

NERC Soil Biodiversity Thematic Programme

**Protocol for Sampling and Recording at the
Sourhope Experimental Site**



D J Caffrey
A M J Lane
A Fitter
R Scott
21st April 1999

(V1.1 1st August 2001)

Soil Biodiversity

NERC Thematic Programme

Protocol for Sampling and Recording at the Sourhope Field Experiment Site

1. Introduction

The Sourhope Field Experiment Site at Rigg Foot, Sourhope has been designated as the focus of intensive, co-ordinated research under the NERC Soil Biodiversity Programme. A sampling protocol is necessary to co-ordinate operations and to support integration of the individual projects. This protocol describes the layout of the experimental design and the procedures which should be followed when sampling, setting up experiments or taking measurements from the site.

2. Experimental Design

2.1 The Field Site and Layout of Sampling Areas

The designated site is situated on the north-facing slope of Rigg Foot, at the Macaulay Land Use Research Institute's research station at Sourhope. The Rigg Foot site lies at around 309m above sea level, varying in slope from 8° at the upper end to 4° towards the lower reaches. The site is dominated by brown forest soils of the Sourhope and Bellshill series with some gleying on the lower slopes. The soils are developed in materials derived from andesite and other intermediate igneous rocks. The vegetation is predominately the National Vegetation Classification (NVC) community U4d: *Festuca ovina* - *Agrostos capillaris* - *Galium saxatile* grassland, *Luzula multiflora*-*Rhytidiadelphus loreus* subcommunity. A high fence bounds the site to exclude grazing.

The combination of treatments and experiments required for the programme has led to the experimental design shown in Appendix I.

The sampling area consists of 5 rows or 'Blocks', labelled 1-5, each having 6 'Main-plots', labelled A-F. Six different treatments (see 2.2 below) have been allocated randomly to the Main-plots within each Block. The Main-plots are each 20m x 12m in size and are separated by guard areas to allow movement around the site with minimal disruption to the sampling areas and to provide a buffer between the different types of treatments. The Main-plots are marked with strings between skewers in their 4 corners and labelled at the bottom left corner (north-east).

Each Main-plot is sub-divided into 10 Sub-plots (labelled P-Y), as shown in Appendix II. Sub-plots are themselves separated by narrow guard areas to give some distance between the different sub-plot treatments (see 2.2 below) and to provide a region for moving around the plot to minimise disturbance on the sampling areas. As the guard areas will receive the Main-plot treatment, these regions should also be used for filling in areas in the sub-plots where

destructive sampling has taken place. The Sub-plots are marked with skewers in their 4 corners and labelled at the bottom left corner (north-east).

Each Main-plot is gridded into Cells, each 0.5m x 0.5m, to form the basis for all sampling/recording. These cells have been designated as the minimum spatial unit by which samples will be referenced in the Soil Biodiversity database, with the combination of Block/Main-plot/Sub-plot/Cell providing the full spatial referencing system for the field site. All sampling/recording should be tied to specific Cells referenced by their X and Y coordinates from the origin at the bottom-left corner of the Main-plot (see diagram in Appendix II). These cells will not be specifically marked on the site, but should be located by measuring within the subplots from the bottom-left corner.

2.2 Treatments

There are 6 main treatments (4 applied treatments and 2 controls) which are allocated randomly to the Main-plots within each Block (see in Appendix I):

- Liming
- Nitrogen
- Nitrogen & Liming
- Biocide
- Control 1
- Control 2

To accommodate the requirement for special treatments to be applied on top of and in addition to the 6 Main-plot treatments, sub-plots P,Q,R,W,X and Y will receive treatments or have designations which vary according to which Main-plot treatment they receive. Sub-plots S,T U and V will not receive additional treatments so that they can be used for general sampling of Main-plot treatments. Sub-plot treatments are as follows:

- ^{13}C
- Destructive sampling
- ^{13}C and Anoxia
- Sewage sludge
- Pesticide
- Metal
- Plough and re-seed
- Fallow

Appendix II shows how these Sub-plot treatments are combined with and allocated across Main-plot treatments.

Cutting:

Mowing will be carried out every three weeks during the growing season. The access paths will be cut to approximately 3 cm whilst the main-plot areas will be cut to 6 cm, level ground permitting. All cuttings will be removed from the whole site.

3. Sampling and Recording

3.1 Strategies and recommendations

All sampling and recording at the Sourhope site should be located in relation to specific Cells, selected either randomly or with reference to pre-established patterns of site heterogeneity. Once sampled, any individual cell will normally only be available for future sampling by the same research team or others working in collaboration. Where several samples may be taken from within a cell over time, a record must be kept by the research team of the exact locations to ensure no point is re-sampled. Any permanent markers used should be flush with the ground surface to allow for mowing; special arrangements will need to be made for anything taller. Investigators are encouraged to use the four central Sub-plots S-V as within-main-plot replicates in order to be able to establish the significance of within-main-plot variation. Samples should normally be made over a depth of 0-10, 0-5 or 5-10cm, or by horizon. Where horizon is used the depth ranges must also be recorded. Any sampling over other depth ranges should be made against specific scientific criteria. Depths should be measured relative to the ground surface (upper surface of the soil litter layer) i.e. 0 = ground surface.

