SOURHOPE
FIELD DATA HANDBOOK 2003

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Soil Biodiversity
NERC Thematic Programme

NATURAL ENVIRONMENT RESEARCH COUNCIL

1. BACKGROUND

At an early stage in the development of the Soil Biodiversity Programme it was decided that the research would be focussed on one site or the soil from that site. It was also agreed that the experimental site would, ideally be located at an existing research facility which could provide security, basic laboratory facilities, a base for visiting workers and for the site Soil Biodiversity Site Manager and background information on climate, land use, soils and vegetation. A number of sites were assessed before the Rigg Foot site at the Sourhope Experimental Farm was chosen as the preferred location.

2. INTRODUCTION TO THE SOURHOPE SITE

2.1 History

Sourhope lies 15 miles south of Kelso at the head of the Bowmont valley, on the western slopes of Cheviot Hills (Figure 1). The Station comprises the farms of Sourhope (940 ha) and Auchope (179 ha). The land rises from 213 to 605 m in altitude and the annual rainfall is 952.4 mm (10 year mean). Earliest records of Sourhope as a farm date from the 14th century and the name is said literally to mean 'the valley of sour pastures'. Work carried out by the Hill Farming Research Organisation (HRFO) in the late 1970's identified parts of the farm as being deficient in copper and cobalt, which may explain why the farm was so named. Substantial research effort was directed towards the detection of cobalt and copper deficiencies in sown swards and natural grazings along with husbandary measures to correct these.

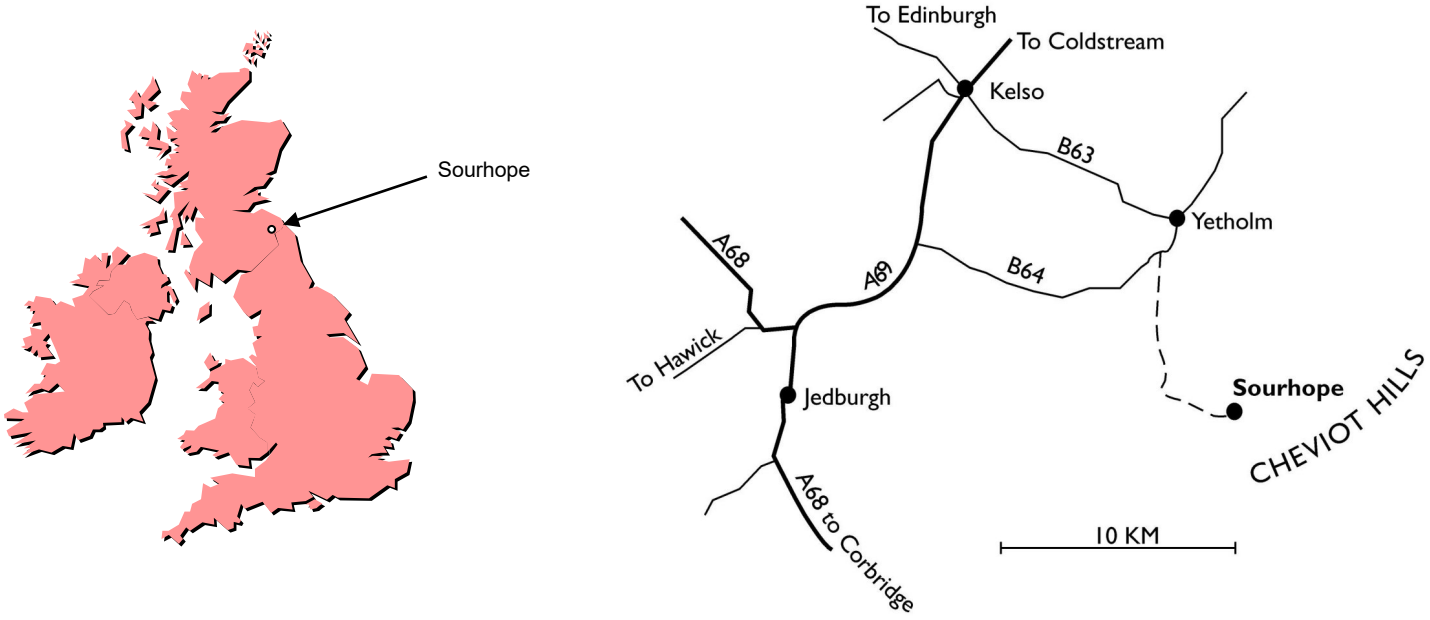


Figure 1: Location of Sourhope

In 1946 the Roxburghe Estate granted the Sourhope tenancy to the East of Scotland College of Agriculture, later the Hill Farming Research Organisation, whose tenure lasted until 1987, when the newly formed Macaulay Land Use Research Institute succeeded to the tenancy. HFRO initiated a substantial research programme to identify the principal determinants of hill sheep production. The physical and financial changes in hill sheep productivity achievable on a self-financing basis by the provision of enhanced nutrition through

pasture were measured. Studies on a similar scale designed to measure the effect of immediate pasture improvement and winter housing, with the higher capital expenditure associated with such a system, were carried out in parallel. The Station's research programme during this period also developed techniques of pasture improvement by grazing control coupled with lime and fertiliser application followed by reclamation and reseeding. Some of these activities will have impinged on the Rigg Foot site, but there are no definite records of fertility improvements in area of the plot.

2.2 Climate

The climate of the area is described as 02H2B2 – Euoceanic very humid southern boreal or lower oroboreal (map 1 of Birse & Dry, 1970). Mean monthly temperatures are shown in Table 1.

TABLE 1: TEMPERATURE (MEAN MONTHLY DRY BULB TEMPERATURE, DEGREES CELSIUS)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Jan		1.83	1.38	2.66	1.92	3.33	2.47	3.14	1.74	4.09	2.87
Feb		0.33	2.84	0.46	3.48	5.44	2.27	3.03	1.64	3.49	2.40
Mar		3.40	1.78	1.27	5.53	4.79	4.23	4.75	1.76	4.72	5.89
Apr		4.60	5.38	5.78	6.12	4.34	6.47	4.58	4.49	6.71	8.07
May		6.86	8.53	5.88	8.15	9.62	9.35	8.38	10.79	9.09	9.26
Jun		10.94	10.66	11.32	10.24	10.35	10.48	10.30	10.85	11.67	13.23
Jul		14.36	14.59	12.85	14.02	11.77	14.17	12.27	13.45	12.73	14.61
Aug		11.77	15.41	13.50	15.48	12.29	12.56	13.60	13.52	14.07	14.65
Sep		9.43	10.42	10.66	10.78	11.50	12.84	11.79	10.35	11.69	11.79
Oct		7.65	10.32	8.72	7.58	6.54	7.86	8.18	10.51	6.93	6.56
Nov	2.44	7.18	5.63	2.87	6.96	3.80	5.25	4.28	5.42	5.76	6.08
Dec	1.69	3.59	0.50	1.55	4.09	3.73	1.05	2.98	2.85	3.31	3.17

Data supplied by the Environmental Change Network from the ECN Automatic Weather Station at Sourhope Farm

2.3 Geology and soils

Sourhope is underlain by andesitic lavas of Old Red Sandstone Age. The soils (Figure 2) are developed on drift derived locally from the underlying lavas. Acid brown forest soils characterise the lower slopes, while more acid peaty podzols and peaty gleys occur at higher elevations with small areas of deep peat on hill summits. Stony skeletal soils are found on steep slopes.

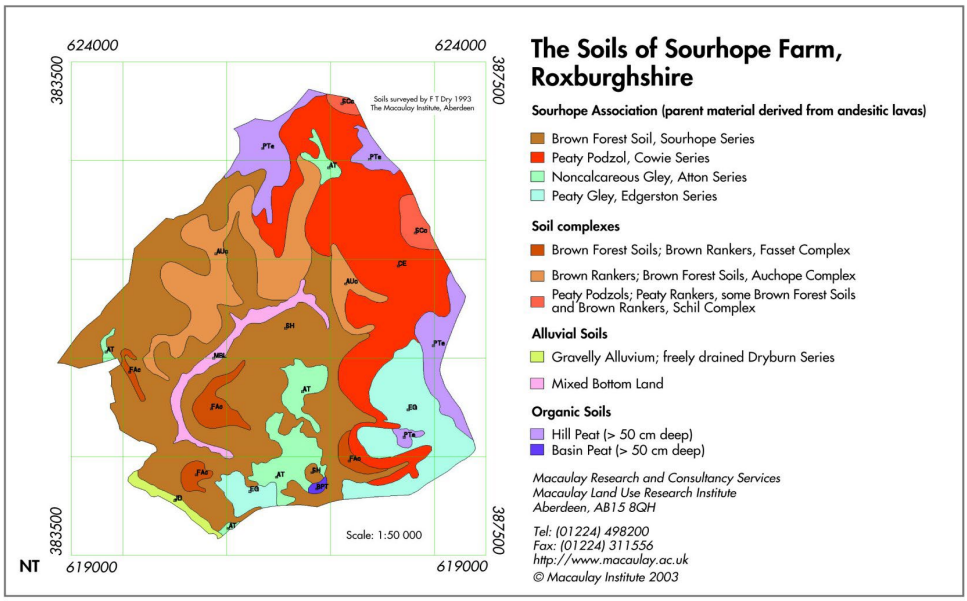


Figure 2: Sourhope Farm soil map (courtesy of Macaulay Institute)

2.4 Land cover and vegetation

The farm is predominantly grassland with smaller areas of heather moor and coniferous plantation (Figure 3). The unimproved grasslands are *Festuca-Agrotis-Galium* (NVC U4) at lower altitudes and *Nardus-Galium* (NVC U5) on higher slopes. *Calluna-Vaccinium* moor is found on ridges in the north of the farm while *Calluna-Eriophorum* moor is found on the eastern ridges. Small areas of *Juncus effusus/acutifloris-Galium palustre* wetlands occur along the streams (Figure 4).

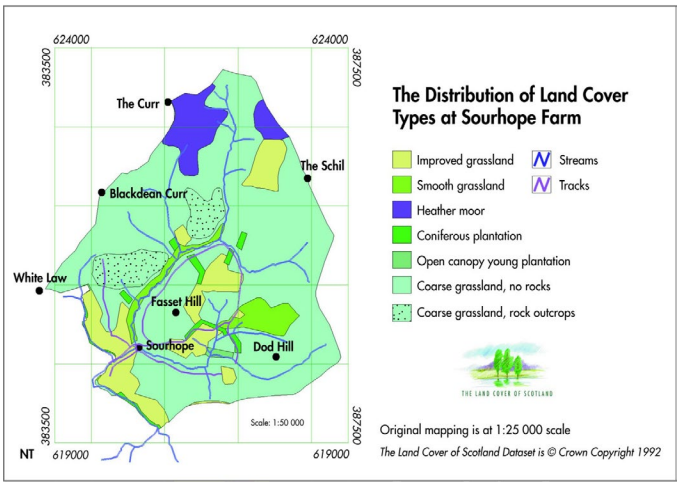


Figure 3: Land cover types at Sourhope Farm (courtesy of Macaulay Institute)

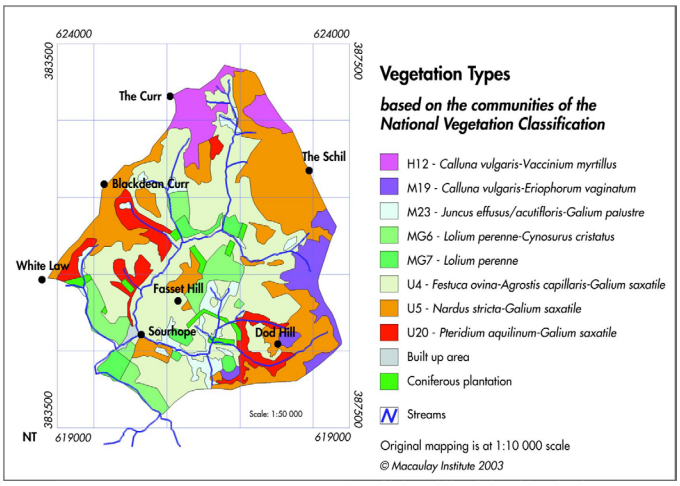


Figure 4: Vegetation types at Sourhope Farm (courtesy of Macaulay Institute)

2.5 Land use

Thirty percent of the 982.2 ha of rough grazing occurs on mainly brown forest soils where *Agrostis* and *Festuca* predominate in association with bracken (*Pteridium aquilinum*) of varying intensity. The remaining rough grazings are Flying bent (*Molinia caerulea* and White bent (*Nardus stricta*) dominant grass heaths. Since1970 some 54.4 ha of rough grazing have been reseeded with perennial ryegrass, timothy and white clover mixtures. The farm also has another 50.9 ha of enclosed grassland, 32.4 ha of which are easily ploughed and 20.0 ha suitable for silage/hay cropping.

