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Macrophytes: ecosystem engineers in UK urban rivers

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Macrophytes act as ecosystem engineers within river channels in that they have the ability to cause geomorphological and ecological change. They induce reductions in flow velocity and associated sediment accumulation, and their system of underground roots and rhizomes also reinforces the accumulated sediment reducing sediment erosion and resuspension and creating habitats.

As sediments, particularly finer-grained, store contaminants including metals, this engineering means that in the specific context of urban rivers where sediments are more likely to be contaminated, macrophytes trap and hold contaminated sediments creating a potentially important sink of metals. However, depending on the ability for the macrophyte to reinforce the sediment and reduce erosion and resuspension, there is the potential for the sink to turn in to a source and metals to be released in to the overlying water.

This research therefore looks at the ecosystem engineering ability of common macrophytes in UK urban rivers by looking at: (i) the effect upon flow velocity and sediment accumulation of *Sparganium erectum* (branched bur-reed); (ii) the sediment reinforcement ability of both *S. erectum*, *Typha latifolia* (bulrush) and *Phalaris arundinacea* (reed canary grass); and, (iii) the storage of metals within the sediment, overlying water and the macrophytes.

Research was undertaken on the River Blackwater, an urban river in Surrey, UK which has extensive macrophyte growth. Flow velocity measurements and fine sediment depths were recorded both within and outside of dense stands of *S. erectum*. The uprooting resistance (as an indicator of sediment reinforcement) was measured for three species: *S. erectum*, *T. latifolia* and *P. arundinacea*. Additionally, some preliminary sampling was undertaken of the sediment, overlying water and the macrophytes to determine metal storage.

Lower flow velocities and greater volumes of fine sediment were recorded within the stands of *S. erectum* as opposed to the adjacent areas of open channel with minimal macrophyte growth. Uprooting resistances were considerable and differences were found both between species and over the annual growth cycle. *T. latifolia* showed the greatest uprooting resistance and *P. arundinacea* the lowest uprooting resistance. Maximum uprooting resistance for all species was in June.

The sampled sediments were found to be a store of metals. For all macrophyte species, the below-ground tissues (roots and rhizomes) generally had greater metal concentrations than above-ground tissues (stem and leafs).

The results from this research will help inform the use of macrophytes in the management of sediment-contaminated urban rivers.