With many different projects and researchers involved in the Programme, there is a need to ensure a co-ordinated approach to sampling and a standardised method of recording, to allow cross-referencing of samples and data wherever possible, and to minimise damage. Standard referencing and coding systems have been devised and built into the Site Visit Record Sheets (see Appendix IV); these forms should be used to record any sampling, experimental or measurement activity on site.

3.2 Sample Identification and Labelling

All soil samples will be referenced to the original 'Sampling Unit' from which they were extracted at the field site. The term 'Sampling Unit' refers to the unit of soil sampled in relation to its 2-dimensional position on the ground surface, at a given point in time. It may refer to an individual core, auger sample, turf, monolith, pit or any other distinct block/unit of soil sampled. A unique 'Sampling Unit Identifier' (SUID) will be allocated by the Sourhope Field Experiment Manager to each Sampling Unit. To this SUID will be attached the spatial reference (Block/Main-Plot/Sub-Plot/Cell), the sampling date, Project Code, Sampling Unit type (core, auger sampling, etc.) and Sampling Unit dimensions. The SUID thus provides a means by which samples and their associated data can be related to the original sampling activity at the field site and cross-referenced across projects.

In most cases, the SUID will also relate to the original physical soil sample as extracted from the ground and taken away (e.g. a complete core). However, in some cases, for example a soil pit, it may be that only sub-samples by depth band or horizon are physically taken away, and the SUID will relate to the whole pit.

Complete samples extracted from the whole Sampling Unit (e.g. a complete core) can use the SUID as their unique identifier. Because of the infinite possibilities for generating derived samples from the original Sampling Unit, for example taking sub-samples by depth/horizon or bulked samples from several Sampling Units, additional systems for identifying and labelling sub or super-samples will need to be devised and handled by each project team, tailored to their own needs. However, it is most important that the SUID should 'track'

samples throughout analyses and archiving, and be spawned through any derived samples, however, wherever and whenever it takes place. Derived samples should be given identifiers which either include or are accompanied by the original SUID, and which enable the derivation of the sample from the original Sampling Unit to be traced. For example, for simple splitting of the original Sampling Unit, a suffix sub-sample code might be attached to the SUID, e.g.101-A, where 101 is the SUID; sub-samples by depth band might use a digit (1,2,3) and sub-samples by horizon might use an alphabetic character (A,B,C). Projects planning more complicated regimes of splitting/bulking will need to devise more sophisticated systems. Whatever system is devised should also be used within project datasets/databases and accompany sample data and meta-data sent in to the Soil Biodiversity database at ITE Merlewood. Sub-samples by horizon must also be accompanied by details of the horizon depth ranges.

Soil samples should be stored in clearly marked polythene bags placed inside a second, similar bag. The outer bag should carry the SUID written with a permanent marker. A label should be placed on the inner bag, carrying at least the following information in permanent ink:

SUID

Derived sample ID (if applicable)

Project Code (of 'lead' project)

Spatial Reference (Block/Main-Plot/Sub-Plot/Cell X&Y)

Sampling Date

3.3 Sample Archiving

Vouchers of all soil samples should be archived at the time of collection. Temporary storage is available in a -20°C freezer at Sourhope; long-term storage at -80° will be available at ITE Merlewood.

3.4 Experimental Set-ups/Inputs

The installation of experimental set-ups (permanent or semi-permanent apparatus), for example rhizotrons or litter bags, or the input of materials into the ground for example injection of gas or introduction of worms into the soil needs to be recorded. Each experimental set-up or input at a particular place should be assigned an ID by the project team responsible, which will uniquely identify it within that project. Measurements taken from the same set-up at a later date should relate to this ID.

3.5 Measurement/Recording

Measurements taken the field site may relate to particular point locations, for example soil moisture recording sites, or delimited regions, for example vegetation quadrats. Each measurement or recording location, i.e. point or region on the ground surface at which measurements take place, should be assigned an ID by the project team responsible which will uniquely identify it within that project. Where measurements relate to an experimental set-up, then the ID of the experimental set-up should be used, or incorporated within the measurement location ID to enable a link to be made. Where more than one project takes measurements from the same set-up or measurement location (e.g. vegetation plot or soil condition monitoring point), then those projects should reference the same ID.