The Station carries a sheep flock of 2780 ewes and hoggs. A suckler herd of 52 beef cows is maintained and is currently used to control sward heights where required for experimental purposes. The Station's goat herd comprises 450 breeding females and functions as the elite herd for the breeding programme operated by Cashmere Breeders Ltd. Part of the herd is used to investigate the inheritance of helminth resistance. The Elite herd is CAE accredited and has MAFF scrapie-monitored status, which requires separation from the sheep pastures.

2.6 Laboratories and other facilities

There is office accommodation for all Station staff, Sourhope-based Macaulay scientists and other visitors. There are laboratory facilities appropriate for the work of the Station, including ovens and freezers. Computers are linked to the main MLURI server at Craigiebuckler, Aberdeen and through it to the Internet. The original farmhouse and outbuildings were rebuilt in 1977 to provide a hostel with nine rooms and living quarters for a cook/caretaker. The hostel offers accommodation for permanent staff, temporary workers and visiting scientists. It operates for most of the year on a self-catering basis.

2.7 Current research programme at Sourhope

Since 1987 the Station has accommodated a significant number of new research initiatives which utilise the scale of resources the Station can offer in terms of land areas and stock numbers while at the same time maintaining commercial farm output. A theme running through the work carried out at the Station is the utilization of indigenous vegetation and the development of sustainable systems within the context of meeting both agricultural and environmental objectives. Projects undertaken include the management of *Nardus*

pastures by beef cattle (SERAD funded), the effects of mixed grazing by sheep and cattle on floristic change and annual production (EC funded), diet selection of indigenous grassland by red deer and South American Camelids (SERAD) and on foraging strategy (SERAD).

Changes in floristic composition, diet selection and soil nutrients of grazed sown swards subject to varying degrees of nutrients stress levels of utilisation are being studied as a means of predicting the outcome of extensification policies with respect to agricultural output, ecological diversity and sustainability. This is a long-term experiment (7 years to date) which provides a resource for a number of other studies (SOAEFD/NERC-funded).

Research into alternative farm enterprises capable of exploiting the hill grazing resource started at Sourhope in 1987 when the Institute's breeding herd of cashmere goats was transferred from Glensaugh Research Station. The herd is being used in quantitative genetics research programme (SERAD and EC) to establish the heritability of fibre traits. In collaboration with the Moredun Research Institute, part of the herd is also used to investigate genetic resistance to gastro-intestinal parasites and its heritability. Studies are also in progress to determine the physiological mechanisms which control the growth and moult of cashmere fibre (SERAD).

Improvement of the financial output of hill sheep systems by the production of wool of substantially better quality has been under investigation since 1989 when the Station's Bowmont (Shetland × Saxon Merino) flock was established. The main effort is directed towards development of breeding stock that can produce wool of such a fineness that fleece cash value is maximised, but coupled to acceptable adaptation of the animals themselves to hill conditions. Research into aspects of the physiology of wool growth is also undertaken on animals drawn from the flock (SERAD funded). The effect on indigenous sheep breeds of increased prolificacy derived genetically from the Icelandic 'Thoka' strain has been under investigation since 1986 using a sub-flock of Cheviot origin which now numbers 76 ewes which have the 'Thoka' gene.

2.8 ECN and other programmes

Sourhope is one of the 12 sites which form the United Kingdom Environmental Change Network (ECN). The Network is funded by a number of sponsors (including DoE, MAFF, NERC and SERAD) and measures soil, air and water quality and invertebrate and plant diversity with the long-term aim of identifying environmental changes and improving the understanding of their causes. Sourhope has been chosen as the main site for research in the SERAD Micronet project between 1998-2002. Micronet aims to answer fundamental questions about the relationships between soil microbial and plant vascular communities among a range of agriculturally important grasslands.

3. THE SOIL BIODIVERSITY PROGRAMME EXPERIMENTAL SITE AT RIGG FOOT, SOURHOPE

3.1 Location and experimental design

The Soil Biodiversity research site was established in 1998 on the north-facing slope of Rigg Foot, at Sourhope. The designated site is situated at a height of 309 m above sea level and varies in slope from 8° at the top end of the plots to just 4° toward the bottom. The experimental design was developed in discussions with the Principal Investigators of the first round awards within the Programme, and with advice from Professor John Jeffers. The design comprises five blocks, divided into thirty plots (Figure 5).

The five blocks are designated from 1 to 5, running from north to south up the slope. Each block is sectioned into six plots measuring 12 x 20m, in which a different treatment has been applied; the plots are labeled A to F. An additional plot was designated for removal of turves for the project being carried out in the controlled environment facility, the Ecotron, located at the Imperial College's Silwood Park campus.

Figure 5: Main plot layout and treatment allocations

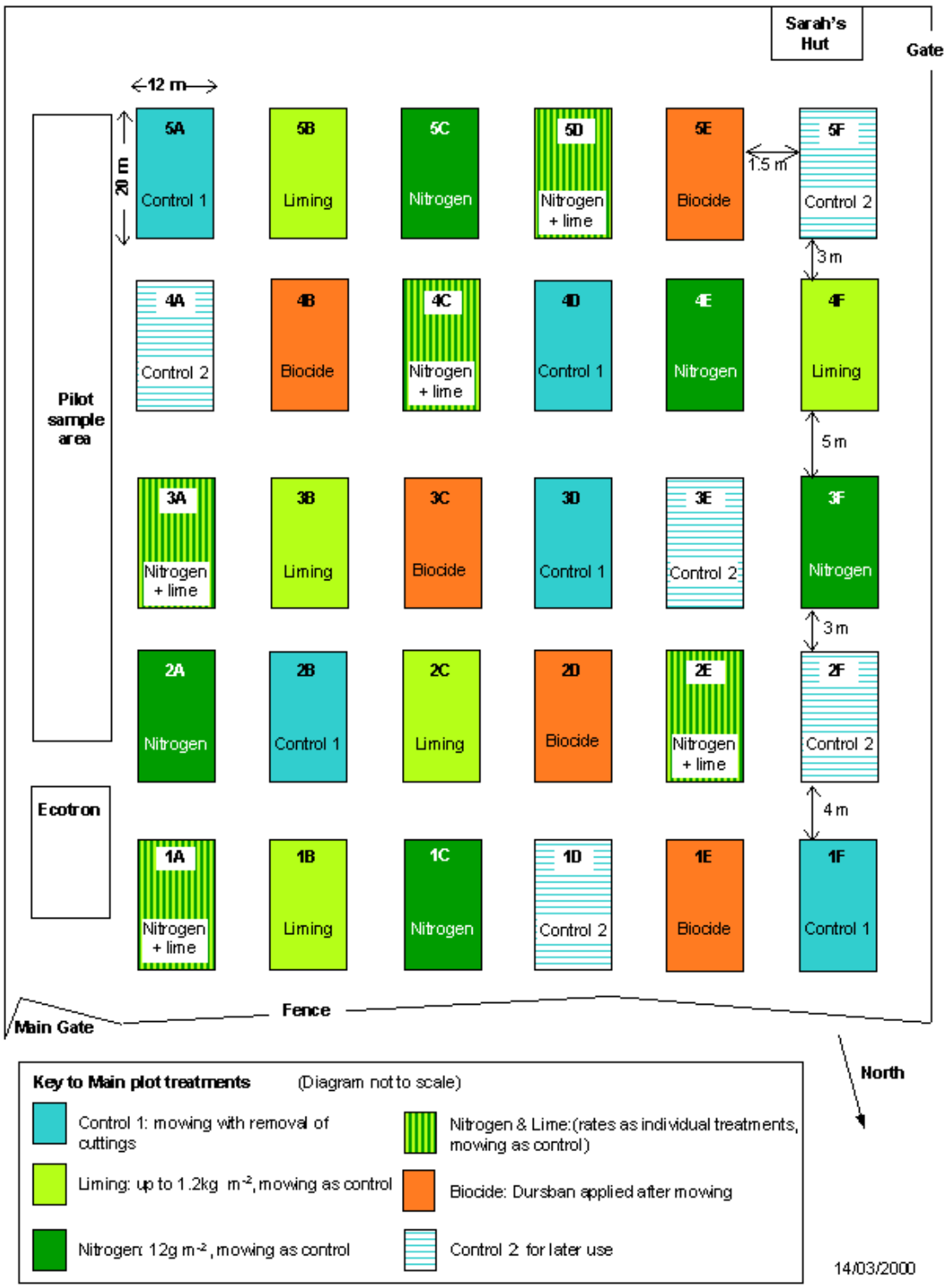
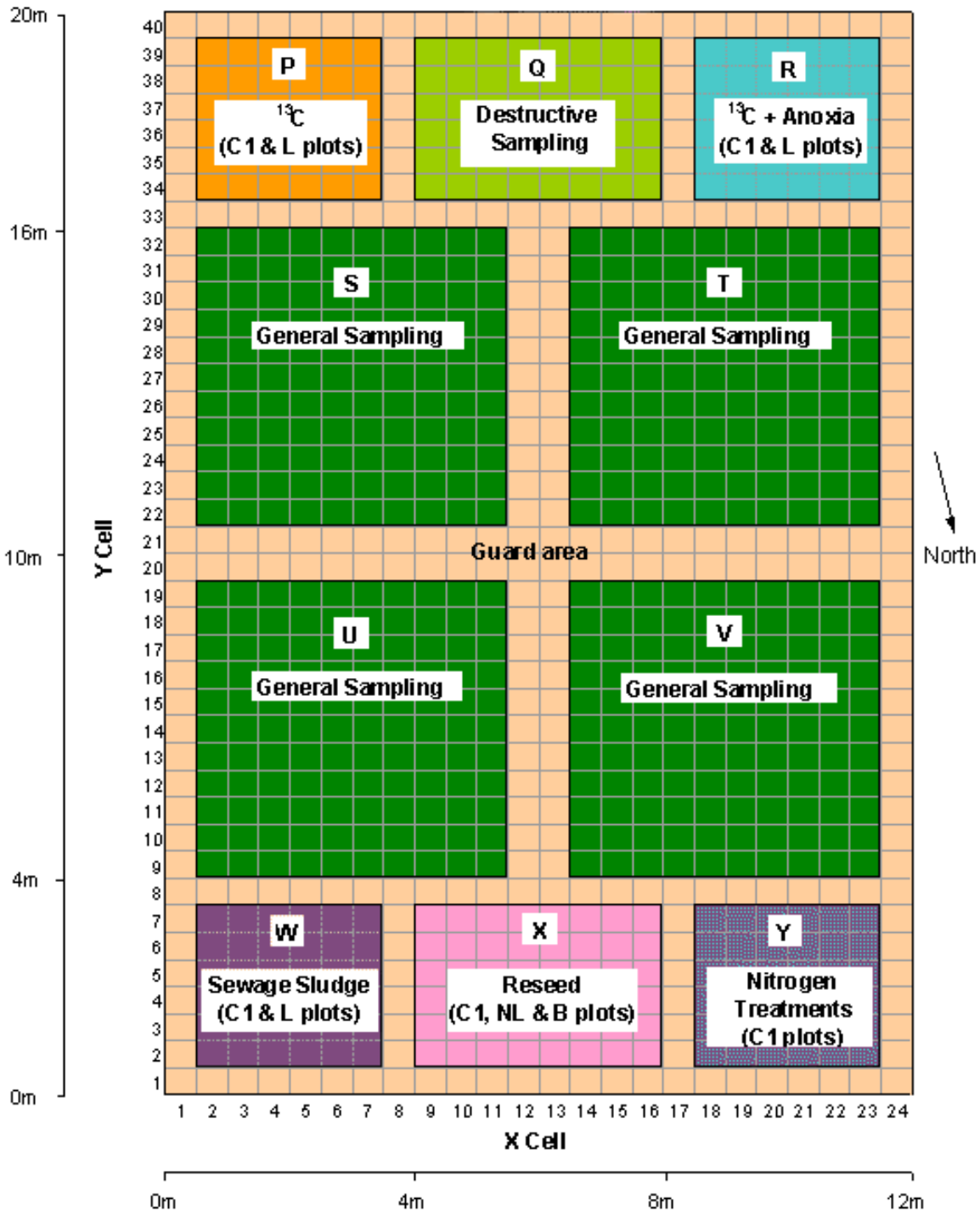
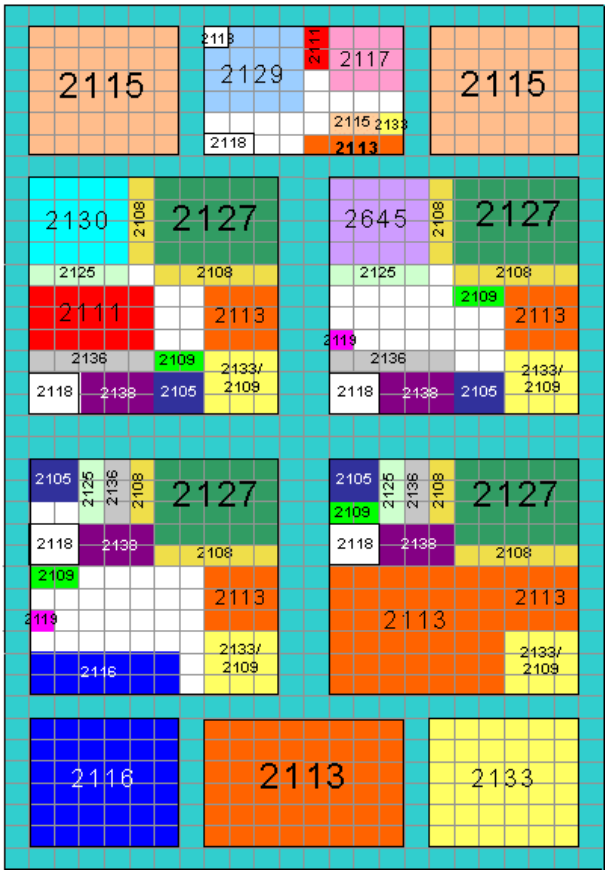


