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Introduction to Soil Protection and Regeneration

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This themed collection in *Environmental Science: Advances* aims to update recent developments in soil science, soil-dependent ecosystem services, and the impacts on soils and their function in the face of pollution and climate change.

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Soil evolves and transforms in response to external factors. Therefore, it is threatened by all hazards that endanger life.

Soil is home to a multitude of diverse life forms, from microorganisms to giant trees, and simultaneously ensures a dynamic network of interactions. However, it is difficult to encapsulate its multitude of properties and attributes in a single word. Soil and its functioning can be pristine or impacted by human activities, or it can be intentionally enriched by fertilisers or controlled by biocides. Human dependence on soil goes beyond its role in supporting agricultural production and maintaining healthy landscapes. Humans' exposure to soil contributes to strengthening the immune system and diversifying the human microbiome, among many other benefits. The dimensions of the human–soil interface are incredibly rich. However, soil faces significant threats that endanger its health and its ability to regenerate. Erosion, pollution, loss of organic matter and loss of biodiversity are just a few examples. The scientific community is concerned about these threats and is willing to address them. This themed collection is an example of this commitment.

Consisting of four research papers and four critical reviews, the collection highlights the various ways in which environmental sciences can diagnose, mitigate and prevent existing soil threats. Together, these studies emphasise the need for systems-level and interdisciplinary approaches in soil science. The collection demonstrates that achieving soil sustainability requires the convergence of multiple disciplines, including biology, chemistry and engineering. Rather than merely highlighting threats, the collection points towards circularity and innovation by combining diverse approaches, such as improved monitoring methods, the development of engineered materials, the use of microbial consortia, and efforts to reach carbon neutrality.

The collection consists of the following articles and reviews and can be viewed under the *Environmental Science: Advances* Themed Collections tab:

A review of research progress on prevention and control technologies for arsenic and cadmium composite pollution in paddy soil

Lidan Lei and Songqing Liu *et al.*
https://doi.org/10.1039/D4VA00293H
Management of phyto-parasitic nematodes using bacteria and fungi and their consortia as biocontrol agents

Chhavi Sharma and Puneet Pathak *et al.*
https://doi.org/10.1039/D4VA00216D
Hydroxyapatite/urea hybrid materials: what is the basis for the enhanced nutrient efficiency?

Jonas Baltrusaitis *et al.*
https://doi.org/10.1039/D4VA00197D
Carbon farming: a circular framework to augment CO_2 sinks and to combat climate change

S. Venkata Mohan *et al.*
https://doi.org/10.1039/D3VA00296A
Phytomanagement strategy leads to plant-derived catalysts for the sustainable synthesis of oxidized Hantzsch esters

Alina Ghinet *et al.*
https://doi.org/10.1039/D5VA00028A
Multi-mode soil chemical passivation and crop protection of severe cadmium and arsenic polluted soils with engineered silica

Paul N. Williams and Yingjian Xu *et al.*
https://doi.org/10.1039/D5VA00055F
Microbial degradation of bioplastic (PHBV) is limited by nutrient availability at high microplastic loadings

Michaela K. Reay *et al.*
https://doi.org/10.1039/D4VA00311J
Viability of elutriation for the extraction of microplastics from environmental soil samples

Jorge Gonzalez-Estrella *et al.*
https://doi.org/10.1039/D4VA00087K

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