4. Site Visit Procedure

All sampling and recording carried out at the Sourhope field experiment site will be authorised and co-ordinated by the Field Experiment Manager. The following procedure should be adopted by all investigators planning to visit the site for sampling, experimental or measurement purposes:

4.1 Pre- Site Visit: Visit Registration Form

Prior to visiting the field experiment site, researchers must complete a Visit Registration Form to outline their visit plans and experimental requirements (see Appendix III). This information is essential for the Sourhope Field Experiment Manager to ensure that investigators' requirements can be met, sampling/experimental areas allocated, visits co-ordinated to prevent damage, and any potential for joint sampling identified. The form can be found on the Soil Biodiversity Webpages (www.nmw.ac.uk/soilbio). On completion of the form, pressing the 'Submit' button will automatically email the information to the Sourhope Field Experiment Manager (Sarah Buckland) and send a copy to the Programme Manager (Richard Scott). The Field Experiment Manager will respond to confirm visit plans or to discuss possible alternative arrangements. Any potential for the sharing of samples between groups which have not already been identified may also be discussed at this stage. Investigators should wait for authorisation before visiting the site.

4.2 Site Visit : Site Visit Record Sheets

All visitors to Sourhope must first report to the Field Experiment Manager before proceeding to the field site. The Field Experiment Manager will confirm or allocate exact locations for sampling, recording or experimentation within the plots, provide the appropriate Site Visit Record Sheets and allocate Sampling Unit IDs (SUID). Visitors should complete these sheets whilst on site, recording exactly what they have done where (see Appendix IV). This information is essential in order to log and cross-reference the type, location and purpose of sampling/experimentation at the site within the Soil Biodiversity database, so that baseline data and project datasets can eventually be integrated (see section 4.3 below).

The completed Site Visit Recording Sheets should be left with the Field Experiment Manager, who will forward a copy to the Asst. Data Manager (Deirdre Caffrey) for incorporation within the Soil Biodiversity database. Investigators should make their own copy at Sourhope (photocopying facilities are available) to ensure that the standard referencing system and SUIDs supplied and attached to samples are referenced within their own datasets/databases.

4.3 Post Site Visit: Data Handling

The Soil Biodiversity database at ITE Merlewood will hold baseline data for the field site, details of project activities (sampling, experiments, measurements) derived from the information supplied on the Site Visit Record Sheets, and eventually the actual project data. The SUIDs, experimental set-up IDs and measurement location IDs, together with the spatial reference coding system (Block/Main-plot/Sub-plot and Cell), form the basis for the eventual linking of samples, data and meta-data on field activities and cross-project research concerned with the Sourhope site. It is most important that these IDs and the spatial referencing system are maintained throughout individual project datasets/databases in order

to enable this linking of project datasets to take place within the Programme database. In particular, the SUID must accompany any sample extracted or derived from that original Sampling Unit, and any analytical/experimental results generated from it. Details of any sub-sampling or bulking of samples and the system adopted for identifying such derived samples and their data should be sent to the Assistant Data Manager at ITE Merlewood as soon as this is known. Project teams are encouraged to contact the Data Managers (see below) at ITE Merlewood for any advice and guidance they might require on the allocation of unique IDs and managing project datasets.

5. Contact Information

Soil Biodiversity Field Experiment Manager at Sourhope:

Graham Burt-Smith
MLURI Research Station
Sourhope
Kelso
Roxburghshire
TD5 8PZ
Tel: 01573 420229
Fax: 01573 420683
Email: g.burt-smith@macaulay.ac.uk

Soil Biodiversity Programme Manager:

Richard Scott
Institute of Terrestrial Ecology
Merlewood Research Station
Grange-over-Sands
Cumbria
LA11 6JU
Tel: 015395 32264
Fax: 015395 35343
Email: Soil.Biodiversity@ite.ac.uk

Soil Biodiversity Data Management:

Mandy Lane (ECN Database Manager)
Environmental Change Network (ECN)
Institute of Terrestrial Ecology
Merlewood Research Station
Grange-over-Sands
Cumbria
LA11 6JU
Tel: 015395 32264
Fax: 015395 34705
Email: M.Lane@ceh.ac.uk

