

The use of earthworms as tool for soil monitoring, characterization and risk assessment.

Example of a Bioindicator Programme developed at National scale (France)

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Soil can be considered as a non-renewable resource that must be protected because it is essential to our economic activities (it provides food, drinking water, biomass and raw materials) but its degradation is still accelerating (e.g. erosion, contamination, compaction). Thus protecting and managing soils require a set of indicators able to judge about degradation and/or remediation of its properties and functions. Considering the lack of bioindicators to describe the quality of soil, a national research programme has been set up to develop such indicators (2006-2012). This "Bioindicator Programme" is really the first one in Europe. The main objectives are to provide new tools for soil monitoring, characterization and risk assessment, based on soil biological properties. In the first step of this programme (2006-2009), research teams developed and tested their indicator (80 indicators) on a few given situations. After selection, the most relevant indicators (22 indicators), as earthworms, are now tested and compared on a large number of common contexts. 13 sites are studied covering France (forest, agricultural and contaminated sites), 51 contexts differing in terms of land use, contamination origin, pollution level).

Earthworms are studied at community level (abundance, biomass, species and functional structures) as well as organism level (applying metallothionein coding gene expression in earthworm). Moreover, the relationships between earthworms, assessed at functional level (epigeic, endogeic, anecic), and the rest of fauna organism (collembola, mites, nematodes) are analysed using multi-parameter analysis.

The results presented in this communication are those obtained during spring 2009. They clearly show the interest of earthworm community as indicator of land uses, especially of the impact of different organic matter inputs, as well as tillage vs no tillage systems. Moreover, earthworm community strongly informs on the level of different sources of pollution (metal or HAP). Furthermore, the first results obtained on *L. terrestris* are encouraging as they show that the expression on metallothionein increases in contaminated soil. The multi-parameter analysis (HAC) leads to 4 groups which

defined specific indicators (indicator of sites, land uses, pollution). These first results are very interesting because they reinforce the interest of earthworm in soil monitoring, characterization and risk assessment.

Key words : Bioindicators, communities, metallothionein, monitoring, national scale.