Figure 6: Sub-plot layout



Main Plot treatment codes
C1 = Control 1; L = Lime; B = Biocide;
N = Nitrogen; NL = Nitrogen & Lime
Reseed is *Lolium perenne*

Figure 7: Sub-plot area allocations by project (Control 1 plots)



For the purposes of conducting the soil and vegetation studies (see sections 3 and 4 below) each 12 x 20 m main plot is divided into fifteen subplots, labelled A - Q. Each subplot measures 4 x 4 m. With reference to the soil and vegetation data, the layout of the subplots is as follows.

A	B	C
D	E	F
G	H	J
K	L	M
N	P	Q

The 8 x 24 m Ecotron plot twelve subdivisions are as shown below, labelled A - M. These too are 4 x 4 m in size.

A	B
C	D
E	F
G	H
J	K
L	M

3.2 The treatments

A series of imposed experimental treatments were included in the design to increase the options open to the research groups involved; these treatments were regarded as perturbations of the system rather than an attempt to simulate specific land management. The initial series of treatments agreed with PIs were control, lime, lime plus nitrogen, biocide and fallow. The plots within each block were assigned to one of the six treatments randomly. The treatments are:

1. Control - untreated
2. + Lime, applied annually
3. + N, as NH_4NO_3 applied twice per year
4. + Lime & N, treatments 2 and 3 combined
5. + Biocide
6. Fallow - no plant cover

A series of trials were carried out in an attempt to create a fallow without physical disturbance. None was successful and so the treatment was omitted and the plots assigned initially to the fallow treatment used as an additional series of control plots (Figure 5).

The plots were sub-divided into sub-plots (Figure 6) in order to control the activities undertaken on each plot. Within these sub-plots, areas were allocated to the initial projects in the Programme (Figure 7).

All plots were also cut to simulate sheep grazing. The cutting is carried out every three weeks during the growing season. All cuttings are removed from the whole site. Cutting height is approximately 3 cm for the paths and 6 cm for the plots, level ground permitting.

Past grazing regimes of the site have been fairly constant with sheep grazing being the norm over the last fifty years. There has been occasional grazing of cattle during this time and goats were grazed on this land for two seasons seven years ago. However no stock has been grazed on this land since December 1997 and the plots were fenced off in April 1998. The local populations of rabbits and roe deer have had some access to the site since this time, but their presence has been of little significance on the prevailing site conditions; a mammal proof fence was erected around the site to prevent access by sheep, rabbits or deer during experiment.

4. VEGETATION SURVEY OF THE EXPERIMENTAL PLOTS

4.1 Sampling method

Using a 50 x 50 cm point quadrat, the vegetation was surveyed from a randomly selected five of the fifteen 50x50 subplots in each main plot. The first survey was carried out between 27th July - 7th August 1998. A total of twenty-five points were recorded in each 50x50 quadrat. Each point of the quadrat was followed down to the soil surface where a record was made of the species which occurred at this precise point. The survey was done on the basis of presence/absence, however the construction of a record of abundance was possible due to the nature of the method used. Data presented in the results tables therefore refers to actual number of times each species was observed in the sample.

4.2 Results of survey and statistical analysis of data

When studying the data, it should be borne in mind that only a third of the subplots were sampled, the results are therefore only a guide as to the species present over the site.

The site is representative of mid-altitude upland grasslands on base-poor, damp, mineral soils. Seasonal variability is expected particularly in the herbs but the dominant grasses should remain more or less the same. Variability seen over this establishment year is most likely to have been a consequence of relaxed/removed grazing pressure since stock were excluded from the site in April of 1998. During this time a shift from *Anthoxanthum odoratum* to *Agrostis capillaris* and *A. canina* has been noted amongst the dominant species.

A total of twenty-five different species have been recorded within the plots in varying frequencies with *Agrostis capillaris* as the most dominant by far (table 2). Species richness increases down the slope, reaching a maximum of seventeen different species recorded in plots 1E, 1F, 2A and 2D. In contrast, in plots 4E and 4F just eight species were observed in the sampled area. For species occurrence information, refer to the tables of data in the relevant experimental block found in Appendix A.

The techniques employed to statistically analyse the vegetation data were those of Twinspan, comparison with National Vegetation Classification (NVC) communities and Association analysis. The analyses were done at whole site, block and plot level, and even subplot level in the Association analysis.

TABLE 2 : SPECIES CODES AND OCCURRENCE IN ORDER OF DOMINANCE

Species code	Species Name	Occurrence
Acp	*Agrostis capillaries*	988
Fr	*Festuca rubra*	523
Ns	*Nardus stricta*	467
Ao	*Anthoxanthum odoratum*	386
Pp	*Poa pratensis*	358
Tr	*Trifolium repens*	183
Hm	*Holcus mollis*	165
Pe	*Potentilla erecta*	123
Gs	*Galium saxatile*	85
Lzm	*Luzula multiflora*	71
Rs	*Rhytidiadelphus squarrosus*	69
Pt	*Poa trivalis*	51
Fo	*Festuca ovina*	48
Ac	*Agrostis canina*	43
Mc	*Molinea caerulea*	35
Lm	*Lathyrus montanus*	33
Df	*Deschampsia flexuosa*	28
Cp	*Cirsium palustre*	20
Ra	*Rumex acetosa*	19
Rr	*Ranunculus repens*	18
Dc	*Deschampsia cespitosa*	16
Br	*Brachythecium rutabulum*	7
Vc	*Veronica chamaedrys*	7
Cb	*Carex binervis*	4
Je	*Juncus effusus*	3

OTHER SPECIES PRESENT BUT NOT RECORDED IN ANY OF THE QUADRATS

Campanula rotundifolia
Cerastium holosteoides
Cyanosaurus critatus
Leontodon autumnalis
Lolium perenne
Mnium hornum
Phleum pratense
Poa annua
Polytrichum commune
Rumex acetosella
Stellaria graminea
Taraxacum officinale
Thuidium tamariscinum

TABLE 3 : SPECIES RECORDED IN EACH PLOT

Plot code	Species present	Subplots sampled
1A	*Ac Ao Acp Cp Fo Fr Gs Hm Lm Lzm Pe Pp Ra Rs Tr*	ADFLP
1B	*Ac Ao Acp Cb Cp Fo Fr Gs Lzm]Ns Pe Pp Rs Tr*	ACFKQ
1C	*Ac Ao Acp Cp Fo Fr Gs Hm Ns Pe Pp Pt Tr Vc*	BFHJM
1D	*Ac Ao Acp Fo Fr Gs Hm Lm Lzm Ns Pe Pp Rs Tr*	CDGJN
1E	*Ac Ao Acp Br Fo Fr Gs Hm Lm Lzm Ns Pe Pp Pt Ra Rs Tr*	CEGMP
1F	*Ao Acp Br Cb Df Fr Gs Hm Lm Lzm Mc Ns Pe Pp Ra Rs Tr*	BDFLM
2A	*Ao Acp Br Cp Fo Fr Gs Hm Lm Lzm Ns Pe Pp Ra Rs Tr Vc*	DJKNP
2B	*Ao Acp Dc Fo Fr Gs Hm Ns Pe Pp Rr Rs Tr*	AFKPQ
2C	*Ac Ao Acp Cp Fo Fr Gs Hm Ns Pe Pp Pt Rs Tr*	ACGLQ
2D	*Ao Acp Br Cp Fo Fr Gs Hm Je Lzm Ns Pe Pp Pt Rr Rs Tr*	AFHJN
2E	*Ao Acp Cp Fo Fr Gs Hm Je Lm Ns Pe Pp Ra Rs Tr*	CEGLN
2F	*Ao Acp Cb Cp Fo Fr Gs Hm Lzm Ns Pe Pp Pt Ra Rs Tr*	ACEJP
3A	*Ao Acp Cp Fr Gs Hm Lzm Ns Pe Pp Ra Rs Tr*	ACGHQ
3B	*Ao Acp Dc Fr Gs Hm Lzm Ns Pe Pp Rr Rs Tr*	BGJMP
3C	*Ao Acp Cp Fo Fr Lm Lzm Ns Pe Pp Ra Rs Tr*	DHKPQ
3D	*Ao Acp Fr Hm Lm Lzm Ns Pe Pp Rr Rs Tr*	BFHKN
3E	*Ao Acp Cp Fr Hm Je Lm Lzm Ns Pe Pp Rr Tr*	ADHNQ
3F	*Ao Acp Fo Fr Hm Lzm Ns Pp Pt Rr Rs Tr*	BFGLQ
4A	*Ao Acp Fr Gs Hm Ns Pe Pp Rs Tr*	AFHMN
4B	*Ac Ao Acp Br Fr Gs Lzm Ns Pe Pp Rs Tr*	CEGNQ
4C	*Ac Ao Acp Fr Gs Hm Lzm Ns Pe Pp Rs*	BDJMP
4D	*Ao Acp Dc Fr Hm Lm Lzm Ns Pe Pp*	CEGKP
4E	*Ao Acp Fr Gs Ns Pe Pp Rs*	BCHKP
4F	*Ao Acp Fr Mc Ns Pe Pp Tr*	BFHKN
5A	*Ac Ao Acp Fr Gs Lm Lzm Mc Ns Pe Pp Rs Tr*	BHKNQ
5B	*Ao Acp Fr Gs Lm Lzm Ns Pe Pp Pt Rs Tr*	AFJLN
5C	*Ac Ao Acp Cp Fr Lzm Ns Pe Pp Pt Rs Tr*	DHKMP
5D	*Ao Acp Df Fr Lm Ns Pe Pp Pt Rr Tr*	AEGLQ
5E	*Ao Acp Df Fr Hm Mc Ns Pe Pp Pt Ra Tr*	BDFLQ
5F	*Ao Acp Dc Df Fr Hm Mc Ns Pp Pt Tr*	CEJKP

