

Review of sublethal ecotoxicological tests for measuring harm in terrestrial ecosystems

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Audience

The review provides background information and is designed for reference by Agency staff and others assessing harm to terrestrial ecosystems. The tests described in the review may be used to determine the health of an individual organism, a population or whole soil ecosystem. The tests will also be useful in determining the future health of soils and their ability to respond to stress resulting from point source or diffuse pollution events including agrochemical use.

Purpose of the research

This is the first phase of a collaborative project between the Environment Agency and the Centre for Ecology and Hydrology, Monks Wood, Huntingdon. The primary aim of this phase is to review available literature concerning the nature of sublethal biological tests that might be used to assess ecological harm in potentially contaminated soil. The focus of the review is to identify the best ways of characterising the biology of soils, and to formulate a list of research priorities for testing the suitability of tools for assessing soil quality.

Plugging the research gap

Soil is a vital part of our environment and an essential resource. The way we use soil will have important and far-reaching effects on terrestrial ecosystems. During its review of the state of UK soil, the Royal Commission on Environmental Pollution recognised a number of pressures that could reduce soil quality. Among the most important was erosion, loss of organic content and chemical contamination. In the review, we focus specifically on chemical effects.

Biological tests have a number of advantages that make them powerful allies of chemical analysis in assessing the extent of ecosystem contamination. These tests can directly measure effects; respond to all contaminants present; consider contaminant bioavailability; integrate the effects of chemical

mixtures; and provide tools for risk communication. Taken together, these advantages make an overwhelming case for the inclusion of biological tests within a soil risk assessment framework.

A recent Environment Agency project (R&D Technical Reports P299 and P300) has proposed a tiered framework that can be used for ecological risk assessment of potentially contaminated sites within the Part IIA contaminated land regime. Within this, a suite of seven biological tests has been suggested for use in Tier 2 assessment (that is, if a potential risk is indicated following a desk study). The tests are;

two soil functional assays; two sublethal plant tests; two acute invertebrate tests; a microbial biosensor assay.

Although these tests have not yet been trialled, it is recognised that they might prove insensitive or unable to predict the consequences of particular profiles of soil contamination on an ecosystem. Beyond this initial suite, there is a need to employ sublethal bioassays to detect potential long-term chronic stress to components of ecosystems and interpret the ecological significance of these.

Research findings

A wide range of biological tools is available that could be used for assessing soil quality. This review illustrates the extent of research undertaken to assess the potential of standardised tests (Chapter 2), routine academic methods (Chapter 3) and developing procedures (Chapter 4). Recent research programmes have produced a number of new methods with

