The drilosphere of anecic earthworms: A hotspot of biochemical and biological activity

W. S. Andriuzzi1,2, P. Ngo3, S. Geisen4, K. Dumack4, T. Bolger5, M. Bonkowski4, C. Rumpel3, O. Schmidt2

Anecic earthworms are “ecosystem engineers”

- Anecic earthworms make permanent vertical burrows in the soil
- The soil around them is the drilosphere
- The earthworm-mediated incorporation of surface organic matter increases soil biochemical heterogeneity and macroporosity

What we did

- We used stable isotope tracers to investigate C and N incorporation in soil around burrows by anecic earthworms
- We analysed sugar composition in the soil organic matter and studied the protists in the drilosphere
- We compared active (= with earthworm) and inactive (= without earthworm) burrows

What we found

- In the topsoil the drilosphere is larger than previously assumed (≥ 8 mm wide, not 2 mm)
- Earthworm presence necessary to maintain distinct drilosphere properties, both biochemical and biological
- Interactive effects of earthworm presence and soil microhabitat on the density of some important amoebozoan groups
- But two co-occurring anecic earthworm species had dissimilar effects
  - L. centralis incorporated more fresh residue than A. longa, with consequences on soil biochemistry (e.g. less decomposed SOM)

How we did it

- Found openings of natural earthworm burrows at the soil surface
- Placed plant litter enriched in 13C and 15N stable isotopes around them
- Collected topsoil after ~50 days
- Took small concentric layers around the burrows (0-2, 2-4, 4-8 and 50-80 mm)
- Measured soil δ13C and δ15N signatures
- In study 2, analysed sugar composition of SOM and identified protists

1 Department of Soil Quality, Wageningen University, Wageningen, The Netherlands, walter.andriuzzi@wur.nl; 2 School of Agriculture & Food Science, University College Dublin, Dublin, Ireland; 3 BIOEMCO, CNRS-INRA-Université Paris VI, Thiverval-Grignon, France; 4 Department of Terrestrial Ecology, Institute of Zoology, University of Cologne, Köln, Germany; 5 School of Botany and Environmental Science, University College Dublin, Dublin, Ireland

This work was supported by the European Commission within the EcoFINDERS project (FP7-264465) and by the Irish Research Council with a Ulysses grant.