Bin2Bean

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Practice abstract 25

Toward Soil Health Assessment in a Life Cycle Perspective #1

Rethinking Soil Health Assessment through Impact Pathways

Within the Bin2Bean project, partners from DTU recently released a study with the aim of bringing Life Cycle Assessment (LCA) one step forward, filling the gaps in the existing LCA approach, to consider how soil biodiversity loss translates into damage to relevant soil functions and related ecosystem services.

Background

Healthy soils, i.e. those capable of sustaining a living ecosystem, host nearly 60 % of Earth's biodiversity, producing over 98 % of the food we consume. Soil organisms have a crucial role in this context. Soil health has been defined as "the capability of a soil to maintain its functions for the support of life on Earth, including human lives".

While it takes thousands of years for soil formation to happen, few years of malpractice can make soil unable to support life. In the past decades, we have gained understanding of the mechanisms linking stressors, such as land use, to soil biodiversity loss, forming the basis for modelling impact metrics, such as Life Cycle Impact Assessment (LCIA), to calculate the potential impact of human activities on ecosystems.

Current assessment frameworks and methodological gap

Existing assessment approaches commonly rely on physicochemical and biological indicators such as organic carbon, pH, nutrients, aggregate stability, and microbial activity.

Across soil health studies, indicator selection, scoring methods, and aggregation strategies vary widely. Many frameworks construct composite indices using weighting schemes based on expert judgement or multivariate statistics.

Although LCIA methods robustly describe how stressors lead to biodiversity decline, they rarely extend beyond this endpoint. The link between biodiversity loss and reduced soil functional capacity remains underdeveloped. Addressing this missing step is essential for a full mechanistic understanding of soil health and for integrating soil processes into sustainability assessment frameworks.

Project partners

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