TABLE 4 : SPECIES DOMINANCE FOR EACH PLOT

	Ac	*Acp*	*Ao*	*Br*	*Cb*	*Cp*	*Dc*	*Df*	*Fo*	*Fr*	*Gs*	*Hm*	*Je*	*Lm*	*Lzm*	*Mc*	*Ns*	*Pe*	*Pp*	*Pt*	*Ra*	*Rr*	*Rs*	*Tr*	*Vc*
BLOCK 1																									
1A	2	27	12			2			4	23	9	4		4	3			5	18		1		3	8	
1B	11	18	26		1	1			1	16	8				3		15	5	14				1	5	
1C	6	26	15			2			1	20	3	4					11	4	13	2				16	2
1D	3	14	14						4	24	7	9		3	8		19	8	7				3	2	
1E	4	24	14	1					4	8	8	1		1	1		21	11	3	16	2		2	4	
1F		26	13	3	1			2		14	1	1		4	1	14	22	9	8		2		2	2	
BLOCK 2																									
2A		17	3	1		1			5	16	9	8		3	2		5	5	24		1		10	10	5
2B		28	13				6		4	11	5	17					3	2	19			2	6	9	
2C	4	16	24			4			3	11	5	4					9	1	24	5			4	11	
2D		17	18	1		3			4	14	1	8	1		3		11	1	23	2		5	1	12	
2E		28	11			2			5	14	6	19	1	1			18	8	3		1		2	6	
2F		34	3		2	1			5	11	1	24			1		20	1	10	2	3		2	5	
BLOCK 3																									
3A		35	6			1				18	1	22			9		5	1	10		2		4	11	
3B		43	4				6			9	4	5			4		13	10	19			2	2	4	
3C		27	14			1			4	13				2	1		25	3	22		4		4	5	
3D		30	7							9		1		2	5		20	1	28			2	1	19	
3E		33	14			1				14		7	1	2	2		22	3	16			3		7	
3F		39	8						4	19		3			1		32		7	5		2	1	4	
BLOCK 4																									
4A		48	9							16	2	10					17	4	9				3	7	
4B	5	26	17	1						18	2				1		22	6	10				8	9	
4C	4	54	12							11	2	6			7		17	10	1				1		
4D		45	20				2			21		7		3	3		12	2	10						
4E		40	15							25	1						33	6	4				1		
4F		50	16							23						6	12	6	10					2	
BLOCK 5																									
5A	2	51	21							17	4			1	3	3	10	2	4				2	5	
5B		32	7							27	6			4	6		21	1	9	3			3	6	
5C	2	33	20			1				26					7		12	1	10	3			3	7	
5D		42	2					18		25				3			8	6	10	5		2		4	
5E		35	11					2		27		2				6	23	1	10	4	3			1	
5F		50	17				2	6		23		3				6	9		3	4				2	

TABLE 5 : TOTAL NUMBER OF THE DIFFERENT SPECIES OBSERVED PER BLOCK AND OVERALL

Block	*Ac*	*Acp*	*Ao*	*Br*	*Cb*	*Cp*	*Dc*	*Df*	*Fo*	*Fr*	*Gs*	*Hm*	*Je*	*Lm*	*Lzm*	*Mc*	*Ns*	*Pe*	*Pp*	*Pt*	*Ra*	*Rr*	*Rs*	*Tr*	*Vc*
1	26	135	94	4	2	5	0	2	14	105	36	19	0	12	16	14	88	42	63	18	5	0	11	37	2
2	4	140	72	2	2	11	6	0	26	77	27	80	2	4	6	0	66	18	103	9	5	7	25	53	5
3	0	207	53	0	0	3	6	0	8	82	5	38	1	6	22	0	117	18	102	5	6	9	12	50	0
4	9	263	89	1	0	0	2	0	0	114	7	23	0	3	11	6	113	34	44	0	0	0	13	18	0
5	4	243	78	0	0	1	2	26	0	145	10	5	0	8	16	15	83	11	46	19	3	2	8	25	0
Gross	43	988	386	7	4	20	16	28	48	523	85	165	3	33	71	35	467	123	358	51	19	18	69	183	7

4.2.1 Twinspan

From the results of the Twinspan divisions of associated samples and species, a number of tables and dendrograms were drawn up. Groups of samples and species were compared showing frequent similarities between plots within one block, and between the blocks themselves. Various combinations of species were also identified as repeatedly occurring together. For a more detailed view of the Twinspan groupings of the site, refer to the diagrams and tables in the document Twinspan.doc[1].

Analysis of the test data by sample produces the following results. As all plots have the dominant species in common, ie. *Agrostis capillaris*, *Anthoxanthum odoratum*, *Festuca rubra* and *Nardus stricta* etc, the Twinspan divisions are determined by the presence/absence of the less frequent species. Such indicator species here include *Deschampsia flexuosa, Deschampsia cespitosa*, *Agrostis canina, Holcus mollis, Ranunculus repens, Carex binervis* and *Juncus effusus*.

Consequently certain associations become apparent. For instance, *D. flexuosa* occurs only in plots 5D, 5E and 5F, where it grows in along with *Molinea caerulea*. *D. cespitosa* is very much a scarce species over the site occurring sparsely in plots 2B, 3B, 4D and 5F. The presence of *A. canina* only reaches any level of significance in Block 1, being mostly absent from all other sampled areas, but even here it is localised and of low frequency. Though *H. mollis* may be frequently present, in almost all plots, it is perhaps restricted to the damper furrows of the site. Another species of low frequency is *R. repens*. This occurs in the more central plots of the site, ie. it is found in 2B, 2D, 3B, 3D and 3E. In contrast to this *C. binervis* occurs only in the edge plots, 1B, 1F and 2F. *J. effusus* may be seen in scattered clumps throughout the site, being of most significance in plots 2D and 2E.

The species classification of the divisions produces 4 overall communities of associated species for the whole site. The most species rich, community produced from the test data unsurprisingly contains the most dominant and/or frequent species of the site vegetation, namely *A. capillaris, A. odoratum, F. rubra, N. stricta* and *Rhytidiadelphus squarrosus*. An association as this is repeated as the predominant community for each block. All the aforementioned species occur in this main group in at least four of the blocks in various combinations. *Poa pratensis* is also included in this community for all blocks. The occurrence of *M. caerulea* may be seen to be associated with the presence of *D. flexuosa, D. cespitosa* and occasionally *H. mollis*. Similarly *Potentilla erecta, Trifolium repens* and *Galium saxatile* invariably occur together, or in combination of pairs. This latter association also forms part of the largest community in all blocks.

4.2.2 National Vegetation Classification

The most closely matching NVC community which has been assigned to each plot, as well as the site as a whole, is U4d. This community describes the site as *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland, *Luzula multiflora-Rhytidiadelphus loreus* subcommunity. This designation recognises the observed dominance of *A. capillaris* and *A. odoratum*, both of which occur in every plot on the site.

[1] www.soilbio.nerc.ac.uk/reports/Index.htm. Choose: Twinspan.doc or .pdf

F. ovina is also notable, occurring in every plot of Blocks 1 and 2, although alongside the more frequent *F. rubra*. In Block 3, *F. rubra* replaces *F. ovina* so in Blocks 4 and 5, *F. rubra* occurs alone. The presence of *N. stricta*, *P. pratensis*, *D. flexuosa* and *D. cespitosa* are also noted under damper conditions, which occur on the site.

Associated monocots in the U4d community are recorded in localised populations in the plots. For instance *Luzula multiflora* is found as individual plants in nearly all plots, and *C. binervis* occurs in plots 1B, 1F and 2F.

Dominant dicotyledons according to the U4d classification and from observation are *G. saxatile* and *P. erecta*. Occasional specimens of *Rumex acetosa*, *R. repens*, *T. repens* and *Veronica chamaedrys* have also been recorded, again concurring with the designation.

As for the bryophyte community, *R.. squarrosus* dominates, with *Polytrichum commune, Thuidium tamariscinum* and *Mnium hornum* occurring at a much lower, localised frequency. This is indeed the case with the plots as *R. squarrosus*, can be seen in almost every plot on site, if you look hard enough through all the other vegetation, whereas only occasional patches of *P. commune, T. tamariscinum* and *M. hornum* are notable and so inevitably did not occur in any of the quadrats.

The subcommunity is very much influenced by climate. In this case mainly enough rainfall in order to maintain the soil at near field capacity. As the soil and the site as a whole is mostly free draining, the amount of rain must be fairly substantial.

There is a localised alternative to the U4d community which has also been identified. This group is the next closest matching community to the data sets after the U4d designation. The community is classified as U5b (*Nardus stricta-Galium saxatile* grassland, *Agrostis canina-Polytrichum commune* subcommunity), and could describe certain plots in Blocks 4 and 5. It is here where the *N. stricta* element equals or exceeds the frequency of *A. capillaris* and/or *A. odoratum*, giving the vegetation its U5b community characteristics. The occurrence of *N. stricta* is seen to greatly increase in the moister reaches of the site, particularly further up the slope from Block 3 to Block 5. Beneath the *N. stricta-G. saxatile* type grassland the soil is likely to be damper and less fertile.

4.2.3 Association analysis

Focusing on the presence/absence of less dominant species of the site to determine the divisions, association analysis produced a pattern of associations not dissimilar to those generated by Twinspan and the NVC designation. The results of these analyses may be seen as diagrams in the document Association.xls[2].

The indicator species for the main plots were *F. ovina, R. repens, D. flexuosa* and *H. mollis.* *F. ovina* occurs widely in the lower reaches of the site, disappearing as from Block 3 upwards. *H. mollis* is fairly central over the site occurring mainly in plots within Blocks 3 and 4, while *D. flexuosa* appears to prefer the edge plots, being the dominant species of this group present in plots 1F, 5D, 5E and 5F. All of these indicator species are absent in plots 5A, 5B, 5C and from three plots in Block 4.

The analysis was also taken to subplot level, studying the actual quadrats samples. Indicator species used in this instance were *G. saxatile, Cirsium palustre, P. pratensis, H. mollis, R. acetosa* and *A. odoratum*. *G. saxatile, H. mollis and P. pratensis* are absent from more plots than they are present. *G. saxatile* appears to follow no regular pattern of distribution, whereas *H. mollis*, as previously noted, tends to avoid the edge blocks. *P. pratensis* is fairly widespread in Blocks 3, 4 and 5, while *R. acetosa* is found in only 5

[2] www.soilbio.nerc.ac.uk/reports/Index.htm. Choose: Association.xls or .pdf

subplots scattered throughout the site.

5. SOIL SAMPLING AND ANALYSIS

5.1 Sampling methods

Soil description, sampling, and subsequent soil analyses were carried out by MLURI staff in August 1998.

Thirty 0-30cm auger cores per plot were taken in the standard "W" pattern to provide an adequate and representative soil sample for each area; the 30 cores were bulked to give the plot sample for analysis.

