

Phytomanaging metal(loid)-contaminated sites using high-biomass plants and organic amendments improves soil physico-chemical properties, microbial activity and diversity

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Abstract:

Phytomanaging metal(loid)-contaminated soils can gradually result in an increase in microbial diversity, carbon sequestration, and soil quality and functionality. However, there is a lack of field evidence demonstrating the beneficial effect of phytomanagement on these ecosystem services. Here, we monitor the medium- to long-term effects of different phytomanagement options (phytostabilisation, phytoextraction and rhizoremediation) on soil physico-chemical properties and metal(loid) bioavailability, soil fertility, and microbial diversity and activity in four field trials: the Biogeco platform in SW France (wood preservation site; Cu- and Cu/PAH-contaminated soils), the Parc aux Angéliques (Chaban-delmas) brownfield (a former harbour dock; metal(loid)s and PAHs); the Touro mine in NW Spain (former Cu mine; acid drainage and Cu-contaminated tailings) and the Rubiais mine in NW Spain (former Pb/Zn mine; Cd/Pb/Zn-contaminated ponds). The field trials have been running for 7-11 years and form part of the PhytoSUDOE network of phytomanaged metal(loid)-contaminated field sites (PhytoSUDOE Project (SOE1/P5/E0189)). The influence of various vegetation covers (short rotation coppices of willow and poplar, perennial grasses [*Agrostis* sp.], high-biomass annuals [sunflower, tobacco]), plant cropping patterns (monoculture or co-culture with leguminous species) and waste-based soil amendments (green compost, composted sewage sludges, sewage sludges, dolomitic limestone, biomass ashes, etc., alone and in combination) on soil ecological processes is assessed. General soil physico-chemical properties (pH, cation exchange capacity, nutrient and metal(loid) availability), carbon sequestration, soil enzyme activities (i.e. urease, phosphatase, arylsulfatase, β -glucosidase, etc.), respiration, potentially mineralisable nitrogen, and community-level physiological profiling (BIOLOG ECOPlates™) have been assessed over time. Here we will present results from phytomanaged and untreated (non-phytomanaged) top-soils, and compare these with uncontaminated reference soils in each area.

Key words: phytoremediation, ecological rehabilitation, contaminant, ecosystem services, soil functions, plant assemblage.