SOIL BIOLOGICAL QUALITY

SOILS Focus 3

Soil biological quality refers to the abundance, diversity and activity of living organisms that contribute to the functioning of soils and enable them to perform essential functions (biomass production, carbon (C) storage, regulation of harmful species, degradation of pollutants, biogeochemical cycles, etc.). It would be beneficial to evaluate soil biological quality more broadly, across more soils, with more indicators.

Towards the monitoring of biological soil quality

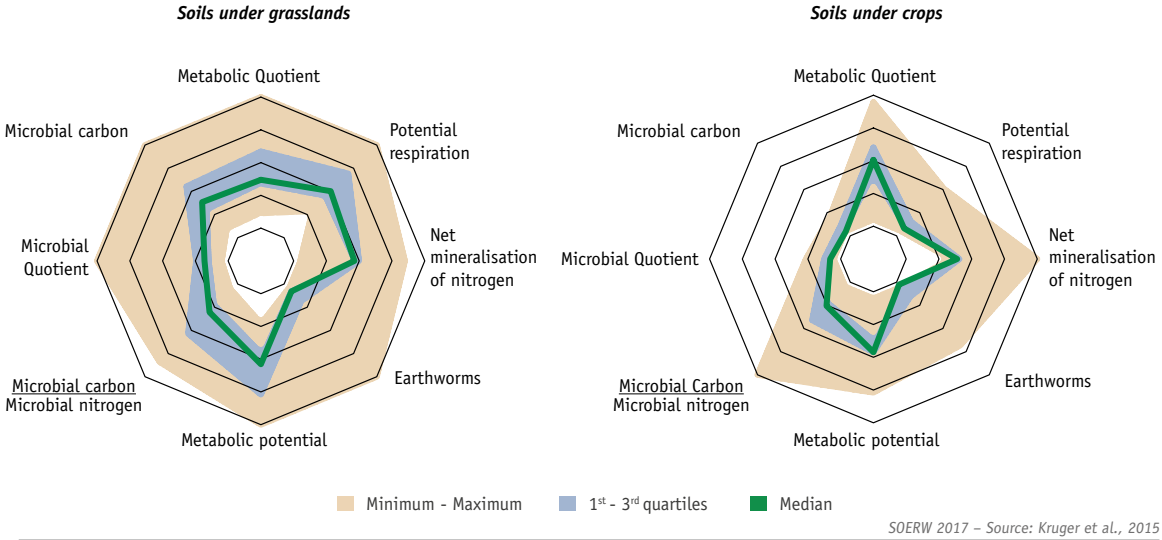
Faced with soil degradation phenomena[1], the assessment and monitoring of soil quality has become a priority in various European countries, notably through the establishment of monitoring networks. In Wallonia, several networks monitor the quality of agricultural[2] and forest soils[3], mainly through the monitoring of conventional physico-chemical parameters (texture, pH, organic C content, cation exchange capacity, etc.), which have numerous advantages (standardised methods, routine analyses, existing reference frames, interpretation in terms of suitability for a particular use or fertiliser advice, for example). However, these parameters do not account for the abundance, diversity and activity of soil organisms that are responsible for major functions. This information can be provided by biological indicators, which also have the advantage of (i) an integrated measurement of ecological conditions in soils and (ii) early sensitivity to environmental disturbances. Ongoing research[4] aims to develop a relevant set of such indicators for Walloon soils.

Eight biological indicators tested

Several indicators for both soil organisms and biological processes are combined to assess the biological quality of soils. At this stage, eight indicators have been measured at 30 sites under grasslands and 30 sites under crops in 10 Walloon agricultural landscape units[5] to establish reference values for the regional territory: metabolic quotient (ratio between potential respiration and microbial C), potential respiration (CO_2 release), net mineralisation of nitrogen (N), earthworms (abundance and mass), metabolic potential of bacteria (diversity of substrates), microbial biomass (microbial C and the ratio of microbial C to microbial N) and the microbial quotient (the ratio of microbial C to total organic C). The results obtained indicate in particular the discriminating power of four of the indicators used with regard to land use (clear distinction between grasslands and crops). For the same land use, the ranges of values found were similar in all the Walloon agricultural landscape units studied. Various applications are envisaged: (i) the establishment of a single comprehensive soil score for a given soil, (ii) the establishment of a radar graph showing all the data for the same land use, and (iii) the establishment of a soil biological quality map for Wallonia (in exploration).

[1] → Introduction to Part 5 | [2] REQUASUD network (www.requasud.be) and CARBOSOL (Goidts & van Wesemael, 2007) e.g. | [3] IPRFW (SPW - DGO3 - DNF, 2015) | [4] CARBIOSOL subsidy | [5] Kruger *et al.*, 2015

Fig. SOILS Focus 3-1 The effect of land use on eight soil biological indicators tested in Wallonia



SOERW 2017 – Source: Kruger et al., 2015