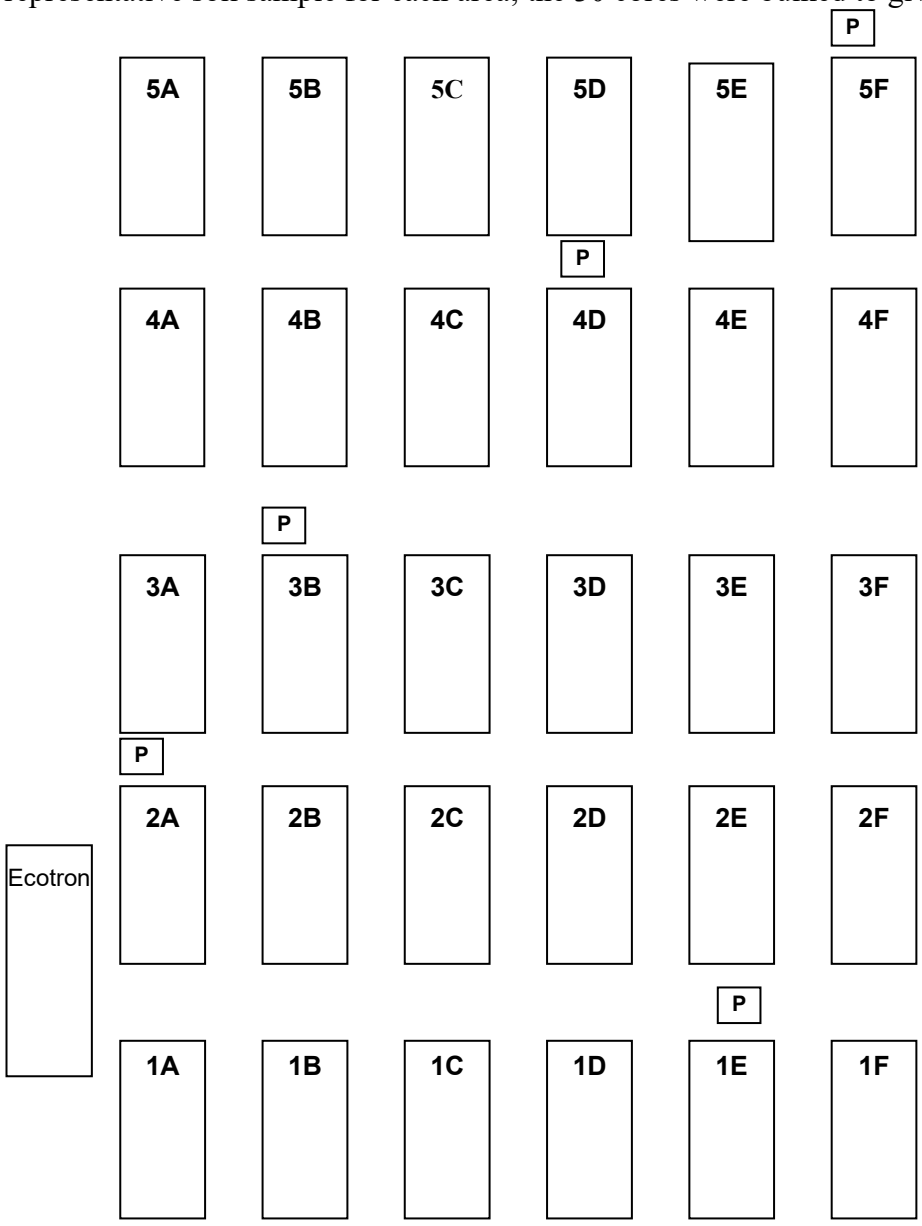


Figure 8: Location of soil pits

In order to obtain information and samples on a profile basis, 1 x 1 m pits were excavated in the pathways above each block, allowing for the description of the soil type and character for the five blocks. The profile pits were dug to 1 m, or as deep as possible depending on the local soil conditions. The pits were sampled on a horizon basis. The symbol P on the site diagram (figure 8) marks the location of the soil pits.

The bulked auger samples and the profile samples were later sub-sampled to give (a) samples for immediate analysis and (b) samples for archive. The latter samples were transported to CEH Merlewood for storage at -80ºC.

Site drainage is normal but soil drainage shows significant variation across the blocks.

No erosion is apparent over any of the sample sites. Small rock outcrops are apparent scattered over the site but are mostly confined to the paths.

5.2 Results of survey and statistical analysis of data from auger sampling

Results of the bulk, auger samples are presented in tables 6 and 7.

For analysis of soil data, by Prof. John Jeffers, see the soil horizon data analysis, analysis of soil samples, including a summary of variables, correlations and uniformity of data throughout the experimental site and linear regressions of soil data all located on the Soil Biodiversity website[3].

Chemical analysis of the soil from the auger sampling within the plots produced the following results. The overall site mean values show the 0-30 cm soil layer to be acidic (pH 4.64) and humic (LoI 16.78). Nitrogen content is (0.56%) and C:N ratio (13.6) typical of upland grassland soils. The contents of extractable cations are small, as would be expected of acidic soils. Considering the mean block values, the highest mean values for seven of the twelve variables measured occur in Block 3, and four occur in Block 5. Mean pH (H_2O) is from 4.54 in Block 1 to 4.81 in Block 5 and mean pH ($CaCl_2$) reaches a maximum of 4.04 in Block 3 and a minimum of 3.88 in Block 4. Nitrogen contents show little variation between block.

Ca is the most abundant cation, followed by Mg, with average concentrations for the site of 2.49 and 1.44 meq $100g^{-1}$, respectively. Na levels however, are very low. Moisture loss and loss on ignition follow a similar pattern to each other with the highest and lowest values of each occurring in the same blocks.

Further study of plot values indicates significant correlation between the following variables.

- %N and %C, Na, % moisture loss, %LOI
- %C and %N, C:N ratio, Na, Mg, % moisture loss, %LOI
- C:N ratio and %C, % moisture loss, %LOI
- Ca and Na, Mg, %LOI, pH (H_2O)
- Na and %N, %C, Ca, Mg, %LOI, pH (H_2O)
- K and pH ($CaCl_2$)
- Mg and %C, Ca, Na, % moisture loss, %LOI, pH (H_2O)
- % Moisture loss and %N, %C, C:N ratio, Na, Mg, %LOI
- %LOI and %N, %C, C:N ratio, Ca, Na, Mg, % moisture loss
- pH (H_2O) and Ca, Na, Mg, pH ($CaCl_2$)

In testing the uniformity of the data, no significant differences are apparent in the variables of wt (mg), %N, %C, C:N ratio, %Moisture loss and %Loss on ignition. However there are significant differences in the values of Ca (meq/100g), Na (meq/100g) and Mg (meq/100g) between the blocks, of K (meq/100g) between the columns and of pH (H_2O) and pH ($CaCl_2$) between the blocks and columns of the

[3] www.soilbio.nerc.ac.uk/reports/Index.htm. Choose: Soil_hoz.xls or .pdf (soil horizon data analysis)
www.soilbio.nerc.ac.uk/reports/Index.htm. Choose: Soildata.xls or .pdf (analysis of soil samples)
www.soilbio.nerc.ac.uk/reports/Index.htm. Choose: Soil_rgs.xls or .pdf (linear regressions of soil data)

experiment. The random design of the plots and treatments however, should render these differences much less significant and should adequately reduce their effect.

The values of the soil components of plots in Blocks 5 and 4 appear particularly anomalous. This is also the case in Blocks 3 and 1, although to a lesser extent. Unusually low levels of %N have been recorded in plot 5B and rather high values for the variables %C and C:N ratio are found in plot 4D. Plot 3A has low values of % moisture loss and plot 3B has irregularly high values for %N, %C, C:N ratio, Na, % moisture loss and % loss on ignition. In Block 1 high levels of Ca and Mg are listed for plot 1A, while plot 1D has apparently low values of weight and pH, but high values of %C, C:N ratio and %LOI.

The regression of each variable against all others produced the following significant results.

- Wt (mg), %C and % Moisture loss account for 87% of the variability in %N.
- %N, % Moisture loss and %LOI account for 93.9% of the variability in %C.
- Wt (mg), % Moisture loss and %LOI account for 71.9% of the variability in the C:N ratio.
- Wt (mg), Mg (meq/100g) and pH ($CaCl_2$) account for 97.1% of the variability in Ca (meq/100g).
- %N, %C, the C:N ration and pH (H_2O) account for 75.5% of the variability in Na.
- Na (meq/100g), Mg (meq/100g) and pH ($CaCl_2$) account for 35.7% of the variability in K.
- Wt (mg), %C, Ca (meq/100g) and K (meq/100g) account for 97.3% of the variability in Mg.
- Wt (mg), %N, %C and C:N ratio account for 80.9% of the variability in %Moisture loss.
- %N, C:N ratio and Na (meq/100g) account for 77.8% of the variability in %LOI.
- Ca (meq/100g), Na (meq/100g) and % Moisture loss account for 74.6% of the variability in pH (H_2O).
- C:N ratio, Ca (meq/100g) and Mg (meq/100g) account for 27.8% of the variability in pH ($CaCl_2$).

TABLE 6 : MEAN VALUES OF ALL VARIABLES FOR EACH BLOCK AND OVERALL SITE MEAN FROM AUGER SAMPLING

Block	Wt (mg)	%N	%C	C:N Ratio	Ca	Na	K	Mg	%ML	% LOI	pH(H_2O)	pH($CaCl_2$)
1	5.434	0.53	7.11	13.29	1.6	0.13	0.74	1.04	4.44	15.51	4.54	3.92
2	5.719	0.56	7.66	13.80	2.84	0.14	0.68	1.62	4.82	17.30	4.60	3.99
3	5.648	0.58	8.09	13.86	2.9	0.15	0.64	1.62	4.94	17.39	4.71	4.04
4	5.789	0.55	7.4	13.43	1.58	0.13	0.65	0.89	4.69	16.41	4.55	3.88
5	5.716	0.57	7.8	13.65	3.56	0.15	0.69	2.05	4.87	17.27	4.81	3.84
Site	5.661	0.56	7.61	13.61	2.49	0.14	0.68	1.44	4.75	16.78	4.64	3.93

5.3 Results and analysis of data from the profile description and sampling

Profile descriptions and results from the chemical analyses are presented in Appendix 1 and summarized in tables 8 and 9. The soils from above blocks 1, 2 and 3 were designated Brown forest soil and those above blocks 4 and 5 Brown forest soils with gleying.

The mean site data again show the surface horizons to be acidic and humic, confirming the results from the auger sampling. There is a gradual decline in acidity with depth, from 4.59 in the FH horizon to 5.00 in the C. The loss on ignition is high in the FH and H horizons, 71.46 and 58.24% respectively, and declines markedly, to 12.71% in the A horizon and to 3.72 in the C. Most of the extractable cations show parallel trends. A comparison of the soil profile for each block data suggests that there are significant differences between blocks in the levels of exchangeable cations in the FH and H layers. The highest levels of Ca occur in the FH and H horizons of Block 5. In fact in these near-surface horizons the Ca content of all other block profiles reduces with depth, whilst in Block 5 it increases. The highest levels of K and Mg are found in the FH layer of Block 1. Block 2 shows the lowest levels of of %N, %C, K, Mg, %Moisture loss and %LOI in its H horizon. The mean values of all variables except pH are at their highest in the FH and H horizons. In contrast pH (H_2O) increases with depth. Below the A horizon concentrations of extractable cations decline markedly and differences between layers and block profiles are less marked. (Refer to Table 8 below for data averages).

Tests for correlation between pairs of variables show that all of the variables except the two pH measurements and wt (mg) are significantly correlated. The principal component analysis of these correlation coefficients further indicate that together %N, %C, C:N ratio, Ca, K, Mg, %Moisture loss and %loss on ignition, account for 70% of the total variation in the sample, while a combined measure of the two pH determinations account for 13.5%.

