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Title:

Which bioindicators are suitable for soil quality monitoring and risk assessment? From relevance study to transfer tool development.

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Introduction- Considering the few numbers of bioindicators available for soil risk assessment and soil characterization, a national research programme has been set up in France by the French Agency For Environment and Energy Management (ADEME) to develop indicators able to judge about soil degradation and/or remediation of its properties and functions. The main objectives of this "BioIndicator programme" are to (i) develop and validate methods for measuring soil biodiversity and soil functions, (ii) test the sensibility and complementarity of the bioindicators for the characterization of different perturbations (contamination, modification of soil uses), iii) identify relevant bioindicators or endpoints for different purposes (ecological risk assessment, monitoring of soil quality..), iv) transfer the results to end-users (policy makers, farmers, research board) by providing suitable tools.

Methods- 22 research teams are involved. 47 bioindicators are tested (microorganisms, fauna, flora) in a large panel of situations (47 situations including agricultural, industrial and forest sites) and sampled at the same moment by applying standardised sampling protocols. A common database allows the management of the high number of data (200.000).

Results- Bioindicator programme initiates a first national benchmark i.e. baselines values for the different biological groups. It provides relevant tools (battery of bioindicators, biological index) adapted to different environmental targets such as i) evaluation of the impact of agricultural practices (crop rotations, ploughing vs reduced tillage, organic and pesticides management), ii) evaluation of the bioavailability of contanimants from industrial activities, iii) evaluation of the biological state of contaminated soils in order to orientate their future use, iv) soil monitoring of biological state at large scale. Moreover, it provides communication tools, such as bioindicator technical sheets and web-interface addressed to end-users (http://ecobiosoil.univ-rennes1.fr/ADEME-Bioindicateur/).

Conclusion- due to 10 years of research, this programme which is unique at European Union scale, permits to improve the knowledge on soil biodiversity and its functioning, and provides tools to stakeholders for future soil management.

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