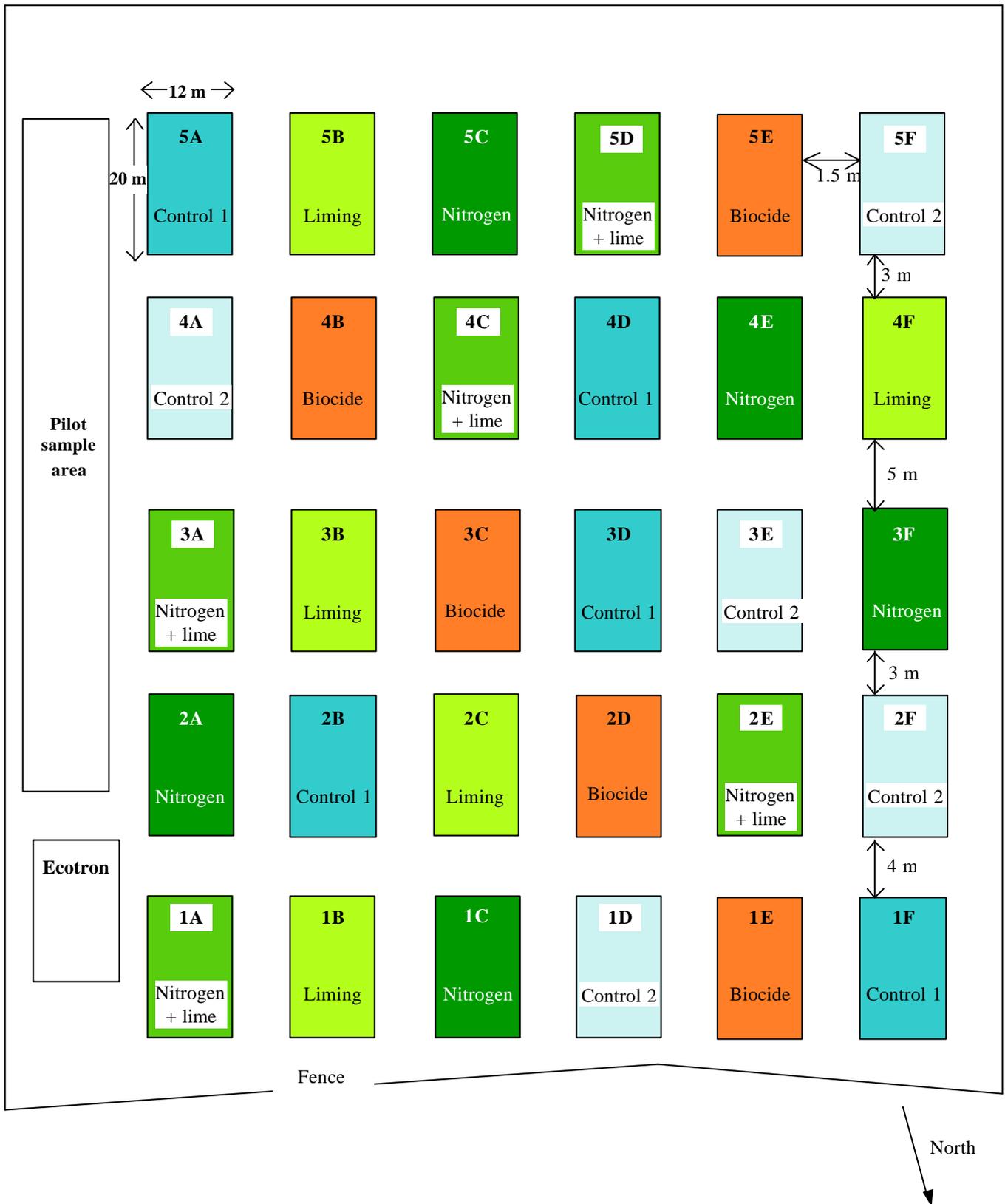
D J Caffrey
A M J Lane
A Fitter
R Scott

21/4/1999

List of Appendices

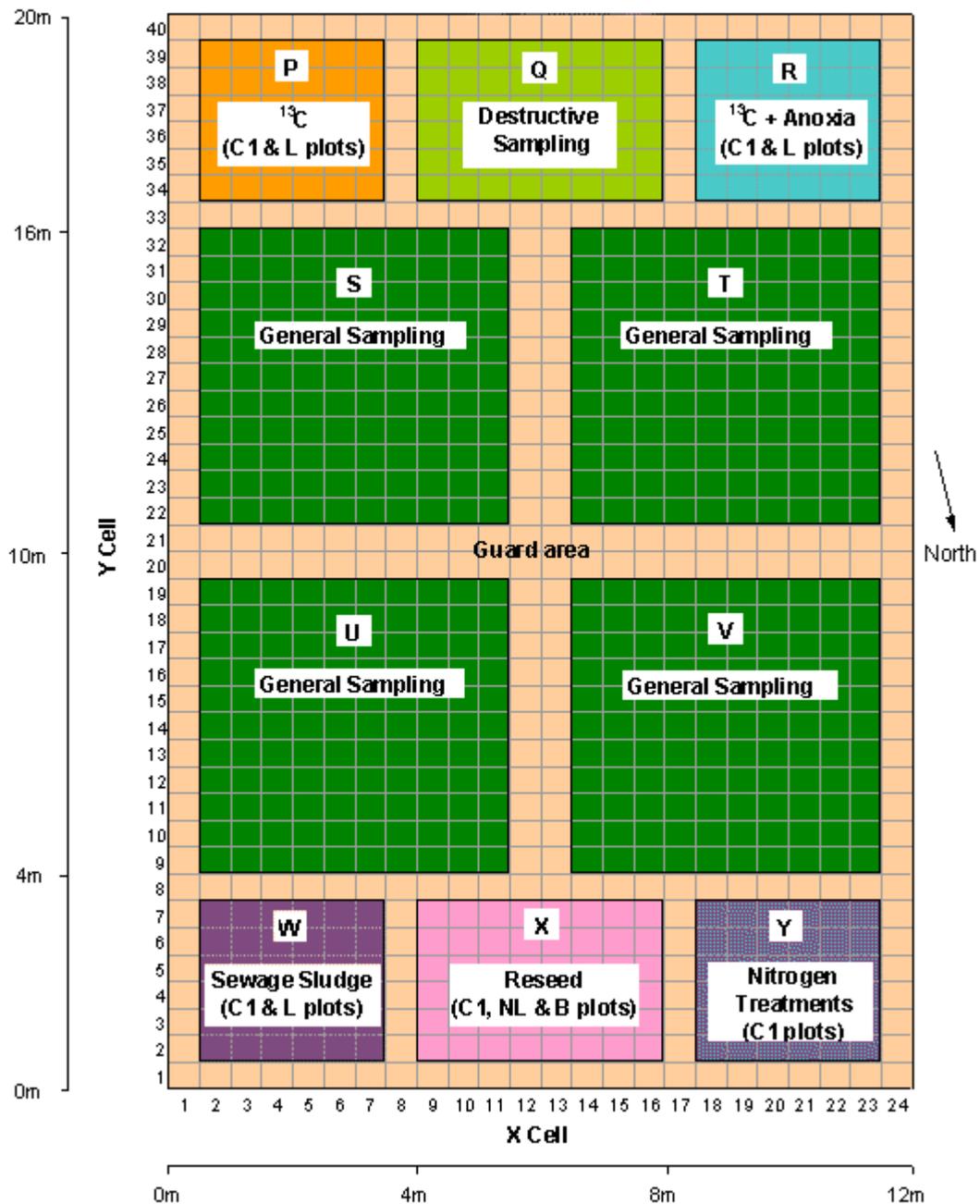
Appendix I :	Main-plot Design
Appendix II :	Sub-plot Design
Appendix III:	Site Visit Registration Form
Appendix IV:	Site Visit Record Sheets

Appendix I: Main-plot Design and Treatments



Appendix II: Sub-plot Design and Treatments

(Treatment regime shown is current as of April 1999)



Main Plot Treatment Codes

C1 = Control 1; C2 = Control 2;
 L = Limed; B = Biocide;
 N = Nitrogen; NL = Nitrogen & Limed

Appendix III: Site Visit Registration Form
(www.nmw.ac.uk/soilbio)

**Soil Biodiversity Programme:
Sourhope Site Visit Registration Form**

This form allows Soil Biodiversity Programme Projects to submit plans for visiting the Sourhope Field Experiment Site. Please complete this form for each planned visit, giving as much detail as possible about the proposed activity. Note that not all fields are mandatory - you may leave blank those fields which do not apply.

Once you have completed the form, click the confirmation box at the end of the form, followed by the 'Submit' button to send the form to the Soil Biodiversity Field Experiment Manager at Sourhope (Sarah Buckland) A copy will also be sent automatically to the Soil Biodiversity Programme Manager (Richard Scott).

Your request will be acknowledged via email, and you will be contacted as soon as possible with confirmation that your planned arrangements may go ahead.

Project Award Number:	<input type="text"/>
Name for contact:	<input type="text"/>