TABLE 7 : SOIL DATA FROM AUGER SAMPLING

	Wt (mg)	%N	%C	C:N Ratio	Ca	Na	K	Mg	%Moisture	% LOI	pH(H_2O)	pH($CaCl_2$)
BLOCK 1												
1A	5.875	0.49	5.80	11.77	2.01	0.15	0.49	1.16	4.04	13.62	4.75	4.16
1B	5.091	0.47	6.72	14.29	1.95	0.13	0.68	1.09	4.40	14.94	4.47	3.98
1C	5.013	0.57	7.65	13.48	2.67	0.14	0.77	1.56	4.51	15.89	4.60	4.03
1D	5.159	0.62	8.40	13.52	1.4	0.12	0.89	1.08	4.65	16.40	4.50	3.81
1E	5.752	0.53	7.36	13.79	0.69	0.13	0.85	0.64	4.90	17.31	4.49	3.78
1F	5.714	0.52	6.71	12.88	0.86	0.12	0.78	0.68	4.12	14.91	4.41	3.78
BLOCK 2												
2A	5.771	0.57	7.30	12.79	2.1	0.14	0.58	1.16	4.36	15.38	4.74	4.11
2B	5.889	0.60	8.90	14.87	3.22	0.14	0.58	1.91	5.25	18.84	4.62	3.98
2C	5.858	0.52	7.17	13.82	3.19	0.14	0.71	1.76	4.82	17.32	4.68	4.00
2D	5.365	0.56	7.75	13.93	3.6	0.14	0.8	2.05	5.14	18.26	4.55	4.00
2E	5.368	0.55	7.70	13.91	2.63	0.14	0.65	1.54	4.95	18.07	4.60	3.95
2F	6.061	0.53	7.12	13.50	2.29	0.12	0.76	1.28	4.38	15.92	4.43	3.92
BLOCK 3												
3A	5.079	0.62	7.97	12.90	3.0	0.15	0.51	1.75	3.69	17.13	4.76	4.12
3B	5.883	0.64	9.73	15.21	3.41	0.18	0.63	2.11	6.54	19.66	4.65	4.04
3C	5.724	0.54	7.58	13.91	2.18	0.13	0.59	1.25	5.20	15.62	4.58	3.95
3D	5.825	0.61	8.28	13.50	3.37	0.15	0.61	1.85	5.11	18.49	4.76	4.08
3E	5.544	0.53	7.26	13.65	3.00	0.14	0.72	1.58	4.54	16.95	4.75	4.07
3F	5.831	0.55	7.71	13.97	2.41	0.14	0.76	1.2	4.53	16.48	4.76	3.95
BLOCK 4												
4A	6.012	0.56	8.02	14.26	2.96	0.15	0.61	1.59	5.15	17.56	4.82	4.05
4B	5.702	0.56	7.65	13.59	1.67	0.14	0.65	0.95	4.90	17.96	4.53	3.88
4C	5.758	0.57	7.20	12.62	1.11	0.13	0.58	0.67	4.46	15.33	4.59	3.91
4D	5.759	0.51	7.00	13.77	1.49	0.13	0.62	0.75	4.74	15.92	4.47	3.96
4E	5.831	0.53	6.80	12.94	1.01	0.12	0.62	0.58	4.29	14.60	4.45	3.84
4F	5.674	0.58	7.73	13.41	1.23	0.12	0.81	0.8	4.61	17.09	4.45	3.64
BLOCK 5												
5A	5.961	0.58	7.66	13.24	3.32	0.15	0.59	1.66	4.72	15.99	4.75	3.96
5B	5.947	0.60	8.07	13.45	2.58	0.14	0.67	1.51	4.94	17.07	4.70	3.76
5C	5.243	0.53	7.48	14.13	3.41	0.16	0.65	2.14	5.05	17.71	4.93	3.94
5D	5.915	0.57	7.51	13.13	5.07	0.16	0.83	2.89	4.60	16.34	4.95	4.14
5E	6.009	0.53	7.01	13.23	3.86	0.14	0.71	2.21	4.69	16.42	4.77	3.70
5F	5.219	0.62	9.07	14.74	3.12	0.17	0.68	1.88	5.19	20.10	4.73	3.53
Ecotron	6.089	0.59	8.22	13.83	2.76	0.15	0.62	1.7	4.79	17.42	4.79	3.82

TABLE 8: MEAN SITE VALUES OF ALL VARIABLES DERIVED FROM THE PROFILE PITS OF EACH BLOCK

Horizon	Wt (mg)	%N	%C	C:N	Ca	K	Mg	%ML	%LOI	pH (H_2O)	pH ($CaCl_2$)
FH	5.89	2.01	36.81	18.35	9.28	3.78	5.09	8.53	71.46	4.59	4.11
H	5.61	2.02	29.60	14.57	7.15	2.20	3.76	9.16	58.24	4.88	4.07
A	5.48	0.36	5.02	13.80	0.85	0.34	0.47	4.49	12.71	4.76	3.92
B	5.55	0.07	0.81	11.50	0.30	0.13	0.23	4.25	5.72	4.82	3.88
C	5.52	0.02	0.19	10.50	1.27	0.20	0.93	3.34	3.72	5.00	3.90

TABLE 9: SOIL PROFILE DATA

Block	Horizon	Wt (mg)	%N	%C	C:N ratio	Ca	K	Mg	%Moisture	%LOI	pH (H_2O)	pH ($CaCl_2$)
1	FH	6.091	2.14	39.97	18.64	9.84	5.13	6.84	8.79	77.88	4.67	4.38
	H	5.809	2.35	34.92	14.87	6.16	2.96	4.24	8.78	67.32	4.55	3.74
	Ap	5.594	0.34	4.43	12.88	0.36	0.31	0.28	4.9	11.83	4.63	3.66
	Bx1	4.935	0.07	0.67	10.07	0.18	0.14	0.23	4.62	5.18	4.66	3.66
	Bx2	5.771	0.03	0.31	11.14	0.15	0.19	0.18	3.89	3.94	4.63	3.63
	BCx	5.679	0.03	0.31	11.21	0.32	0.2	0.37	4.29	3.93	4.7	3.62
	CR	5.452	0.01	0.12	9.39	0.52	0.22	0.63	3.55	3.28	4.76	3.62
2	FH	5.914	1.85	32.81	17.72	8.36	3.29	3.93	8.03	62.81	4.38	3.74
	H	5.109	1.31	17.93	13.72	5.84	1.14	2.62	7.61	37.76	4.71	3.98
	A h	5.731	0.49	7.01	14.33	1.79	0.52	0.81	4.81	16.2	4.98	3.98
	B	5.899	0.18	2.3	12.51	0.39	0.1	0.21	4.81	8.8	5.13	4.05
	BCx	6.129	0.03	0.3	9.1	0.19	0.12	0.17	3.98	4.75	4.93	3.94
	CR	5.656	0.02	0.19	9.26	0.23	0.15	0.21	2.64	3.07	5.42	4.08
3	FH	5.4	2.11	39.38	18.71	6.24	3.76	4.3	8.75	76.36	4.42	3.92
	H	5.558	2.15	31.82	14.84	4.13	2.78	3.08	9.87	62.5	4.99	4.05
	Ah	5.758	0.34	5.34	15.56	0.42	0.37	0.24	4.69	14.68	4.6	3.78
	AB	5.231	0.23	2.7	11.6	0.18	0.17	0.07	3.42	8.11	5.03	4.06
	Bs	5.263	0.12	1.75	14.36	0.15	0.07	0.06	4.24	7.11	4.95	4.09
	BCx	5.191	0.02	0.3	12.12	0.21	0.14	0.09	3.96	4.57	4.98	3.97
	C	5.483	0.02	0.25	10.95	0.18	0.12	0.07	3.2	3.67	4.89	3.97
4	FH	5.827	1.88	38.12	20.24	10.05	3.41	4.48	8.94	73.26	4.76	4.01
	H	5.869	2.14	32.25	15.1	7.08	2.73	3.35	10.09	63.99	4.94	4.19
	Ah	5.141	0.42	6.41	15.3	0.92	0.53	0.33	4.77	14.59	4.57	3.95
	AB	5.446	0.12	1.77	14.73	0.36	0.07	0.13	4.93	8.24	5.05	4.09
	Bs	5.449	0.08	1.04	12.64	0.59	0.12	0.25	6.8	8	4.8	3.94
	Cx	5.677	0.02	0.27	12.43	0.34	0.19	0.26	4.11	4.47	5.02	3.88
5	FH	6.218	2.05	33.81	16.46	11.91	3.3	5.92	8.16	67	4.66	4.48
	H	5.717	2.17	31.06	14.31	12.54	1.5	5.5	9.43	59.64	5.2	4.41
	Ah	5.488	0.65	9.36	14.36	2.38	0.59	1.52	5.42	19.27	4.34	3.88
	AB	5.464	0.27	3.17	11.61	0.35	0.13	0.27	2.97	8.78	4.87	3.95
	Bg	5.592	0.06	0.72	11.58	0.19	0.05	0.15	2.79	6.05	4.66	4.02
	BCg	5.618	0.04	0.43	10.2	0.64	0.14	0.64	3.17	4.83	4.79	3.84
	Cg	5.372	0.01	0.12	10.45	5.08	0.32	3.5	3.21	4.12	4.94	3.97

Appendix A: Soil and vegetation data for each block

Information taken from Soil Biodiversity Programme Research Report No. 1: Sourhope field site baseline data. R. Scott, J. Bell, C. Kenny, J.N.R. Jeffers and S. Buckland. 2001.

TABLE 1.

BLOCK 1 SOIL AND VEGETATION DATA

(a)

SITE DETAILS OF RIGG FOOT, SOURHOPE : BLOCK 1	
Grid reference	NT8545019630
Altitude	304 m
Slope bearing	4º
Soil drainage	Moderate
Series	SH 74711 Sourhope, Sourhope
Parent material	Undefined
Major soil subgroup	Brown forest soil
Rock type	77 60: andesite and undifferentiated intermediate igneous
Base of profile pit	Lowest horizon continues

(b)

SOIL PROFILE OF RIGG FOOT, SOURHOPE : BLOCK 1		
Horizon	**Depth (cm)**	**Soil description**
LF	0 - 1	No identifiable mineral grains; fibrous; moist; no stones; clear wavy boundary.
FH	1 - 6	Very dark greyish brown, 10yr 3/2 matrix colour; no identifiable mineral grains; semi-fibrous; moist; abundant very fine fibrous roots; many fine fleshy roots; no stones; sharp wavy boundary.
H	6 - 10	Very dark grey, 10yr 3/1 matrix colour; no identifiable mineral grains; semi-fibrous; moist; weak fine angular blocky structure; abundant very fine fibrous roots; many fine fleshy roots; no stones; clear wavy boundary.
A p	10 - 29	Dark brown, 7.5yr 4/2 matrix colour; sandy silt loam; no mottles; moderate medium subangular blocky structure tending to moderate fine granular structure; moist; friable; abundant very fine fibrous roots; many fine fleshy roots; abundant very small angular undifferentiated intermediate igneous stones; common medium subangular andesite stones; sharp smooth boundary.
B x1	29 - 44	Reddish brown, 5yr 5/3 matrix colour; strong brown 7.5yr 5/6 mottle colour; sandy silt loam; common fine distinct clear mottles; massive structure tending to moderate medium platy structure; moist; moderate induration; common very fine fibrous roots; very abundant very small angular undifferentiated intermediate igneous stones; few medium subangular undifferentiated intermediate igneous stones; clear wavy boundary.
B x2	44 - 60	Reddish brown, 5yr 4/3 matrix colour; strong brown, 7.5yr 5/6 mottle colour; sandy silt loam; common fine distinct clear mottles; massive structure tending to weak medium platy structure; moist; moderate induration; few very fine fibrous roots; very abundant very small angular undifferentiated intermediate igneous stones; few medium subangular undifferentiated intermediate igneous stones; clear wavy boundary.
BCx	60 - 79	Brown, 7.5yr 5/2 matrix colour; loamy sand; no mottles; massive structure; moist; weak induration; no roots; very abundant very small angular undifferentiated intermediate igneous stones; few small subangular undifferentiated intermediate igneous stones; clear wavy boundary.
CR	79 - 95	Reddish grey, 5yr 5/2 matrix colour; loamy sand; no mottles; massive structure; moist; very firm; no roots; very abundant very small angular undifferentiated intermediate igneous stones; abundant small angular andesite stones.

