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Practice abstract 26

Toward Soil Health Assessment in a Life Cycle Perspective #2

From Soil Stressors to Biodiversity Loss in Life Cycle Assessment

Biodiversity loss should not be treated as a final endpoint but as an intermediate stage in a broader cause–effect chain. Declines in biodiversity ultimately influence soil functions and ecosystem services. Advancing soil health assessment therefore requires moving from descriptive indicators toward pathway-based frameworks capable of quantifying impacts of specific stressors.

Overview of soil stressors

The proposed framework integrates Life Cycle Impact Assessment pathways into soil health evaluation by identifying key anthropogenic stressors affecting soil ecosystems. These include chemical contaminants, plastics, climate-related emissions, excess nutrients, acidifying substances, and land use and land-use change. Each stressor follows distinct but sometimes overlapping impact mechanisms leading toward biodiversity loss.

Chemical and metallic contaminants

Organic chemicals and metals affect ecosystems through a three-step pathway: environmental fate, ecosystem exposure, and ecotoxicological response. Fate describes transport and transformation across environmental compartments, exposure determines the fraction available to organisms, and effects are quantified using species sensitivity distributions. This enables translation of toxicity into biodiversity damage metrics.

Plastics, climate, nutrients, and land use

Plastics introduce additional physical impacts such as particle accumulation, smothering, and microbial interactions. Climate stressors operate radiative forcing and temperature rise driving habitat shifts and extinction risks, amplified by feedback loops. Nutrient and acidifying emissions may disrupt ecosystems through eutrophication and chemical imbalance. Land use change alters soil structure, biology, and function through sealing, erosion, and compaction, typically assessed via species richness loss.

Project partners

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