Biological Diversity and Ecosystem Function in Soil

Soil Biodiversity

NERC Thematic Programme

Natural Environment Research Council

Newsletter - Issue number 2 *Dec 1998*

Report from the Award Holders Meeting at University of York, 16 – 18 Sept 1998

This meeting was held in the York Conference Centre to help foster collaboration between the researchers and ensure integration of the projects at an early stage in the Soil Biodiversity Programme. Each of the awards was represented at the meeting, along with a party of US collaborators from the US-NSF Soil Biodiversity Programme from Colorado State University, pictured to the right. Various guests from linked programmes and facilities were also at the meeting.

On the first day each award holder gave a presentation on their proposed work and how it fitted into the Programme.

On the second day award holders divided into three topic groups to discuss *inter alia* the links between the various projects and how they would integrate on methods and data. Each group was summarised in a plenary session.

Topics	1. Taxonomy	2. Experiments	3. Sampling
Sessions	prokaryotes	models	microscosms
	fungi	treatments	mesocosms (Ecotron)
	protozoa/nematodes	carbon flux	field
	arthropods/annelids	baseline data	

Much discussion took place and some good interaction achieved. Hard work for those involved, but a good start for the Soil Biodiversity Programme.

Elizabeth Skinner, Programme office

Left to right: Stan Blum, Tom Powers, Valerie Behan-Pelletier, Bill Hunt, Diana Wall (nee Freckman), Tim Seastedt and Andy Parsons.

The US-NSF Programme

Surprisingly few data exist on the factors affecting soil community structure and function, or the relation of soil biodiversity to ecosystem function.

The US-NSF programme are studying:

- Plant influence on belowground biodiversity
- Consequences of soil biodiversity on ecosystem processes

Field experiments will test controls on soil community structure and diversity. We will examine plant species diversity, plant functional diversity (C3 *vs* C4 species), resource quality, net primary productivity, and soil abiotic characteristics. The sites chosen are the Konza Prairie Long-Term Ecological Research (LTER) site (Kansas), and a one time sampling at the Cedar Creek Natural History Area LTER site (Minnesota) to test the hypothesis that soil nematode diversity tracks plant biodiversity. The combined studies will form the basis for a collaborative and co-ordinated effort with the NERC programme based at Sourhope.

Diana Wall, NERL Colorado State University

AWARD HOLDERS - first named principal investigator

1/2105 Dr Mark Blaxter — University of Edinburgh — £180k*
Title: Development of a molecular barcode system for soil nematode identification
E-mail: mark.blaxter@ed.ac.uk

4/2108 Prof Peter Young — University of York — £190k*
Title: Function and taxonomic diversity of mycorrhizas in grassland
E-mail: jpy1@york.ac.uk

5/2109 Dr Peter Millard — Macaulay Land Use Research Institute, Aberdeen — £214k
Title: Mangement of field experiments at Sourhope
E-mail: p.millard@mluri.sari.ac.uk

7/2111 Dr Clare Robinson — King's College, University of London — £64k*Δ
Title: Biodiversity of saprotrophic fungi of grassland in relation to their function
E-mail: clare.robinson@kcl.ac.uk

9/2113 Dr Phil Murray — Institute of Grassland and Environmental Research, North Wyke — £234k*
Title: Biodiversity of invertebrate root feeders and their impact on soil microbial communities
E-mail: phil.murray@bbsrc.ac.uk

11/2115 Dr Phil Ineson — Institute of Terrestrial Ecology, Merlewood — £323k
Title: Soil faunal biodiversity and carbon cycling
E-mail: p.ineson@ite.ac.uk

12/2116 Dr Ian Head — University of Newcastle — £257k*
Title: Effects of soil improvement treatments on bacterial community structure and function
E-mail: i.m.head@newcastle.ac.uk

13/2117 Dr Jonathan Leake — University of Sheffield — £168k
Title: The effects of mycorrhizal mycelium on the diversity, biomass and functioning of soil microbial communities and its role in carbon and nutrient cycles
E-mail: j.r.leake@shef.ac.uk

14/2118 Prof Jim Prosser — University of Aberdeen — £211k*
Title: The influence of land-use management practices on species and functional biodiversity of nitrite-oxidising bacteria and nitrification and denitrification processes
E-mail: j.prosser@abdn.ac.uk

