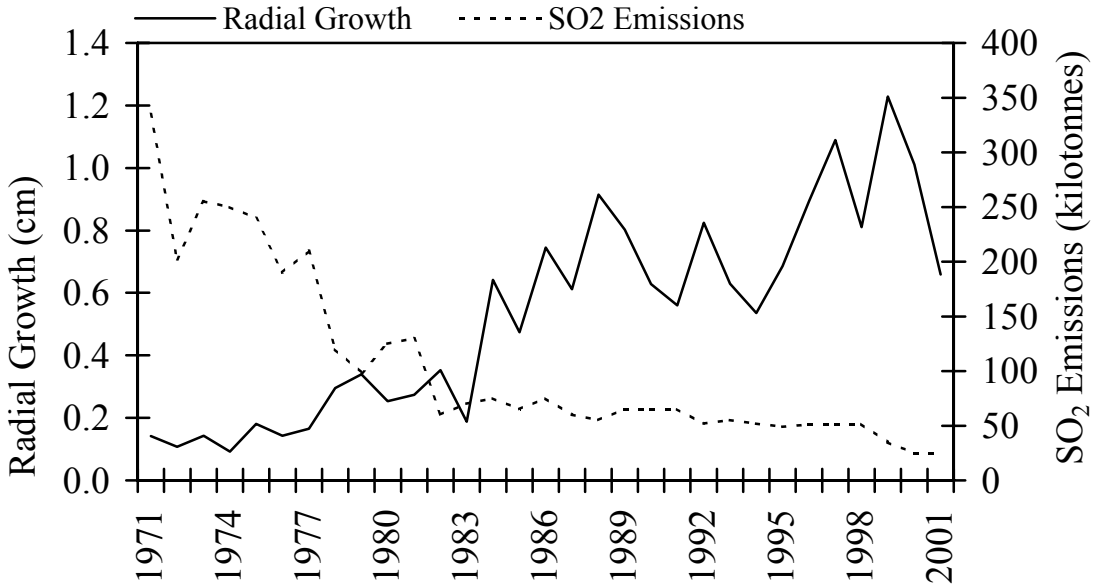
Abstract

Dendrochemical analysis (tree-ring chemistry) can be used to monitor changes in the chemical composition of both the atmosphere and soil, and when combined with tree-ring growth analysis, an association between radial growth and coincidental changes in soil or atmospheric chemistry may be achieved. Although previous studies have demonstrated causal relationships between stress and radial growth/tree-ring chemistry, little is known about the interactive effects of soil, climate, and atmospheric deposition on the radial growth and chemical composition of annual tree-rings. Thus, the purpose of this study is to investigate the effect of smelter emissions and, pollution-induced, microclimatic stress on radial growth and tree-ring chemistry of three deciduous tree species, growing along a multiple-stress gradient. Monitoring stations documenting, site-specific, wind-speed and direction, soil moisture, soil temperature, and ground level SO_2, in addition to dendrometer bands, which measure daily radial growth, will be utilized to assess intra-annular growth responses to multiple-stresses. X-ray fluorescence will be used to analyze tree-ring chemistry. Preliminary results depict a strong negative correlation between radial growth and SO_2 emissions. Correlation between intra-annular growth measurements, microclimatic variables, SO_2 emissions, and tree-ring chemistry enables the effect of multiple-stresses on radial growth and tree-ring chemistry to be more discretely evaluated than previous attempts.



Correlation between annual radial growth of red maple (n=3) and SO_2 emissions ($r = -0.766$, $p = 0.01$).