Email address for contact:	<input type="text"/>
Sourhope Visitors' Names:	<input type="text"/>
Other Projects involved:	<input type="text"/>
Proposed Dates(s) of Visit	From: <input type="text"/> To: <input type="text"/>
	Arrival Time: <input type="text"/>
Purpose of Visit:	<input type="checkbox"/> Sampling
	<input type="checkbox"/> Experimental Set-up
	<input type="checkbox"/> Measurements only (ie no disturbance)
	<input type="checkbox"/> Other: please specify: <input type="text"/>
Main Plots/Treatments Required	<input type="text"/>
Sub-plots/Treatments Required	<input type="text"/>
SAMPLING:	
Description of sample type	<input type="text"/>
Size of sampling areas	<input type="text"/>
EXPERIMENTAL SET-UP:	

Description of set-up:

Size of set-up areas:

Transport requirements:

Field assistance requirements:

Other requirements:

Number and Frequency of future visits

Please confirm that all the above details are correct: Then:

Click to send your visit plan. (Clicking will clear the form, if you want to start again)

You may alternatively send completed print-outs of this form to:

Graham Burt-Smith
Soil Biodiversity Field Experiment Manager
MLURI Research Station
Sourhope
Kelso
Roxburghshire
TD5 8PZ
Tel: 01573 420229
Fax: 01573 420683
Email: g.burt-smith@macaulay.sari.ac.uk

Appendix IV: Site Visit Record Sheets

A number of record sheets have been designed to record what is done where, and when, at the Sourhope field experiment site. This information will be used by the Site Manager for planning purposes and will also be fed into the Soil Biodiversity Database.

