

## Can changes in metal bioavailability be used to assess phytoremediation?

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Measurement of metal concentrations in plant tissues can indicate the potential of different plants for phytoextraction, but gives no information about changes in concentration and chemical speciation of metals in the soil. Metals are held in soil by a number of different mechanisms. Easily released metal is described as 'bioavailable', and exists in equilibrium with a much larger 'non-bioavailable' fraction. Bioavailability is commonly measured using extractants, either singly or sequentially, designed to release metals held predominantly by a specific mechanism or mechanisms. The aim of this study was to measure changes in metal concentrations in soil, and changes in the distribution of metals between different fractions, using selective sequential extraction. Willow (*Salix* spp.) had been growing on the site for 5 years and metal changes were monitored in unplanted, planted / uncut and planted / cut areas over a 6 month period following coppicing in December.

Cd and Zn were the most bioavailable metals in this soil, whereas Cr was the least; the soil chemistry of Cu and Pb was dominated by organically held metal; for Ni, about 50% was in the residual fraction, while almost 20% was in the acetic acid extractable form. Changes in acetic acid-extractable and peroxide-extractable Cd, Cr, Cu, Ni, Pb and Zn were measured. There was no difference over this time between the soils of the unplanted, uncut and cut areas in both the Cd-acetic and Cd-peroxide fractions, or in the Cr-acetic and Ni-peroxide fractions. The most significant changes occurred in the concentrations of Cu, Pb and Zn in these soils. For all three metals and for both extractants, the unplanted soil contained higher concentrations of both extractable fractions than the two planted soils, suggesting that uptake by the trees over 5 years had removed significant amounts of metal from the bioavailable pools in the soil. The concentrations in the acetic acid- and peroxide-extractable fractions of Cu, Pb and Zn in the unplanted soil did not change over the 6-month sampling period. In soil of the cut area, the acetic-extractable and peroxide-extractable concentrations of all three metals (except Pb-acetic) fell in June compared to December, reflecting the more vigorous rate of growth that occurs in trees following cutting. The trees that had been cut in December depleted the bioavailable pool of Cu, Pb and Zn to a greater extent than the uncut trees.