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Use of Locally Effective Microorganisms in Conjunction with Biochar to Remediate Mine-Impacted Soils

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Abstract : The Oronogo-Duenweg mining belt –approximately 20 square miles around the Joplin, Missouri area– is a designated United States Environmental Protection Agency Superfund site due to lead-contaminated soil and groundwater by former mining and smelting operations. Over almost a century of mining (from 1848 to the late 1960's), an estimated ten million tons of cadmium, lead, and zinc containing material have been deposited on approximately 9,000 acres. Sites that have undergone remediation, in which the O, A, and B horizons have been removed along with the lead contamination, the exposed C horizon remains incalcitrant to revegetation efforts. These sites also suffer from poor soil microbial activity, as measured by soil extracellular enzymatic assays, though 16S ribosomal ribonucleic acid (rRNA) indicates that microbial diversity is equal to sites that have avoided mine-related contamination. Soil analysis reveals low soil organic carbon, along with high levels of bio-available zinc, that reflect the poor soil fertility conditions and low microbial activity. Our study looked at the use of several materials to restore and remediate these sites, with the goal of improving soil health. The following materials, and their purposes for incorporation into the study, were as follows: manure-based biochar for the binding of zinc and other heavy metals responsible for phytotoxicity, locally sourced biosolids and compost to incorporate organic carbon into the depleted soils, effective microorganisms harvested from nearby pristine sites to provide a stable community for nutrient cycling in the newly composited 'soil material'. Our results indicate that all four materials used in conjunction result in the greatest benefit to these mine-impacted soils, based on above ground biomass, microbial biomass, and soil enzymatic activities.

Keywords : locally effective microorganisms, biochar, remediation, reclamation
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