# Developing and Evaluating Indicators for Biodiversity: The EcoFINDERS Project

*Rachel Creamer, Dote Stone*

*Teagasc Env Research Centre, Johnstown Castle, Wexford*
*Rachel.Creamer@teagasc.ie*

## Introduction

The majority of soil processes are mediated by the soil biota. Soil biodiversity is the engine driving soil based ecosystem services such as food production, nutrient cycling, carbon sequestration, and water purification (Wardle et al. 2004). The European Commission (DG ENV) acknowledge the importance of soil biodiversity in the role of ecosystem functioning and the Commission's soil strategy is to protect and enhance soil based ecosystem services, with a view to promoting sustainable intensification of agriculture. There is, however, not enough information available on soil biodiversity across Europe to allow informed policy decisions (Creamer et al. 2010).

The EcoFINDERS (FP7) project was set-up in 2011 to identify soil threats, harmonize methods for measuring biodiversity and to generate European datasets of soil biodiversity and ecosystem function. Teagasc is the lead partner in the work package dedicated to developing and evaluating such indicators.

Both known and novel indicators are being assessed across a range of land-uses and European climate zones. Large-scale sampling campaigns are underway to determine the normal operating range (NOR) of potential biodiversity indicators and their sensitivity to soil threats.

## Materials and Methods

Indicators were selected by a vigorous sifting process known as a logical sieve which allowed the selection of indicators that would provide information meaningful and useful to end-users, such as policy makers and land managers (Ritz et al., 2009). The logical sieve was applied to a large pool of indicators culled from the literature. This took place at a workshop of experts gathered together in December 2011 and resulted in a list of indicators to be tested (Table 2)

**Table 1. Indicators selected by Logical sieve and assessed by sampling LTOs and Transect sites**

| Biodiversity | Function |
|---|---|
| TRFLP (DNA) | |
| Protozoa (DNA) | |
| PLFA | |
| Fungi (ergosterol) | |
| FG nitrification (DNA) | |
| FG denitrification (DNA) | |
| Earthworms | |
| Enchytraeids | |
| Micro-arthropods | |
| Nematodes | |
| | Bait Lamina |
| | Water infiltration |
| | Resilience |
| | Nitrification |
| | HW-C & PM-N |
| | Micro-resp |
| | Enzyme Activity |
| | FG Supressiveness |

Using partner owned sites of long standing (Long Term Observatories or LTOs), the sensitivity of indicators to soil threats across 6 sites were assessed. The sites used incorporated different land uses and management practices.

In addition, a transect of 81 sites across Europe of varying land use and climatic zone were sampled for the presence of biodiversity indicators. Sites ranged from Mediterranean arable soils to Boreal forest soils and included Alpine pastures and wet Atlantic soils.

## Results and Discussion

A list of most appropriate to measure indicators selected at the logical sieve workshop can be seen in Table 1 and was used in the Indicator-LTO testing.

The indicator-LTO sampling campaign was successfully carried out in the autumn of 2012. Six LTO sites were visited and samples taken from control plots and plots of the most extreme treatment (Table 2).

**Table 2. Indicator-LTO sites**

| Land use | Treatment | Climate zone |
|---|---|---|
| Arable | conv/organic | Continental |
| Arable | till/no-till | Atlantic |
| Arable | till/no-till | Pannonian |
| Arable | cereal/fallow | Mediterranean |
| Grass | Intensive /extensive | Continental |
| Grass | Intensive /extensive | Atlantic |

The Transect sampling campaign was successfully carried out in the Autumn of 2012. 81 sites were sampled over 3 months and analyses are currently underway across Europe at partner institutions (Figure 1).


**Figure 1. Transect sample map**

## Conclusions

The dataset collected in this large-scale sampling campaign will allow the EcoFINDERS project to recommend specific indicators of biodiversity and ecosystem function to the EU for the purposes of policy development.

## Acknowledgements

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## References

Creamer et al. (2010) Implications of the proposed Soil Framework Directive on Agricultural Systems in Atlantic North-west Europe - a Review, *Soil Use and Management,* 26;198-211

Wardle et al. (2004) Ecological linkages between aboveground and below-ground biota, *Science,* 304;1629-33.