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Second edition
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Soil quality — Sampling of soil invertebrates —

Part 6: Design of sampling programmes with soil invertebrates

Qualité du sol — Prélèvement des invertébrés du sol —

Partie 6: Conception de programmes d'échantillonnage des invertébrés du sol

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 4, *Biological characterization*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 444, *Environmental characterization of solid matrices*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 23611-6:2012), which has been technically revised.

The main changes are:

— addition of detailed recommendations about the statistical methods that should be applied in site-specific risk assessment of contaminated land in 7.5;

— removal of the informative Annex A with examples of case studies.

A list of all parts in the ISO 23611 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The biodiversity of soil fauna is tremendous. Soil harbours species-rich communities, which regulate ecosystem processes such as organic matter decomposition, nutrient flows or soil fertility in general.[1],[2] All terrestrial animal phyla can be found in soils.[3] In addition to thousands of bacterial and fungal "species", more than 1 000 species of invertebrates in abundances of up to 1,5 million individuals can be found within a square metre of soil.[4],[5] This diversity can only be reliably estimated by investigation of the soil community itself, since other parameters such as climate are not or only weakly correlated with species richness.[6]

The composition of this community, as well as the abundance and biomass of the individual species and groups is a valuable source of information, since they integrate various abiotic and biotic effects such as soil properties and conditions, climate, competition or biogeographical influences.[7] For this reason, the evaluation of the biodiversity of soil invertebrate communities becomes more and more important for the classification and assessment of biological soil quality.[8] However, this work is only possible if data collection (i.e. sampling of the soil fauna) is carried out according to standardized methods. For this reason, a number of ISO standards have been prepared covering the sampling of the most important soil organism groups.

In the individual parts of the ISO 23611 series,[74] the practical work concerning the respective animal group is described in detail. However, (nearly) nothing is said about how to plan the use of such methods or how to evaluate the results. Despite the fact that sampling for any field study can be different depending on the individual purpose, guidance is needed for monitoring studies in a legal context. Such studies can include the following:

— site-specific risk assessment of contaminated land;

— study of potential side effects of anthropogenic impacts (e.g. the application of chemicals or the building of roads);

— the biological classification and assessment of soils in order to determine the biological quality of soils;

— long-term biogeographical monitoring in the context of nature protection or restoration, including global change [e.g. as in long-term ecological research projects (LTERs)].

Spatial studies focusing on environmental and ecological questions require a carefully designed strategy for collecting data.[9],[10] Before identifying the optimal design, two issues need to be clarified: what is the objective of the study and what is already known about the survey area? Afterwards, one may select one of the well-known design patterns (e.g. grid sampling, random sampling, clustered sampling or random transects) or prepare a study-specific design. In any case, the field sampling design needs to be practical, e.g. the volume of soil to be sampled, depending on the size and distribution of the organisms, needs to be manageable (i.e. the smaller the individual animal, the smaller the size), and cost effective.

In studies focusing on soil invertebrates, it is not possible to observe the entire population. Therefore, sampling is done only at a limited number of locations. The main reason for using statistical sound sampling schemes is that such sampling guarantees scientific objectivity and avoids forms of bias such as those caused by judgement sampling. This is especially valuable if the objective is to obtain data that are representative for the whole area. At the same time, statistics-based sampling schemes ensure standardized sampling methods over time, i.e. if the same area is to be re-sampled in the future, the results will be comparable.

The rationale provided in this document on the design of field sampling methods for soil invertebrates takes into consideration the descriptions provided in ISO 18400-101,[64] ISO 18400-104[67] and ISO 18400-107[69] describing soil sampling in general.

The design of microbiological studies is already covered by ISO 18400-102,[65] ISO 18400-104,[67] ISO 18400-105,[68] ISO 18400-206,[73] ISO 14240-1[58] and ISO 14240-2[59].

Soil quality — Sampling of soil invertebrates —

Part 6:
Design of sampling programmes with soil invertebrates

1 Scope

This document provides requirements and recommendations for the design of field studies with soil invertebrates (e.g. for the monitoring of the quality of a soil as a habitat for organisms). It applies to all terrestrial biotopes inhabited by soil invertebrates, although this information can vary according to the national requirements or the climatic and regional conditions of the site to be sampled.

NOTE While this document aims to be applicable globally, the existing information refers mostly to temperate regions. However, the (few) studies from other (tropical and boreal) regions, as well as theoretical considerations, allow the conclusion that the principles laid down in this document are generally valid.[1],[11],[12],[13]

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1 General terms

3.1.1
community
association of organisms, belonging to different species, families, etc. living at the same time at the same place, i.e. the living portion of an ecosystem

Note 1 to entry: Adapted from Reference [14].

3.1.2
invertebrate
metazoan (Kingdom Animalia or Metazoa) without backbone (spine)

Note 1 to entry: This is not a taxonomic classification, but based on convenience and tradition.

Note 2 to entry: Adapted from Reference [15].

3.1.3
microfauna
soil fauna (invertebrate animals) including individuals with body sizes (length, diameter) between 20 µm and 200 µm

EXAMPLE Water bears (Tardigrade), wheel animalcules (Rotifera) and roundworms (Nematoda).