(c)

SOIL ANALYSIS OF RIGG FOOT, SOURHOPE : BLOCK 1 PROFILE							
Horizon	**FH**	**H**	**Ap**	**Bx1**	**Bx2**	**BCx**	**CR**
MLURI Barcode	603931	603932	603933	603934	603935	603936	603937
Wt (mg)	6.091	5.809	5.594	4.935	5.771	5.679	5.452
%N	2.14	2.35	0.34	0.07	0.03	0.03	0.01
%C	39.97	34.92	4.43	0.67	0.31	0.31	0.12
C:N Ratio	18.64	14.87	12.88	10.07	11.14	11.21	9.39
Ca (meq/100g)	9.84	6.16	0.36	0.18	0.15	0.32	0.52
Na (meq/100g)	0.66						
K (meq/100g)	5.13	2.96	0.31	0.14	0.19	0.2	0.22
Mg (meq/100g)	6.48	4.24	0.28	0.23	0.18	0.37	0.63
% Moisture loss	8.79	8.78	4.90	4.62	3.89	4.29	3.55
% Loss on Ignition	77.88	67.32	11.83	5.18	3.94	3.93	3.28
pH(H_2O)	4.67	4.55	4.63	4.66	4.63	4.70	4.76
pH($CaCl_2$)	4.38 (5g)	3.74 (5g)	3.66	3.66	3.63	3.62	3.62

(d)

SOIL ANALYSIS OF RIGG FOOT, SOURHOPE : BLOCK 1 AUGER SAMPLES						
Plot no.	**1A**	**1B**	**1C**	**1D**	**1E**	**1F**
MLURI Barcode	603900	603901	603902	603903	603904	603905
Wt (mg)	5.875	5.091	5.013	5.159	5.752	5.714
% N	0.49	0.47	0.57	0.62	0.53	0.52
% C	5.80	6.72	7.65	8.40	7.36	6.71
C:N Ratio	11.77	14.29	13.48	13.52	13.79	12.88
Ca (meq/100g)	2.01	1.95	2.67	1.4	0.69	0.86
Na (meq/100g)	0.15	0.13	0.14	0.12	0.13	0.12
K (meq/100g)	0.49	0.68	0.77	0.89	0.85	0.78
Mg (meq/100g)	1.16	1.09	1.56	1.08	0.64	0.68
% Moisture loss	4.04	4.40	4.51	4.65	4.90	4.12
% Loss on Ignition	13.62	14.94	15.89	16.40	17.31	14.91
pH(H2O)	4.75	4.47	4.60	4.50	4.49	4.41
pH(CaCl2)	4.16	3.98	4.03	3.81	3.78	3.78

(e)

VEGETATION SURVEY OF RIGG FOOT, SOURHOPE : BLOCK 1

PLOT 1A																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
A		3	5						4	3	1				1				6				1	1	
D		2	6		2					5	2				1				4				1	2	
F			7							6	2	4							3					3	
L	2	2	5							5	2			2				1	3				1	2	
P		5	4							4	2			2	1			4	2		1				
Species totals	2	12	27	0	2	0	0	0	4	23	9	4	0	4	3	0	0	5	18	0	1	0	3	8	0

PLOT 1B																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
A	3	6	4							4	2						2		2				1	1	
C	4	5			1	1				3	3						3	1	3					1	
F		9	2						1	2	3						3	1	3					1	
K	4	2	6							4							3	1	3					2	
Q		4	6							3					3		4	2	3						
Species totals	11	26	18	0	1	1	0	0	1	16	8	0	0	0	3	0	15	5	14	0	0	0	1	5	0

PLOT 1C																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
B		4	6							2									7					6	
F	3		7						1	4	2						3	1	2					2	
H		6	4		2					6							3		2					2	
J		3	5							8							2	1	2					4	
M	3	2	4								1	4					3	2		2				2	2
Species totals	6	15	26	0	2	0	0	0	1	20	3	4	0	0	0	0	11	4	13	2	0	0	0	16	2

PLOT 1D																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
C		2	5						1	4	2			1	1		5	3	1						
D		2	6							5	1	3		1			3	1	3						
G		3	3						1	5					4		5	2						2	
J	3	2							2	4	2	6					3	2					1		
N		5								6	2			1	3		3		3				2		
Species totals	3	14	14	0	0	0	0	0	4	24	7	9	0	3	8	0	19	8	7	0	0	0	3	2	0

PLOT 1E																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
C	4	3	4								3				1		5	1		4					
E		3	6	1							3						2	3		4	1			2	
G		2	6							5	2	1		1			3	2		3					
M		3	3						4								5	4	3		1		2		
P		3	5							3							6	1		5				2	
Species totals	4	14	24	1	0	0	0	0	4	8	8	1	0	1	1	0	21	11	3	16	2	0	2	4	0

PLOT 1F																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
B		2	4	1						3				2		5	5	1						2	
D		3	6	1				2								5	3		2		2		1		
F		3	6							5					1	3	3	3					1		
L		2	5	1		1				3	1	1		2			7	2							
M		3	5							3						1	4	3	6						
Species totals	0	13	26	3	0	1	0	2	0	14	1	1	0	4	1	14	22	9	8	0	2	0	2	2	0

TABLE 2.

BLOCK 2 SOIL AND VEGETATION DATA

(a)

SITE DETAILS OF RIGG FOOT, SOURHOPE : BLOCK 2	
Grid reference	NT8551019610
Altitude	306 m
Slope description	7°
Soil drainage	Free
Series	SH 74711 Sourhope, Sourhope
Parent material	Undefined
Major soil subgroup	Brown forest soil
Rock type	77 60: andesite and undifferentiated intermediate igneous
Base of profile pit	Weathered rock

(b)

SOIL PROFILE OF RIGG Foot, Sourhope : BLOCK 2		
Horizon	**Depth (cm)**	**Soil description**
LF	0 - 1	No identifiable mineral grains; fibrous; wet; no stones; clear smooth boundary.
FH	1 - 4	Yellowish brown, 10yr 5/4 matrix colour; no identifiable mineral grains; fibrous; wet; abundant very fine fibrous roots; common fine fleshy roots; no stones; sharp wavy boundary.
H	4 - 6	Black, 5yr 2/1 matrix colour; v; amorphous; wet; weak medium angular blocky structure; abundant very fine fibrous roots; few fine fleshy roots; no stones; clear wavy boundary.
A h	6 - 24	Dark reddish brown, 5yr 3/2 matrix colour; sandy silt loam; no mottles; moderate medium subangular blocky structure tending to moderate fine granular structure; moist; friable; many very fine fibrous roots; few fine fleshy roots; abundant very small angular undifferentiated intermediate igneous stones; common medium subangular andesite stones; sharp broken boundary.
B	24 - 35	Dark brown, 7.5yr 4/2 matrix colour coarse sandy loam; no mottles; weak medium subangular blocky structure tending to moderate fine subangular blocky structure; moist; friable; many very fine fibrous roots; abundant very small angular undifferentiated intermediate igneous stones; common small subangular undifferentiated intermediate igneous stones; clear broken boundary.
BCx	35 - 52	Reddish grey, 5yr 5/2 matrix colour; strong brown, 7.5yr 5/6 mottle colour; coarse loamy sand; few fine faint diffuse mottles; massive structure tending to moderate coarse platy structure; moist; moderate induration; no roots; abundant very small angular undifferentiated intermediate igneous stones; abundant small subangular andesite stones; sharp wavy boundary.
CR	52 - 80	Dark reddish grey, 5yr 4/2 matrix colour; coarse sand; no mottles; single grain structure; moist; loose; no roots; very abundant very small angular undifferentiated intermediate igneous stones; many small subangular andesite stones.

(c)

SOIL ANALYSIS OF RIGG FOOT, SOURHOPE : BLOCK 2 PROFILE						
Horizon	**FH**	**H**	**Ah**	**B**	**BCx**	**CR**
MLURI Barcode	603938	603939	603940	603941	603942	603943
Wt (mg)	5.914	5.109	5.731	5.899	6.129	5.656
%N	1.85	1.31	0.49	0.18	0.03	0.02
%C	32.81	17.93	7.01	2.30	0.30	0.19
C:N Ratio	17.72	13.72	14.33	12.51	9.10	9.26
Ca (meq/100g)	8.36	5.84	1.79	0.39	0.19	0.23
Na (meq/100g)						
K (meq/100g)	3.29	1.14	0.52	0.1	0.12	0.15
Mg (meq/100g)	3.93	2.62	0.81	0.21	0.17	0.21
% Moisture loss	8.03	7.61	4.81	4.81	3.98	2.64
% Loss on Ignition	62.81	37.76	16.20	8.80	4.75	3.07
pH(H_2O)	4.38	4.71	4.98	5.13	4.93	5.42
pH($CaCl_2$)	3.74 (5g)	3.98 (5g)	3.98	4.05	3.94	4.08

(d)

SOIL ANALYSIS OF RIGG FOOT, SOURHOPE : BLOCK 2 AUGER SAMPLES						
Plot No.	**2A**	**2B**	**2C**	**2D**	**2E**	**2F**
MLURI Barcode	603906	603907	603908	603909	603910	603911
Wt (mg)	5.771	5.889	5.858	5.365	5.368	6.061
%N	0.57	0.60	0.52	0.56	0.55	0.53
%C	7.30	8.90	7.17	7.75	7.70	7.12
C:N Ratio	12.79	14.87	13.82	13.93	13.91	13.50
Ca (meq/100g)	2.1	3.22	3.19	3.6	2.63	2.29
Na (meq/100g)	0.14	0.14	0.14	0.14	0.14	0.12
K (meq/100g)	0.58	0.58	0.71	0.8	0.65	0.76
Mg (meq/100g)	1.16	1.91	1.76	2.05	1.54	1.28
% Moisture loss	4.36	5.25	4.82	5.14	4.95	4.38
% Loss on Ignition	15.38	18.84	17.32	18.26	18.07	15.92
pH(H_2O)	4.74	4.62	4.68	4.55	4.60	4.43
pH($CaCl_2$)	4.11	3.98	4.00	4.00	3.95	3.92

(e)

VEGETATION SURVEY OF RIGG FOOT, SOURHOPE : BLOCK 2

PLOT 2A																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
D		3	4							6	1						2		4				1	4	
J			3	1	1					3	2							1	5				1	3	5
K			3						3		2			3			1	1	5		1		6		
N			3						2	5	2				1			3	7				2		
P			4							2	2	8			1		2		3					3	
Species totals	0	3	17	1	1	0	0	0	5	16	9	8	0	3	2	0	5	5	24	0	1	0	10	10	5

PLOT 2B																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
A		3	4						4		2						3		6				3		
F		2	5									14											1	3	
K			6							7	3								5					4	
P		8	5							4									4				2	2	
Q			8				6					3						2	4			2			
Species totals	0	13	28	0	0	0	6	0	4	11	5	17	0	0	0	0	3	2	19	0	0	2	6	9	0

PLOT 2C																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
A		8	3							2	3						4		4				1		
C		6	2		4				3		2							1	3				2	2	
G	4	5																	8	5				3	
L		1	6							4							2		9					3	
Q		4	5							5		4					3						1	3	
Species totals	4	24	16	0	4	0	0	0	3	11	5	4	0	0	0	0	9	1	24	5	0	0	4	11	0

PLOT 2D																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
A		4	2		1					3							3	1	8					3	
F		4	5		1							6					2		4					3	
H		2	5							7	1				2					2		3	1	2	
J		2	3	1	1					4		2			1		3		4			2		2	
N		6	2						4				1				3		7					2	
Species totals	0	18	17	1	3	0	0	0	4	14	1	8	1	0	3	0	11	1	23	2	0	5	1	12	0

PLOT 2E																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
C		4	9		1					5							2	1					1	2	
E			5							3		14	1											2	
G			11						2	6		4												2	
L		2	3								3	1					9	6			1				
N		5			1				3		3			1			7	1	3				1		
Species totals	0	11	28	0	2	0	0	0	5	14	6	19	1	1	0	0	18	8	3	0	1	0	2	6	0

PLOT 2F																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
A			6		1	2				4	1				1		5		3				1	1	
C		3	5						3								9	1			1		1	2	
E			5						1	3		9					3		3					1	
J			10									8					3			2	2				
P			8						1	4		7							4					1	
Species totals	0	3	34	0	1	2	0	0	5	11	1	24	0	0	1	0	20	1	10	2	3	0	2	5	0

TABLE 3.

