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Practice abstract 27

Toward Soil Health Assessment in a Life Cycle Perspective #3

Linking Biodiversity, Soil Functions and Ecosystem Services

Soil functions depend on specific biological communities. Nutrient cycling is driven by decomposers and symbiotic microbes enabling biogeochemical transformations. Carbon cycling reflects plant–microbe interactions controlling organic matter turnover and storage. Water regulation is impacted by vegetation and soil organisms influencing infiltration and redistribution. Biodiversity loss is thus interpreted as reduced functional diversity rather than simple species loss.

Ecosystem services and areas of protection

The framework extends from biodiversity impacts to soil function decline and ecosystem service reduction. The area of protection (AoP) in environmental sustainability is defined as “the entity that we want to protect”. Ecosystem services are treated as Areas of Protection, while soil functions act as intermediate damage categories in assessment. If each ecosystem service is treated as a separate area of protection, then losses of soil functions would correspond to damage categories. This enables integration into Life Cycle Assessment (LCA) and supports a continuous cause–effect representation of the environmental impacts.

Challenges and implications of the study

Key challenges include selecting indicators, aggregating diverse effects, and addressing trade-offs between impacts. Ecosystem engineers and keystone species receive particular attention due to their disproportionate influence on soil processes. Integrating biodiversity-mediated functions into impact assessment enables more operational soil health metrics, linking mechanistic models with ecosystem service evaluation for decision support and policy applications. The described full damage pathway should be seen as the first necessary step toward including soil health in quantitative sustainability, expanding the actual LCA methods.

Project partners

Consorzio Italbiotec · WAGENINGEN UNIVERSITY & RESEARCH · N3 NACHHALTIGKEITSBERATUNG DR. FRIEGE & PARTNER · RUOKAVIRASTO Livsmedelsverket • Finnish Food Authority · euroquality A WARRANT HUB COMPANY · HIICE SHAPING THE CIRCULAR ECONOMY · STADTREINIGUNG.HAMBURG · etaflorence renewableenergies · AMS AMSTERDAM INSTITUTE FOR ADVANCED METROPOLITAN SOLUTIONS

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originally published on

Co-funded by the European Union

EU CAP NETWORK

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