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Wetland plants involved in marsh restoration

Differences in the way wetland plants accumulate pollutants are helping researchers understand how vegetation can be used to help restore contaminated marshes. In a study by Belgian researchers, certain plants, including bulrushes, were identified as being potentially useful for locking away metal contaminants below the surface, thereby helping to reduce spread of these pollutants through food chains and to the wider environment.

The researchers studied an eight-hectare site on the Schelde estuary, at the mouth of the Scheldt River, which crosses Belgium and the Netherlands. In this region, thousands of hectares of tidal marsh need to be restored to achieve EU-conservation goals.

The study site itself was used as cropland and irrigated with polluted water from the Schelde before 2003, after which it was restored to freshwater tidal marsh, using an experimental technique. The technique involved introducing embankments and culverts – large drainage pipes – to direct the flow of water. Together, these provided a weak tidal effect, increased water storage capacity for flood control and encouraged the growth of wetland plants.

However, even now, the site remains highly contaminated with metals mainly deposited in the 1960s and 1970s. The researchers were interested in understanding how different plants are involved in 'processing' these contaminants to shed light on how they could be deliberately used for 'phytoextraction', a decontamination technique whereby plants remove pollutants from soil or water.

They measured concentrations of eight metal contaminants (cadmium, chromium, copper, iron, manganese, lead, nickel and zinc) and arsenic (a metal-like compound) in 29 wetland plants to establish which species might be important in the restoration process.

The highest concentrations of metals were found in a type of yellow-green algae called *Vaucheria*. Concentrations in *Vaucheria* were between 3-14 times higher, depending on the metal, than in other plants. According to the researchers, this algae's cell walls may explain its high capacity for metals, as they tend to exchange calcium for other metals. However, *Vaucheria* only covered small areas of mudflats and therefore did not accumulate large quantities of metal overall.

None of the plants studied by the researchers accumulated enough metals to be considered 'hyperaccumulators'. Overall, only a very small proportion – around 0.05% - of the metals contaminating the wetland site was transferred to the above-ground parts of wetland plants. This means they are probably not useful for phytoextraction.

The lowest metal concentrations were found in monocotyledons or 'monocots', which are flowering plants that produce just one seed leaf as seedlings, as opposed to two. However, the researchers say that some of these plants, including certain species of bulrushes, might be preferable for use in decontaminating wetlands because they reduce the amount of metal entering the food chain through the above-ground parts of the plant. This represents a form of 'phytostabilisation' rather than phytoextraction.

In the absence of hyperaccumulators, plants that store less metal in their leaves and stems pose less of a risk to foraging animals. Leaf beetles and snails, for example, have been known to accumulate cadmium when feeding on vegetation in contaminated areas.

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