

# New framework and online tool can promote understanding of the role of soil biota

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In one teaspoon of soil, we can find more than 5,000 species of bacteria, fungi, nematodes and other microbial organisms. Such "soil biota" support a wide range of functions, such as nutrient cycling and water regulation and purification. Yet it is challenging to define how soil organisms contribute to these soil functions. A new framework can help

us understand the complexity of soil biology in relation to multiple soil functions. The framework is supported by an online tool that enables users to better select methods for assessing soil quality.

Often the biological component is underrepresented in soil quality assessments. Despite the publication of more than 14,000 papers on the topic in the last two decades, there is no agreement on which measurements of soil biology should be used to monitor soil functioning and soil quality. Two recently publications by a research team of Wageningen University & Research and Université Paul Sabatier in Toulouse embrace the complexity of soils.

The researchers present a framework (Creamer et al., 2022) to help us understand the complex ways soil biota bring about soil functions. They collected the current scientific understanding of how soil biota support the four primary soil functions: nutrient cycling, carbon and climate regulation, water regulation and purification, and disease and pest regulation. The team also evaluated which measurements can be applied to assess these soil functions across a range of research and monitoring situations (Zwetsloot et al., 2022). This has resulted in the new BIOSIS-tool to select methods accustomed to researchers' practical requirements.

## **Defining the role of soil biota in soil processes**

Prof. Rachel Creamer of Wageningen University & Research explains, "The framework helps to define the role of soil [biota](#). This starts at looking at their functions, then breaking these down into subfunctions, and then further into processes." Those processes are supported by a range of biological "actors" that can be measured by a number of methods. Take earthworms, for example. The burrowing activity of earthworms influences the way water moves through the soil and to which extent carbon and nutrients are available to plants. By measuring the actor "earthworms," we gather information about the processes

"bioturbation" and "[aggregation](#)," which support three of the four major soil [functions](#).

But which actors and what type of measurements are suitable to assess the different processes? In some cases, processes can be measured directly. In other cases, the biological actors can be measured as a proxy of the process. The research team summarized the existing information and provided a tool to help select suitable measurements.

## Methods that meet practical requirements

The BIOSIS (Biological Soil Information System) tool developed and explained in Zwetsloot et al. helps researchers to identify which methods of measurement are best to represent the biological actors or processes defined in the soil frameworks that they have developed.

Dr. Marie Zwetsloot of Wageningen University & Research says, "Users of the tool can specify a variety of criteria and filters that meet their practical requirements. This will result in a list of suggested context-specific methods." For example, researching how the availability of plant nutrients changes in response to new [soil](#) management practices requires detailed measurements at an experimental field site. On the other hand, monitoring the ability of agricultural soils to provide crops with nitrogen throughout the country asks for quick but reliable methods. The BIOSIS tool provides users with this flexibility. It is future-proof; new methods or findings can be added easily. The BIOSIS tool is freely accessible online.

**More information:** R.E. Creamer et al, The life of soils: Integrating the who and how of multifunctionality, *Soil Biology and Biochemistry* (2022). [DOI: 10.1016/j.soilbio.2022.108561](https://doi.org/10.1016/j.soilbio.2022.108561)

Marie J. Zwetsloot et al, A flexible selection tool for the inclusion of soil

biology methods in the assessment of soil multifunctionality, *Soil Biology and Biochemistry* (2021). [DOI: 10.1016/j.soilbio.2021.108514](https://doi.org/10.1016/j.soilbio.2021.108514)

The free online tool is available at [biosisplatform.eu/](https://biosisplatform.eu/)

Provided by Wageningen University

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