



# Science, Technology, Research & Innovation for the Environment

# STRIVE

## SUMMARY OF FINDINGS

### STRIVE Report No. 67

**CréBeo – Baseline data, response to pressures, functions and conservation of keystone micro- and macro-organisms in Irish soils  
(2005-S-LS-8)**

**Author:** Olaf Schmidt, Aidan M. Keith, Julio Arroyo, Tom Bolger, Bas Boots,  
John Breen, Nicholas Clipson, Fiona M. Doohan, Christine T. Griffin,  
Christina Hazard, Robin Niechoj

**Lead Organisation:** University College Dublin

---

European and national policy developments on soil protection and conservation of biological diversity (biodiversity) have exposed knowledge gaps that need to be addressed by research.

---

### Main Objectives of Project

The project had four specific **scientific objectives**:

- To provide baseline data on the distribution and diversity of a range of important soil organisms in major land uses and soil types in Ireland;
- To establish the need for protecting specific habitats where soil-dwelling ant species occur;
- To investigate under field conditions the response of important organisms to pressures caused by land spreading of organic waste materials;
- To conduct innovative ecological experiments that examined links between biodiversity and functions in soils.

## Key points

- A survey was conducted of the diversity of micro-organisms (bacteria and fungi), root-associated fungi (mycorrhizas), nematodes (microscopic worms), earthworms, micro-arthropods (mites) and ants at 61 sites representing 5 dominant land uses and 8 major soil groups in Ireland. The survey produced a wealth of new data on the occurrence, abundance and diversity of these organisms; it showed that patterns of biodiversity across land use classes varied for different groups of organisms, that soil type had limited effects on biodiversity, but soil properties were related to the diversity of many soil organism groups. Differences across classes suggest that the usefulness of particular taxa/groups as biodiversity indicators may be land use specific, while variation within land uses suggests that this classification could be refined. Previously unrecorded species include 13 predatory nematodes, an earthworm endemic to southern France and a mite species potentially new to science. These findings highlight the lack of inventory data on soil organisms in Ireland; increasing the number of sites would likely lead to further discoveries. This survey provides the first systematic baseline data for future monitoring and reporting on biodiversity in Ireland.
- Eighty field sites in 10 habitat types were surveyed and characterised in terms of their conservation value for rare ant species and other vulnerable organisms that are associated with ants.
- The biodiversity of key functional groups in agricultural soils was shown to be resilient to the application of a common soil management pressure. In two replicated field experiments, annual land-spreading for two years of two types of biosolids (treated sewage sludge) at permitted rates ( $\sim 5$  t dry matter  $ha^{-1}$ ) had few measurable effects on soil micro-organisms, mycorrhizal fungi or nematode worms, and had positive effects on earthworm abundance in an arable soil. Temporal variability was generally greater than treatment effects for all soil organism groups.
- New molecular biology and isotopic tools were used to investigate the inter-relationships of important soil species and ecological functions. Grassland ants were shown to alter the properties of soil and to harbour (in their nests and abdomens) different micro-organisms and functional genes related to nitrogen cycling than occur in soil. Earthworm species that feed on plant residues were shown to contribute to the recycling of nitrogen and carbon; any loss of such species (e.g. through predation by exotic flatworms) would have impacts on ecosystem functions such as decomposition and nutrient cycling.

## **Recommendations**

- For soil biological monitoring in Ireland:
- To revise and differentiate more land-use classes including separation of coniferous and broadleaf woodland, and permanent and ley pastures;
- To identify benchmark or target sites so that monitoring can be assessed against a soil biological typology;
- To use a tiered structure of core indicators at all sites and specific indicators at appropriate sites;
- To integrate measurements of soil processes in order to make better links between soil biodiversity and function;
- To establish a working group to oversee the development of a national monitoring scheme.
- For protecting habitats where soil-dwelling ants occur:
- To set up a nationwide recording scheme including the major Irish habitat types to provide data, currently lacking on many Irish ant species;
- To assure and extend the guaranteed protection of limestone pavements as prime habitats for species richness of ants, and many other species;
- To compile knowledge on localities where ant species are known to support populations of rare species such as the Chough or myrmecophiles, e.g. sites with *Formica lemani* and *Microdon mutabilis* (Diptera; Syrphidae) for an integrated approach to conservation;
- To rapidly develop species action plans for conservation of species which are rare and vulnerable (especially *Formica lugubris*, *Lasius fuliginosus*) and their habitats.
- Relating to further research on pressures on and functions of soil organisms:
- To examine the long-term effects of biosolids on soil functioning;
- To examine sub-lethal effects of biosolids that could have longer-term implications for soil organism populations;

- To examine relationships between temperate ants, microbes and soil functions.

#### **For Further Information**

Contact: Olaf Schmidt (UCD School of Agriculture, Food Science and Veterinary Medicine, Agriculture and Food Science Centre, University College Dublin, Belfield, Dublin 4, Ireland. Tel.: +353 1 7167076, E-mail: olaf.schmidt@ucd.ie

This report is published as part of the Science, Technology, Research and Innovation for the Environment (STRIVE) Programme 2007–2013. The full report is published by the EPA and is available from <http://www.epa.ie/downloads/pubs/research/land/>

#### **Publications connected to this work**

Keith, A. M and Schmidt, O. (in press) First record of the earthworm *Prosellodrilus amplisetosus* (Oligochaeta: Lumbricidae) outside continental Europe. *Irish Naturalists' Journal*.

Keith, A.M., Griffin, C.T. and Schmidt, O., 2009. Predatory soil nematodes (Nematoda: Mononchida) in major land-use types across Ireland. *Journal of Natural History* **43**: 2571–2577.

Schmidt, O. and Keith, A., 2010. Soils – the last frontier. *Biodiversity Ireland: Bulletin of the National Biodiversity Data Centre* **6** (Autumn), p. 11.