15/2119 Prof John Lawton — NERC Centre for Population Biology — £273kΔ
Title: Soil biodiversity, carbon and nitrogen fluxes in replicate, model Sourhope ecosystems: an Ecotron experiment
E-mail: j.h.lawton@ic.ac.uk

21/2125 Dr Anne Glover — University of Aberdeen — £146k*
Title: What is the link between microbial diversity and soil resilience?
E-mail: l.a.glover@abdn.ac.uk

23/2127 Prof Donald Davidson — University of Stirling — £173k
Title: Interactions of soil biodiversity, micromorphology, structure and organic matter
E-mail: d.a.davidson@stir.ac.uk

25/2129 Prof David Hopkins — University of Dundee (Universtiy of Stirling from Jan 99) — £187k*Δ
Title: Earthworm diversity and the integration of physical, biochemical and microbiological functions
E-mail: d.w.hopkins@dundee.ac.uk

26/2130 Dr Bland Finlay — Institute of Freswater Ecology, Windermere — £281kΔ
Title: Soil protozoan diversity and its role in carbon and nitrogen turnover
E-mail: b.finlay@ife.ac.uk

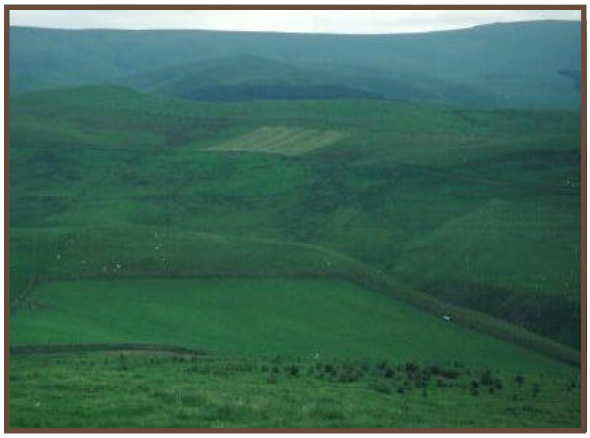
29/2133 Dr Richard Bardgett — University of Manchester — £171k
Title: The relationship between diversity, biomass and function of soil microarthropod communities
E-mail: rbardget@fs1.scg.man.ac.uk

32/2136 Dr Mark Bailey — Institute of Virology and Environmental Microbilogy, Oxford — £172k*
Title: Establishing the link between functional and total bacterial diversity, its response to perturbation and effect upon carbon flux to other trophic levels
E-mail: mbj@mail.nerc-oxford.ac.uk

34/2138 Dr Elizabeth Wellington — University of Warwick — £180k*
Title: Assessment of chitin decomposer diversity: the role of actinomycetes and other bacteria in C and N cycling in limed and unlimed grasslands.
E-mail: eg@dna.bio.warwick.ac.uk

* Studentship additional to award. Δ Value of award still awaiting confirmation.

SOURHOPE BASELINE DATA HANDBOOK



Rigg Foot experimental plots viewed from Fasset Hill, Sourhope Research Station.

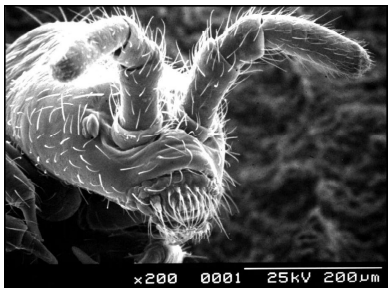
In July and August 1998 a comprehensive survey was done on the soils and surface vegetation of the Rigg Foot main plots. Soil samples were taken across each 12 x 20 m main plot, bulked for chemical analysis. A soil profile pit was dug and horizons described in each of the five blocks. Plant species frequency was recorded in five randomly placed 0.25 m squares. Soil data were subject to anova and PCA to pick out block effects, there being differences, but no clear gradient. Vegetation analyses revealed some heterogeneity between the plots, with species abundance differences sufficient to shift the National Vegetation Class in some cases. A preliminary data handbook was produced for the York meeting, an edited and amplified version of which is now available from the Programme office.

