

Monitoring the ecological functions of rehabilitated soils: the contributions of biological indicators

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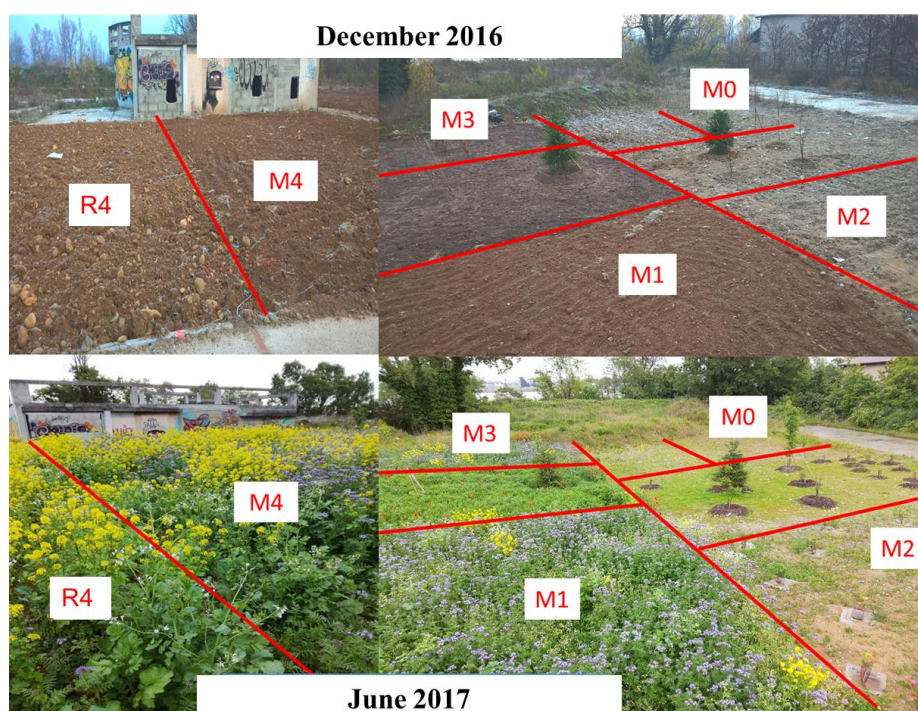
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Soil is recognized as a major component of the functioning of terrestrial ecosystems and a key element for the provision of Ecosystem Services (ES). In a context of tensions over their use, the ecological rehabilitation of abandoned sites (industrial, urban or agricultural wasteland) is an opportunity to make territories more resilient to the consequences of climate change (Climate and Resilience Law, 2021) and to meet the objectives of preserving and restoring biodiversity (Biodiversity Plan, 2018). The question then arises of the reversibility of this soil degradation via refunctionalization, i.e. the restoration of ecological processes that should ultimately lead to the provision of ecosystem services adapted to these new uses. One of the obstacles to the success of ecological rehabilitation projects is linked to the difficulty of recreating functional ecosystems starting from degraded soil (compacted, sterile, impermeable).

As part of the BioTubes project (<https://expertises.ademe.fr/content/biotubes-bio-technosols-urbains-faveur-biodiversite-services-ecosystemiques>), a urban wasteland was rehabilitated (Figure 1) using different ecological engineering paths including, soil decompaction or importation, controlled inoculation by microorganisms and sowing & planting of local plant species. The functioning of these soils, from which stems their ability to provide ES, is based on their physico-chemical but also biological parameters, in particular those of microbial communities and nematodes, which play a fundamental role in bio-geochemical cycles. For 3 years, monitoring of activity, biomass and microbial and nematofauna diversity were carried out in parallel with physico-chemical parameters and plant diversity in order to identify (bio)indicators that are witnesses of effective rehabilitation. In particular, this work has focused on integrating indicator measurements to reflect the state of soil ecological functions (Figure 2, carbon storage and dynamics, nutrient supply, habitat for biodiversity).

Keywords: soils, microbial communities, nematofauna, bioindicators, ecological functions, rehabilitation, wastelands



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Figure 1. Study site after soil ecological rehabilitation (december 2016) and the following spring (june 2017). M0 to M4 and R4 are codes given for the different experiments.

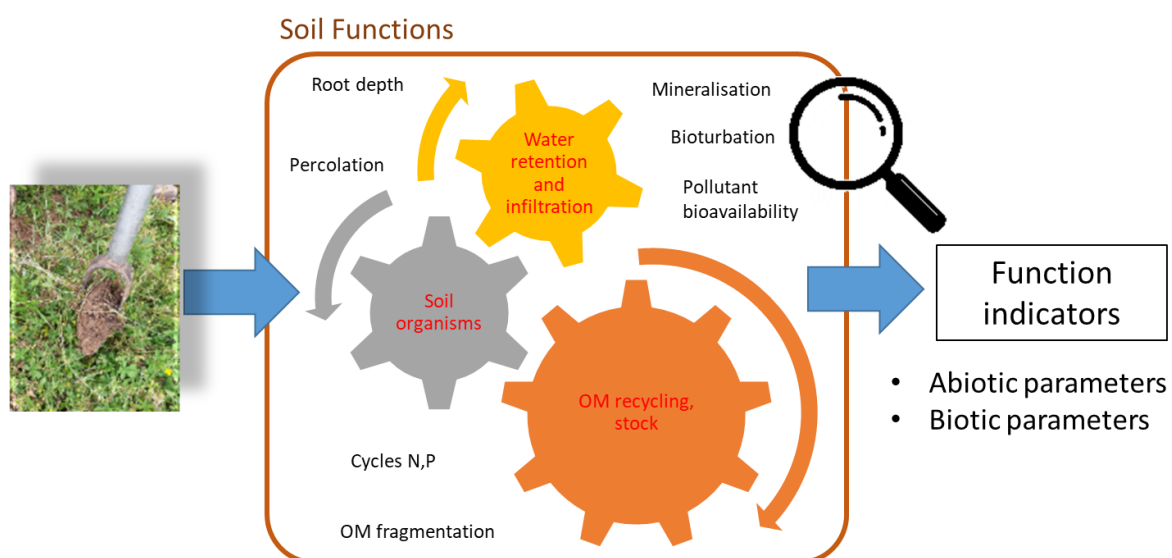


Figure 2. Soil ecological function result from the interactions between biotic and abiotic compartments.