Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37665

Forest composition and tree species control atmospheric Hg foliage uptake in temperate and boreal ecosystems

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Mercury (Hg) is a toxic metal that presents a major risk to ecosystems, biota, human health, and remains a priority concern. Anthropogenic activities have accentuated the mobilization of Hg and altered the exchange between the atmosphere, lithosphere, biosphere, and hydrosphere. Mercury biogeochemical cycle remains complex and influenced by numerous factors and the nature of the ecosystem. In recent years, forest ecosystems have been shown to be a crucial component of global Hg cycling. Notably, tree leaves play a key role in capturing elemental Hg (Hg^0) from the atmosphere through stomatal absorption. Once incorporated in leave tissues, it can be transferred to the soil via leaf litter, contributing to the building of large soil Hg reservoirs. This study, 1) aimed to quantify leaf Hg concentrations in thirteen species of broadleaves and conifers across 38 sites distributed over a large territory across temperate and boreal biomes in Eastern Canada (Québec) 2) to identify the environmental factors governing Hg accumulation in foliage. Principal Component Analysis (PCA) and Mixed Linear Models (MLM) were used to evaluate the influence of tree species, leaves nutrient content, climate, soil chemistry and ambient Hg concentration in the atmosphere. Our study confirms that foliar Hg accumulation is strongly governed by tree species, without any strong evidence between broadleaves and conifers. Leaves nutrient content (particularly nitrogen) and to a lesser extent climate (vapor pressure deficit) and Hg concentration in air are also important factors to consider. This study contributes to our knowledge of Hg bioaccumulation in forest environments and highlights the importance of considering plant species diversity and environmental heterogeneity for a more accurate assessment of atmospheric Hg fluxes to forests.