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Microbiological indicators for assessing ecosystem soil quality and changes in it at degraded sites treated with compost

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Soil quality is defined as the capacity of a soil to function as a vital system, within natural or managed ecosystem boundaries, sustain plant and animal health and productivity, maintain or enhance air and water environment quality and support human health and habitation. Soil organisms are extremely diverse and contribute to a wide range of ecosystem services that are essential to the sustainable functioning of natural and managed ecosystems. In particular, microbial communities provide several ecosystem services, which ensure soil quality and fertility. In fact, they adapt promptly to environmental changes by varying their activity and by increasing the reproduction of populations that have favourable skills.
The structure (e.g. cell abundance) and functioning (e.g. viability and activity) of natural microbial communities and changes in them under different environmental conditions can be considered useful indicators of soil quality state.
In this work we studied the quality state of three different soils, located in Taranto Province (Southern Italy), affected by land degradation processes, such as organic matter depletion, desertification and contamination (PCB and metals). Moreover, compost, produced from selected organic waste, was added to the soils studied in order to improve their quality state.
Soil samples were collected before and after compost addition and both microbial and chemical analyses were performed in order to evaluate the soil quality state at each site at different times. For this purpose, the microbiological indicators evaluated were bacterial abundance (DAPI counts), cell viability (Live/Dead method), dehydrogenase activity (DHA) and soil respiration. At the same time, the main physico-chemical soil characteristics (organic carbon, available phosphorous, total nitrogen, carbonate and water content, texture and pH) were also measured. Moreover, in the contaminated soil samples PCB and inorganic (e.g. Pb, Se, Sn, Zn) contaminants were analysed respectively by GC-MS and ICP-MS.
The overall results showed that the bacterial structure and functioning were affected in different ways by the organic carbon availability and quality, and contaminant occurrence (organic or inorganic compounds). The compost treatment contributed to improve soil fertility and to increase cell number and activity after 7 months in the two low organic carbon content soils. At the polluted site a general increase in bacterial activity after compost addition was also observed and this might be related to a decrease in inorganic and organic contamination levels.