Typha Seedling Growth Models Provide Improved Assessment of Treatment Wetland Performance Limitations

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A novel bioassay technique shows promise for assessing the contribution of soil legacy nutrients to wetland water quality. An ex-situ assessment based on plant growth responses better explained variation of phosphorus removal performance among several full-scale treatment wetlands within the Everglades Stormwater Treatment Area (STA) network compared to traditional soil parameters (soil TP). Rather than using chemical extractions to characterize plant-available P or other soil constituents individually, the growth response of *Typha* seedlings under controlled conditions was used to compare soils.

Typha growth metrics, including leaf length, biomass dry weight, tissue P content and biomass P, increased with soil fertility (P, N, micronutrients, organic matter content) over a range of wetland soils. Expected positive correlations were observed between soil P and *Typha* tissue P. When air-dried leaves from the bioassay *Typha* plants were submerged in low-nutrient surface water, a substantial portion of the P mass in dried leaf tissues was readily lost through leaching under dark laboratory conditions: 18-34% from live leaves and 19-41% from standing dead leaves was leached within 24 hours. The mass of P lost through leaching and the resulting dissolved organic P (DOP) concentration in the leachate also increased with tissue P and were therefore proportional to soil fertility.

Typha seedling growth was well-described by a four-parameter logistic model, and the assayed soils supported a range of modeled growth-rate coefficients. Water column P concentration data from the field-scale systems from which the soils were obtained were consistent with several growth response metrics, in particular with modeled growth-rate coefficients, supporting the hypothesis that the internal phosphorus loading rate (iPLR) via plant-mediated translocation of wetland soil P to the water column is an important factor affecting outflow P concentrations in the STAs. Further, iPLR may be influenced by multiple soil factors that are best represented by an integrated biological assessment of soil nutrient availability. The technique shows promise for identifying soil conditions with increased potential for P return cycling (iPLR) to the water column, which for STAs can reduce treatment efficiency.