



An alternative for the ecosystem restoration in Cartagena-La Union Mining District, SE Spain.

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Mine soils from Cartagena-La Unión Mining District, SE Spain, possess elevated concentrations of heavy metals and constitute a high risk of pollution for the environment due to the strong eolic and hydric erosion processes. As a consequence of the high concentration of metals, the large area affected by mining activities and the related prohibitive costs, diverse remediation techniques such as mine soil removal and phytoextraction, are not suitable in this region. Therefore, chemical stabilization of metals combined with revegetation/phytostabilization was selected as a reclamation technique in two representative mining ponds. The experimental design consisted of 20 square field plots located in each pond, where organic amendments (pig manure and sewage sludge) and lime (marble industry waste product) were added. Soil samples were taken immediately after the construction of the plots and after 12 and 24 months of amendments addition. A physico-chemical and ecotoxicological characterization of the samples was carried out. DTPA- and water-extractable metals were also measured in order to assess Zn, Pb, Cd and Cu mobility. Results of 2 years remediation program point to: 1) an increase in pH, total nitrogen, organic carbon, phosphorous and equivalent calcium carbonate contents; 2) a reduction of acid drainage; 3) a diminish in heavy metal mobility and ecotoxicity; 4) an improvement of spontaneous plant establishment; 5) a decrease in heavy metal plant uptake; 6) a reduction in metal bioaccumulation factors in the plants which showed the low risks of transference of Cd and Cu, and Pb and Zn to the food chain. In consequence, the reduction of metal mobility and the associated risks, and the establishment of autochthonous plants, will lead to a

recovery of the landscape and the whole ecosystem. The field experiments carried out under semi-arid conditions showed that phytostabilization assisted by amendments decreased risks associated to metals and promoted the stabilization of these mining areas. Therefore, this technique is a low-cost feasible alternative that can be applied in the large zone affected by mining activities in the Cartagena-La Unión Mining District.