Four types of 'Site Visit Record Sheets' have been drawn up to capture this information and are entitled:-

- Project/Purpose (P)
- Soil Sampling Details (S)
- Experimental Set-up/ Input Details (E)
- Measurement Details (M)

For each visit, a Project/Purpose sheet should be completed. The number and type of other record sheets to be completed will depend on the nature of the visit and the number of main plots visited.

Example completed record sheets are included in this document, following some explanatory notes (which are referenced in the record sheets using superscript numbers). The record sheet templates themselves can be downloaded via a separate accompanying link on the website, for use in the field.

Notes on completing the Site Visit Record Sheets

Project/Purpose

- 1. Project Code(s):** If the purpose of visit is relevant to more than one project, then all project codes should be given. The first listed will be taken as the lead project.
- 2. Visitor Name:** Only one nominated person's name need be given, ideally the person with overall responsibility during the visit.

Soil Sampling Details

3. Sampling Unit: The term 'Sampling Unit' refers to the unit of soil to be sampled in relation to its position on the ground surface. It may refer to an individual core, auger sample, turf, monolith, pit or any other distinct block/unit of soil which is used for sampling. In most cases the Sampling Unit will relate to an original physical soil sample as it is extracted from the ground. In the case of soil pits however the Sampling Unit will be the pit as a whole, and the individual samples taken from within that pit will be recorded as sub-samples from that unit.

4. Diagram Label: Each Sampling Unit should be marked on the plot diagram and given a label by which it is then referenced in the table. A cross should be placed in the cell containing the Sampling Unit(s), and the cell reference numbers (in x and y) given in the table.

Where there is more than one distinct sampling unit in a cell, give a different reference label for each. Where the Sampling Unit is an area which covers more than one cell (e.g. a 1m² turf removal), it should be given a single reference label, and all the cells it occupies should be marked on the diagram and listed in the table.

If there is a particular need to spatially reference Sampling Units at a finer resolution than the cell within the database (e.g. for analysis of within-cell spatial variation), please attach to the record sheet more precise dimensions along with a sampling frame description.

5. Sampling Unit ID (SUID): A unique ID will be allocated to each individual Sampling Unit extracted or dug at the site and this will be supplied by the Sourhope Site Manager during the visit. The SUID should be listed in the table on the record sheet along with the other details requested for each Sampling Unit. It should be retained with any samples derived from the sampling unit through splitting or bulking, for cross-referencing and linking into the Soil Biodiversity database.

6. Depth Range: The depth range given should be relative to the ground surface.

Experimental Set-up/Input Details

7. Experimental Set-up: This term refers to any permanent or semi-permanent apparatus for experimentation installed at a particular place (e.g. rhizotron, litter bag) or the input of any substance to the ground (e.g. injection of gas to soil, introduction of worms).

8. Diagram Label: Each experimental set-up or input carried out should be marked on the plot diagram and given a label by which it is then referenced in the table. A cross should be placed in all the affected cells, and the cell reference numbers (in x and y) given in the table.

9. Experimental Set-up ID: An ID should be allocated which will uniquely identify each experimental set-up or input at a particular place. These IDs should be devised by the project team. Measurements taken from the same set-up at a later date should relate to this ID.

10. Experiment Type: This should be a brief description of the set-up/input e.g. litter bag placement, rhizotrons inserted, gas injected, worms introduced.

11. Experiment Removal Date: If apparatus, for example, is set up and is later going to be removed, it is necessary to record the dates during which it was in place. The planned removal date should be given at time of set-up, and the actual removal date should be recorded on the same sheet when it is removed.

Measurement Details

12. Measurement Location: The measurement location is the region or point on the ground surface from which measurements are taken.

13. Diagram Label: Each measurement location should be given a label on the plot diagram by which it is then referenced in the table on the record sheet. A cross should be placed in all the affected cells, and the cell references (in x and y) given in the table.

14. Measurement Location ID: An ID should be allocated to uniquely identify each location (region or point) on the ground surface from which measurements are taken. These IDs should be devised by the project team. Where measurements relate to an experimental set-up, then the ID of the experimental set-up should be used, or incorporated within the measurement location ID to enable a link to be made.

15. Measurement Type: This should be the type of measurement being taken e.g. vegetation species, soil temperature, emission readings.

16. Method: This should briefly describe how the measurements are recorded, including an instrument type and frequency of recording where appropriate, for example pin-frame or quadrat for vegetation recording, theta-probe for soil moisture readings taken at hourly intervals.

