Northeastern Section (39th Annual) and Southeastern Section (53rd Annual) Joint Meeting (March 25–27, 2004)

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SILICON ACCUMULATION IN TREE LEAVES FROM THE UPPER PIEDMONT OF SOUTH CAROLINA

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The role of aboveground biomass in the biogeochemical cycle of silicon is poorly understood. Silicon enters plants from soil solution as silicic acid and is deposited in intercellular spaces in leaves as hydrated amorphous silica phytoliths. Previous studies have shown that silicon can be present in tree leaves in amounts comparable to essential macronutrients. However, the variation in silicon concentrations among tree species growing in the same region has not been addressed.

Our study was conducted in two oak-pine-hickory forests growing on ultisols developed on high-grade felsic metamorphic rocks in the piedmont of South Carolina. Leaves of 12 tree and shrub species were collected in 2002 (a year of extreme drought) and in 2003 (a year of above-average rainfall). Multiple leaves from individual trees were collected, rinsed with deionized water, dried, ground together, and ashed in a muffle furnace. The ash was then dissolved in hot nitric acid, sodium bicarbonate, or ammonium hydroxide solutions, which then were analyzed for silicon, magnesium, calcium, sodium, and potassium concentrations. Results indicated that nitric acid and ammonium hydroxide were superior to the sodium bicarbonate method for dissolving phytoliths.

Silicon concentrations ranged from 141 mg/kg in black gum (Nyssa sylvatica) to 2875 mg/kg in willow oak (Quercus phellos). In some species, silicon was present in higher concentrations than Mg, Na, and K. Compared to local stream waters, leaf tissue was enriched in Mg, K, and Ca and depleted in Na and Si on a molar basis. Significant differences were not found in the silicon concentrations between years. This suggests that silicon uptake is more complicated than passive uptake of an uncharged molecule in the transpiration stream. The wide ranges in silicon concentrations both within and among tree species in our study suggests that substantial variability must be considered when modeling silicon budgets in heterogeneous forest ecosystems.

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General Information for this Meeting

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Undergraduate Research (Posters) II
Hilton McLean Tysons Corner: Ballrooms A and B
1:00 PM-5:00 PM, Friday, March 26, 2004

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