

# Evaluation of agroecological practices on soil health with **Biofunctool**<sup>®</sup>, an in-field integrative approach

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**Goals :** Measuring the impact of practices and changes in use on soil health



## Criteria :

- **In the field:** to respect the physical integrity of the soil
- High number of **repetitions:** to take into account land variability
- **Low tech fast & effective cost:** to make it accessible to end users (advisors, farmers, students, NGO, technical institutes, etc.)

**Problem :** Current measures of soil quality are based on the measurement of inherent properties (carbon, nitrogen, number of organisms, etc.) and not on the functions of the soil.

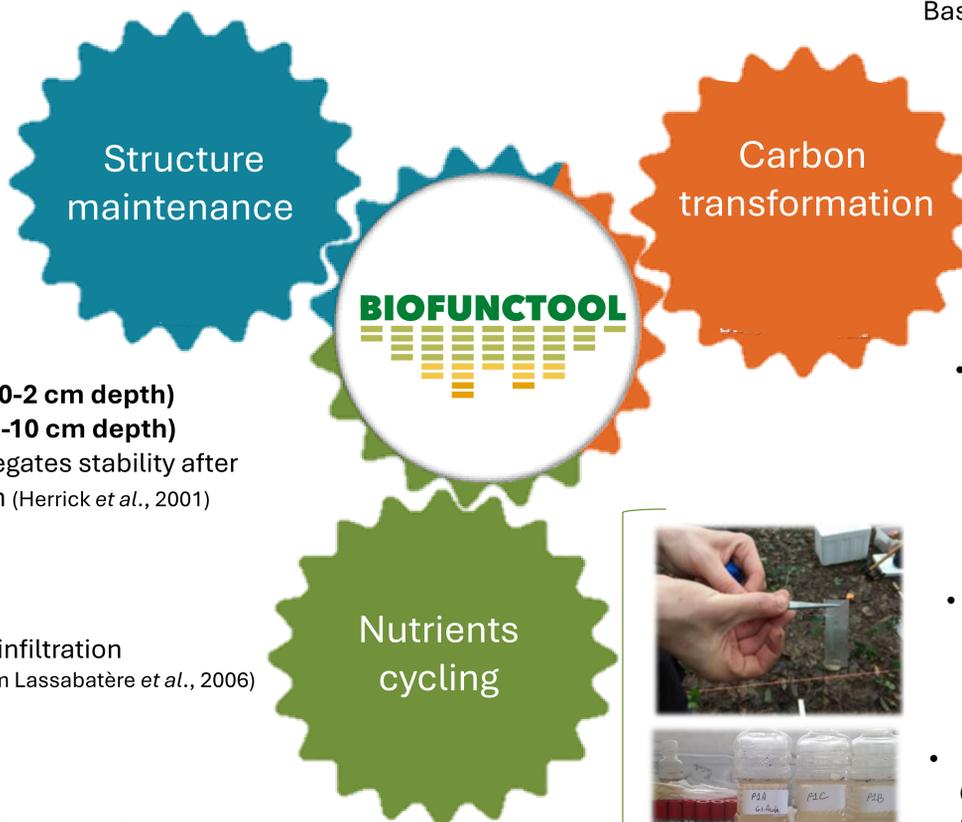
**Proposition :** Measuring functions resulting from the activity of soil organisms

Capacity of soil to perform **functions** and provide **ecosystem services**

## How it works :

Applied in a wide range of contexts and land management, it has been validated both spatially and temporally

**9 indicators of 3 soil functions**  
In situ measurement → soil quality score



- **AggSurf (0-2 cm depth)**
- **AggSol (2-10 cm depth)**  
Water aggregates stability after immersion (Herrick *et al.*, 2001)



- **Beerkan**  
Soil water infiltration (adapted from Lassabatère *et al.*, 2006)



- **Visual evaluation of soil structure**  
VESS (Guimarães *et al.*, 2011)

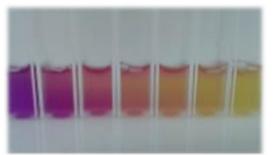


- **Lamina Baits**  
Mesofauna and little macrofauna activity (Von Törne *et al.*, 1990)



- **Ion exchange membranes**  
Dynamics of nutrients available in the soil (Qian et Schoenau, 2002; Le Cadre *et al.*, 2018)

- **Extraction of mineral nitrogen**  
Quantifying the nutrients available in the soil (Maynard et Kalra, 1993)  
→ improvements in progress to measure N fluxes



- **SituResp**  
Basal soil respiration – CO<sub>2</sub> emissions by microbial activity (Thoumazeau *et al.*, 2017)



- **POXC**  
Short-term soil carbon pool (Weil *et al.*, 2003)



## Results :



Example of a comparison of an agroecological cropping system with a conventional system in Aude, near Carcassonne, France (same type of soil)

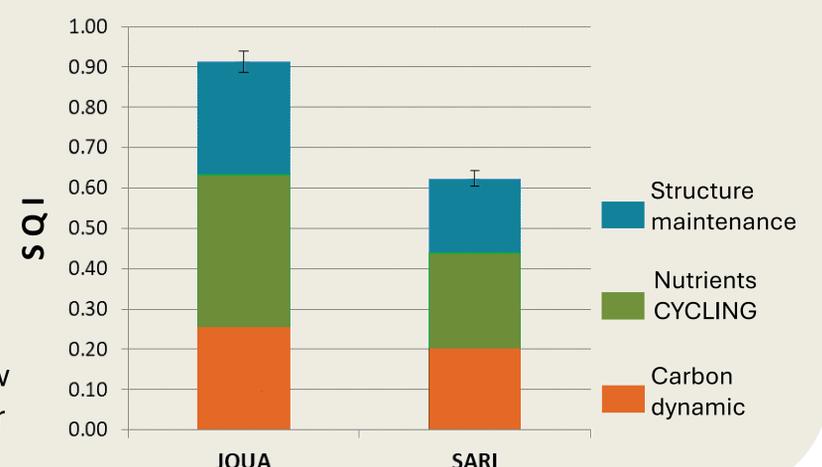


**JOUA :** 20 years of shallow tillage with summer cover crop protection



**SARI :** conventional with autumn ploughing, bare soil during intercropping

A Soil Quality Index (SQI between 0 and 1) summarizes the contribution of each function to the index :



References:  
Thoumazeau A. et al. "Biofunctool<sup>®</sup>: a new framework to assess the impact of land management on soil quality. Part A: concept and validation of the set of indicators." *Ecological Indicators* 97 (2019): 100-110.  
Pheap S. et al. "Multi-functional assessment of soil health under Conservation Agriculture in Cambodia." *Soil and Tillage Research* 194 (2019): 104349.