Example

SITE VISIT RECORD SHEET

Project/ Purpose

Soil
Biodiversity

NERC Thematic Programme

Project Code(s)¹: GST2112

Visitor Name²: Joe Bloggs

Dates on Site: From: 3-3-99 To: 5-3-99

Purpose of Visit

Category		Total number of main-plots used
Sampling	<input type="text" value="3"/>	5
Experimental setup/ input	<input type="text"/>	
Measurements only (i.e. no disturbance)	<input type="text"/>	
Other (please specify)	<input type="text"/>	

Brief Description of Activity

Removal of soil cores from each replicate of nitrogen & lime treated main-plots

Additional Comments (e.g. unusual conditions, factors which may affect sampling)

¹² see notes sheet

SITE VISIT RECORD SHEET

Soil
Biodiversity

Sampling Details

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The diagram below represents one main-plot at the site, showing its 10 constituent sub-plots (labelled P to Y) and a grid of 0.5x0.5m cells. Complete a separate sheet for each main-plot visited.

This sheet should be used to record the position, dimensions and type of each distinct *Sampling Unit*³ which has been used for soil sampling. Mark and label each Sampling Unit on the diagram and give details in the table below.

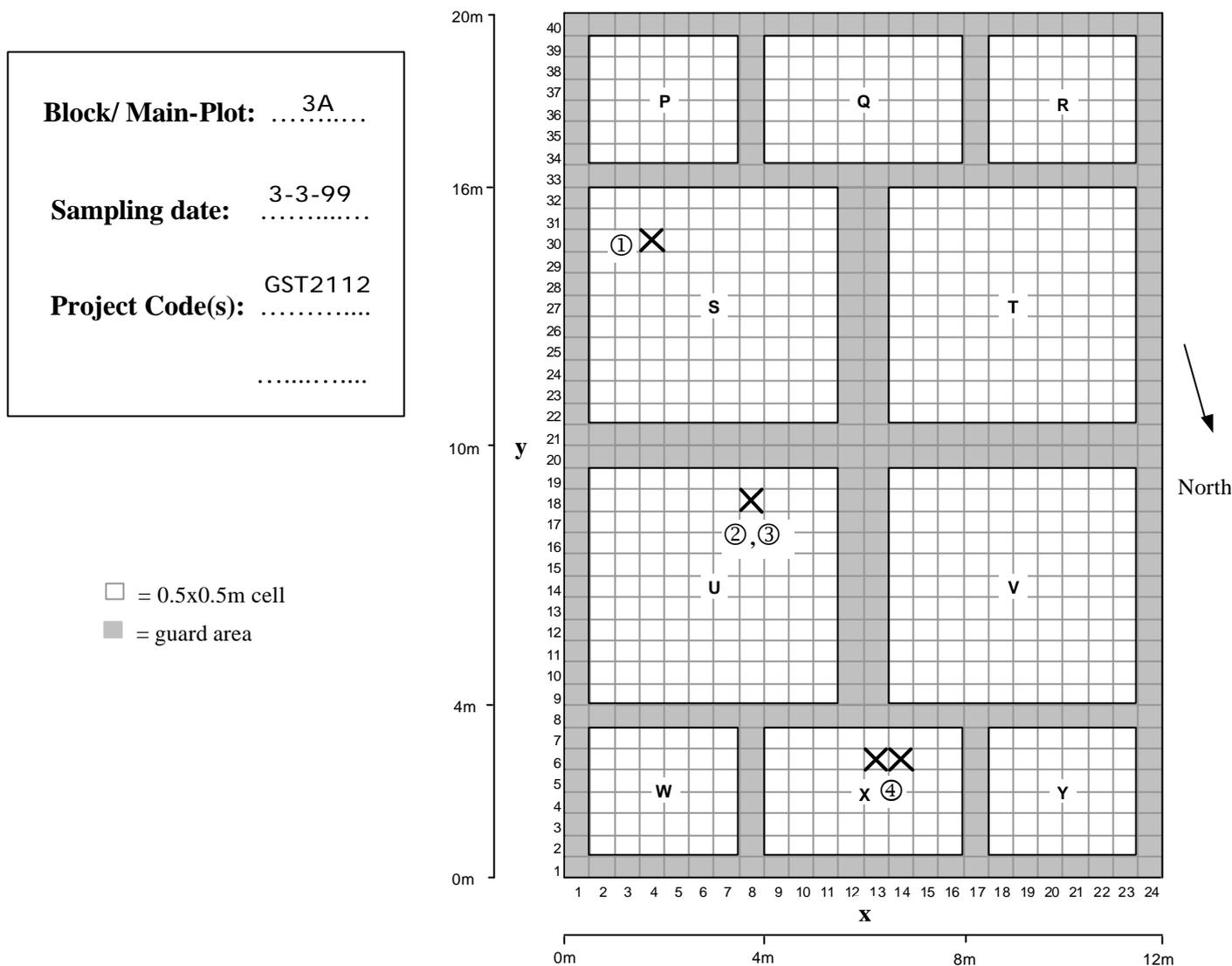


Diagram Label ⁴	Sampling Unit ID ⁵ (SUID)	Sub-plot	Cell Reference		Sampling Unit Type	Surface Area Dimensions	Depth Range ⁶ (cm)	
			x	y			Upper	Lower
1	394	S	4	30	Soil core	10cm diameter	0	20
2	395	U	8	18	Soil core	5cm diameter	0	10
3	396	U	8	18	Soil core	5cm diameter	0	10
4	397	X	13	6	Pit	80cm X 20cm	0	100
4	397	X	14	6	Pit	80cm X 20cm	0	100