MAIN PLOT TREATMENT ALLOCATION - York Design

5A	5B	5C	5D	5E	5F
Cutting with removal of clippings Control 5	Liming treatment + cutting with removal Liming 5	Nitrogen addition + cutting and removal Nitrogen 5	Nitrogen addition + liming, cutting and removal Nitrogen/Lime 5	Biocide with cutting and removal Biocide 5	Fallow with no plant cover Fallow 5
4A	**4B**	**4C**	**4D**	**4E**	**4F**
Fallow with no plant cover Fallow 4	Biocide with cutting and removal Biocide 4	Nitrogen addition + liming, cutting and removal Nitrogen/Lime 4	Cutting with removal of clippings Control 4	Nitrogen addition + cutting and removal Nitrogen 4	Liming treatment + cutting with removal Liming 4
3A	**3B**	**3C**	**3D**	**3E**	**3F**
Nitrogen addition + liming, cutting and removal Nitrogen/Lime 3	Liming treatment + cutting with removal Liming 3	Biocide with cutting and removal Biocide 3	Cutting with removal of clippings Control 3	Fallow with no plant cover Fallow 3	Nitrogen addition + cutting and removal Nitrogen 3
2A	**2B**	**2C**	**2D**	**2E**	**2F**
Nitrogen addition + cutting and removal Nitrogen 2	Cutting with removal of clippings Control 2	Liming treatment + cutting with removal Liming 2	Biocide with cutting and removal Biocide 2	Nitrogen addition + liming, cutting and removal Nitrogen/Lime 2	Fallow with no plant cover Fallow 2
1A	**1B**	**1C**	**1D**	**1E**	**1F**
Nitrogen addition + liming, cutting and removal Nitrogen/Lime 1	Liming treatment + cutting with removal Liming 1	Nitrogen addition + cutting and removal Nitrogen 1	Fallow with no plant cover Fallow 1	Biocide with cutting and removal Biocide 1	Cutting with removal of clippings Control 1

ECOTRON

The Ecotron is a unique controlled environment facility based at the NERC Centre for Population Biology, Silwood Park that allows up to 16 individual, (1 m^2) terrestrial ecosystems to be created under precisely controlled environment conditions, with known flora and fauna, and standardised microbial assemblages. The most recently completed series of experiments in the Ecotron (part-funded by the TIGER programme and carried out by an international team of researchers involving over 26 principal collaborators), had, as one of its main foci, the impacts of rising CO_2 and temperature on below-ground microbial and arthropod diversity, and ecosystem processes. These studies have demonstrated the potential opportunities provided by the Ecotron to measure, accurately and in detail, carbon and nutrient fluxes in intact model terrestrial ecosystems.



Folsomia candida, one of the species of collembola used in the Ecotron experiments.

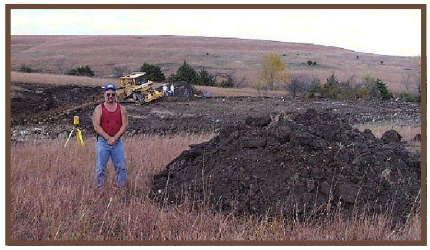
As part of the Soil Biodiversity Programme the research team aim to create model analogues of Sourhope grassland using the Ecotron facility. By controlled manipulations of the soil fauna it should be possible to understand the role of different faunal groups, and their interactions, in soil carbon and nitrogen fluxes. During the experiment it is also hoped to:

- characterise the taxonomic and metabolic diversity of these analogue ecosystems
- determine the impacts of experimentally manipulating faunal size-classes, on the abundance, species richness and composition of soil bacteria, fungi, and non-manipulated fauna
- document pathways and rates of movement of carbon and nitrogen through these model systems and determine how experimental treatments impact upon these fluxes.

A primary aim of the Ecotron work is to generate experimental results and prediction considerably faster than will be possible at the field site. These predictions can then be critically examined by the research groups working at the field site. It is hoped also to be able to measure the resistance and resilience of the model systems when subjected to an experimentally imposed perturbation.

Hefin Jones (Ecotron Project Leader) is currently co-ordinating all expressions of interest in possible collaboration with the research team. A users meeting is being planned in late 1998 to initiate discussions on the experiment – more details will be forwarded soon to those who have expressed interest in collaboration. Any queries: contact Hefin Jones on 01344 294483 (tel); 01344 873173 (fax); t.h.jones@ic.ac.uk (e-mail).

A LITTLE BIT OF KONSA



The picture shows soil at the Konsa Prairie, USA, ready for its long trip to Sourhope! The soil developed under this C4 vegetation provides an ideal natural C isotope label for carbon dynamics work under the Soil Biodiversity Programme

(Best caption for this photo will appear in the next newsletter – answers to the Programme office.)

DATES FOR THE DIARY

23 & 24 Sept 1999	Proposed date for the award holders annual meeting. Venue to be advised.

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