An underground revolution: biodiversity and soil ecological engineering for agricultural sustainability.

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Volume 31, Issue 6, June 2016, Pages 440-452

Review

An Underground Revolution: Biodiversity and Soil Ecological Engineering for Agricultural Sustainability

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https://doi.org/10.1016/j.tree.2016.02.016

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Recent evidence showed that soil biodiversity supports several ecosystem functions simultaneously, underpinning its crucial role in ecosystems worldwide.

To enable the proper functioning of ecosystems, soil biodiversity has to be enhanced and maintained.

Our analysis indicates that the sustainability of agricultural ecosystems can be restored by stimulating soil life and internally regulated ecosystem processes.

To face the immense global problems related to a growing human population and deterioration of the global biosphere, targeted manipulations of soil organisms become necessary in addition to promoting soil biodiversity.

Targeted approaches through soil ecological engineering to maximize the contribution of soil biological processes to sustainable ecosystem functioning can help to provide food security while minimizing negative environmental impacts.

Soil organisms are an integral component of ecosystems, but their activities receive little recognition in agricultural management strategies. Here we synthesize the potential of soil organisms to enhance ecosystem service delivery and demonstrate that soil biodiversity promotes multiple ecosystem functions simultaneously (i.e., ecosystem multifunctionality). We apply the concept of ecological intensification to soils and we develop strategies for targeted exploitation of soil biological traits. We compile promising approaches to enhance agricultural sustainability through the promotion of soil biodiversity and targeted management of soil community composition. We present soil ecological engineering as a concept to generate human land-use systems, which can serve immediate human needs while minimizing environmental impacts.

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