Example

SITE VISIT RECORD SHEET Measurement Details

Soil Biodiversity

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The diagram below represents one main-plot at the site, showing its 10 constituent sub-plots (labelled P to Y) and a grid of 0.5m x 0.5m cells. Complete a separate sheet for each main-plot visited.

This sheet should be used to record information about any measurements taken at the site. Mark and label each *Measurement Location*¹² on the diagram and give details for each in the table below.

Block/ Main-Plot: 4A

Recording date: 25-4-99

Project Code(s): GST2116
.....

□ = 0.5x0.5m cell
■ = guard area

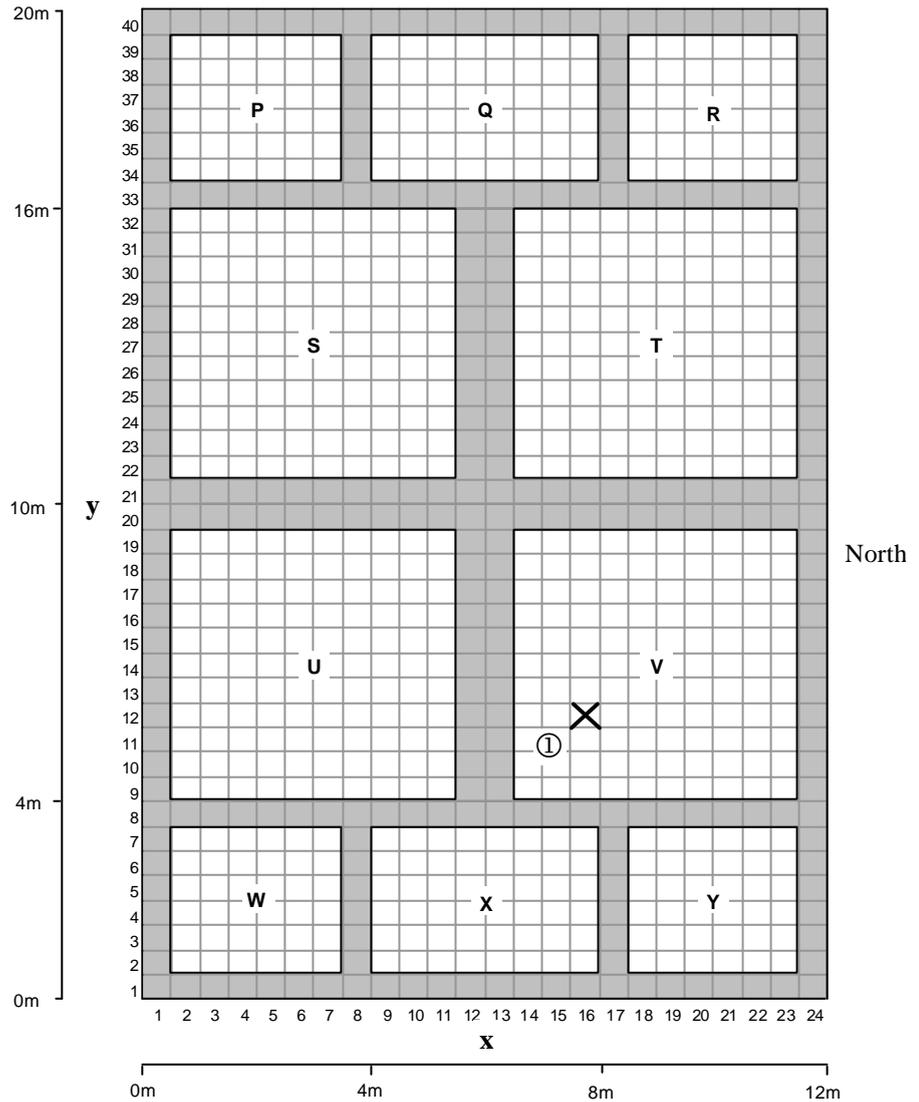


Diagram Label ¹³	Measurement Location ID ¹⁴	Sub-plot	Cell Reference x y	Measurement Type ¹⁵	Surface Area Dimensions	Method ¹⁶
I	29	V	16 12	Vegetation Species	50 x 50	25 point quadrat

Continue overleaf if necessary.

12 13 14 15 16 see notes sheet