BLOCK 3 SOIL AND VEGETATION DATA

(a)

SITE DETAILS OF RIGG FOOT, SOURHOPE : BLOCK 3	
Grid reference	NT8549019590
Altitude	308 m
Slope description	7°
Soil drainage	Free
Series	SH 74711 Sourhope, Sourhope
Parent material	Undefined
Major soil subgroup	Brown forest soil
Rock type	77 60: andesite and undifferentiated intermediate igneous
Base of profile pit	Lowest horizon continues

(b)

SOIL PROFILE OF RIGG Foot, Sourhope : BLOCK 3		
Horizon	**Depth (cm)**	**Soil description**
LF	0 - 1	No identifiable mineral grains; fibrous; moist; no stones; clear smooth boundary.
FH	1 - 3	Dark grey, 10yr 4/1 matrix colour; no identifiable mineral grains; fibrous; moist; abundant very fine fibrous roots; common fine fleshy roots; no stones; sharp wavy boundary.
H	3 - 8	Very dark grey, 10yr 3/1 matrix colour; loamy peat; amorphous; moist; weak medium subangular blocky structure; abundant very fine fibrous roots; common fine fleshy roots; no stones; sharp irregular boundary.
A h	8 - 26	Dark reddish brown, 5yr 3/2 matrix colour; sandy silt loam; no mottles; moderate medium angular blocky structure; moist; friable; many very fine fibrous roots; common fine fleshy roots; common medium subangular undifferentiated intermediate igneous stones; common large subangular andesite stones; clear smooth boundary.
AB	26 - 37	Brown, 7.5yr 5/2 matrix colour; fine sandy silt loam; no mottles; weak fine subangular blocky structure; moist; friable; many very fine fibrous roots; common fine fleshy roots; many very small angular undifferentiated intermediate igneous stones; few small subangular undifferentiated intermediate igneous stones; clear irregular boundary.
B sh	37 - 55	Yellowish red, 5yr 5/6 matrix colour; fine sandy silt loam; no mottles; weak fine subangular blocky structure; moist; friable; common very fine fibrous roots; few fine fleshy roots; abundant very small angular undifferentiated intermediate igneous stones; common small subangular undifferentiated intermediate igneous stones; sharp wavy boundary.
BCx	55 - 78	Reddish brown, 2.5yr 4/4 matrix colour; strong brown, 7.5yr 5/6 mottle colour; sandy clay loam; common fine distinct clear mottles; massive structure tending to moderate medium platy structure; moist; moderate induration; few very fine fibrous roots; very abundant very small angular andesite stones; common medium subangular andesite stones; clear wavy boundary.
C	78 - 90	Reddish brown, 5yr 5/3 matrix colour; sandy silt loam; no mottles; massive structure; moist; firm; no roots; very abundant very small angular undifferentiated intermediate igneous stones; common medium subangular andesite stones.

(c)

SOIL ANALYSIS OF RIGG FOOT, SOURHOPE : BLOCK 3 PROFILE							
Horizon	**FH**	**H**	**Ah**	**AB**	**Bs**	**BCx**	**C**
MLURI Barcode	603944	603945	603946	603947	603948	603949	603950
Wt (mg)	5.400	5.558	5.758	5.231	5.263	5.191	5.483
%N	2.11	2.15	0.34	0.23	0.12	0.02	0.02
%C	39.38	31.82	5.34	2.70	1.75	0.30	0.25
C:N Ratio	18.71	14.84	15.56	11.60	14.36	12.12	10.95
Ca (meq/100g)	6.24	4.13	0.42	0.18	0.15	0.21	0.18
Na (meq/100g)							
K (meq/100g)	3.76	2.78	0.37	0.17	0.07	0.14	0.12
Mg (meq/100g)	4.3	3.08	0.24	0.07	0.06	0.09	0.07
% Moisture loss	8.75	9.87	4.69	3.42	4.24	3.96	3.20
% Loss on Ignition	76.36	62.50	14.68	8.11	7.11	4.57	3.67
pH(H_2O)	4.42	4.99	4.6	5.03	4.95	4.98	4.89
pH($CaCl_2$)	3.92 (5g)	4.05 (5g)	3.78	4.06	4.09	3.97	3.97

(d)

SOIL ANALYSIS OF RIGG FOOT, SOURHOPE : BLOCK 3 AUGER SAMPLES						
Plot No.	**3A**	**3B**	**3C**	**3D**	**3E**	**3F**
MLURI Barcode	603912	603913	603914	603915	603916	603917
Wt (mg)	5.079	5.883	5.724	5.825	5.544	5.831
%N	0.62	0.64	0.54	0.61	0.53	0.55
%C	7.97	9.73	7.58	8.28	7.26	7.71
C:N Ratio	12.90	15.21	13.91	13.50	13.65	13.97
Ca (meq/100g)	3.0	3.41	2.18	3.37	3.00	2.41
Na (meq/100g)	0.15	0.18	0.13	0.15	0.14	0.14
K (meq/100g)	0.51	0.63	0.59	0.61	0.72	0.76
Mg (meq/100g)	1.75	2.11	1.25	1.85	1.58	1.2
% Moisture loss	3.69	6.54	5.20	5.11	4.54	4.53
% Loss on Ignition	17.13	19.66	15.62	18.49	16.95	16.48
pH(H_2O)	4.76	4.65	4.58	4.76	4.75	4.76
pH($CaCl_2$)	4.12	4.04	3.95	4.08	4.07	3.95

(e)

VEGETATION SURVEY OF RIGG FOOT, SOURHOPE : BLOCK 3

PLOT 3A																								
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
A			7							1		9			1				4		2		1		
C			2							2	1	2			4		3	1	6					4	
G		3	10							3		4			2		2						1		
H		2	9		1					6		3												4	
Q		1	7							6		4			2								2	3	
Species totals	0	6	35	0	1	0	0	0	0	18	1	22	0	0	9	0	5	1	10	0	2	0	4	11	0

PLOT 3B																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
B			12								2				2			5	3				1		
G		2	7									2					3	3	5				1	2	
J		2	13							3					1				4					2	
M			8				6			4							3		2			2			
P			3							2	2	3			1		7	2	5						
Species totals	0	4	43	0	0	0	6	0	0	9	4	5	0	0	4	0	13	10	19	0	0	2	2	4	0

PLOT 3C																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
D		2	7							4							10	1					1		
H			4						4	2									13				2		
K		2	10							5								1	3		4				
P		3	3		1												11	1	6						
Q		7	3							2				2	1		4						1	5	
Species totals	0	14	27	0	1	0	0	0	4	13	0	0	0	2	1	0	25	3	22	0	4	0	4	5	0

PLOT 3D																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
B		1	4							3				2	2		7	1						5	
F		1	5							3					3		6		5			2			
H		2	7														2		8				1	5	
K			10														5		8					2	
N		3	4							3		1							7					7	
Species totals	0	7	30	0	0	0	0	0	0	9	0	1	0	2	5	0	20	1	28	0	0	2	1	19	0

PLOT 3E																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
A		6	3							7		3	1		2			1						2	
D		3	9									4							7					2	
H		3	10											1			3		6					2	
N		2	6		1					7				1			5					3			
Q			5														14	2	3					1	
Species totals	0	14	33	0	1	0	0	0	0	14	0	7	1	2	2	0	22	3	16	0	0	3	0	7	0

PLOT 3F																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
B		4	6						2								11					2			
F		2	6							12									3					2	
G			13							2					1		3			3			1	2	
L			7														12		4	2					
Q		2	7						2	5		3					6								
Species totals	0	8	39	0	0	0	0	0	4	19	0	3	0	0	1	0	32	0	7	5	0	2	1	4	0

TABLE 4.

BLOCK 4 SOIL AND VEGETATION DATA

(a)

SITE DETAILS OF RIGG FOOT, SOURHOPE : BLOCK 4	
Grid reference	NT8546019550
Altitude	312 m
Slope description	8°
Soil drainage	Imperfect
Series	SH 74714 Sourhope, Bellshill
Parent material	Till
Major soil subgroup	Brown forest soil with gleying
Rock type	77 60: andesite and undifferentiated intermediate igneous
Base of profile pit	Lowest horizon continues

(b)

SOIL PROFILE OF RIGG Foot, Sourhope : BLOCK 4		
Horizon	**Depth (cm)**	**Soil description**
LF	0 - 1	No identifiable mineral grains; fibrous; moist; no stones; clear smooth boundary.
FH	1 - 4	No identifiable mineral grains; fibrous; moist; abundant very fine fibrous roots; common fine fleshy roots; no stones; sharp smooth boundary.
H	4 - 8	Black, 10yr 2/1 matrix colour; no identifiable mineral grains; amorphous; moist; weak medium angular blocky structure; abundant very fine fibrous roots; common fine fleshy roots; no stones sharp wavy boundary.
A h	8 - 29	Dark reddish brown, 5yr 2/2 matrix colour; sandy silt loam; no mottles; weak medium subangular blocky structure tending to moderate fine granular structure; moist; very friable; many very fine fibrous roots; common fine fleshy roots; many small subangular undifferentiated intermediate igneous stones; common medium subangular andesite stones; sharp smooth boundary.
Abg	29 - 40	Pinkish grey, 7.5yr 6/2 matrix colour; strong brown, 7.5yr 5/6 mottle colour; coarse sandy silt loam; common fine faint diffuse mottles; moderate medium angular blocky structure; moist; firm; many very fine fibrous roots; abundant very small angular undifferentiated intermediate igneous stones; many small subangular undifferentiated intermediate igneous stones; clear smooth boundary.
B sg	40 - 61	Brown, 7.5yr 5/4 matrix colour; strong brown, 7.5yr 5/8 mottle colour; sandy silt loam; common fine faint diffuse mottles; moderate medium angular blocky structure tending to moderate medium platy structure; moist; firm; common very fine fibrous roots; few fine fleshy roots; many very small angular undifferentiated intermediate igneous stones; many small subangular undifferentiated intermediate igneous stones; sharp smooth boundary.
C gx	61 - 95	Reddish brown, 5yr 5/3 matrix colour; strong brown, 7.5yr 6/5 mottle colour; sandy clay loam; common fine distinct clear mottles; massive structure tending to moderate medium platy structure; moist; weak induration; few very fine fibrous roots; very abundant very small angular undifferentiated intermediate igneous stones; common medium subangular andesite stones.

(c)

SOIL ANALYSIS OF RIGG FOOT, SOURHOPE : BLOCK 4 PROFILE						
Horizon	**FH**	**H**	**Ah**	**AB**	**Bs**	**Cx**
MLURI Barcode	603951	603952	603953	603954	603955	603956
Wt (mg)	5.827	5.869	5.141	5.446	5.449	5.677
%N	1.88	2.14	0.42	0.12	0.08	0.02
%C	38.12	32.25	6.41	1.77	1.04	0.27
C:N Ratio	20.24	15.10	15.30	14.73	12.64	12.43
Ca (meq/100g)	10.05	7.08	0.92	0.36	0.59	0.34
Na (meq/100g)						
K (meq/100g)	3.41	2.73	0.53	0.07	0.12	0.19
Mg (meq/100g)	4.48	3.35	0.33	0.13	0.25	0.26
% Moisture loss	8.94	10.09	4.77	4.93	6.80	4.11
% Loss on Ignition	73.26	63.99	14.59	8.24	8.00	4.47
pH(H_2O)	4.76	4.94	4.57	5.05	4.8	5.02
pH($CaCl_2$)	4.01 (5g)	4.19 (5g)	3.95	4.09	3.94	3.88

(d)

SOIL ANALYSIS OF RIGG FOOT, SOURHOPE : BLOCK 4 AUGER SAMPLES						
Plot No.	**4A**	**4B**	**4C**	**4D**	**4E**	**4F**
MLURI Barcode	603918	603919	603920	603921	603922	603923
Wt (mg)	6.012	5.702	5.758	5.759	5.831	5.674
%N	0.56	0.56	0.57	0.51	0.53	0.58
%C	8.02	7.65	7.20	7.00	6.80	7.73
C:N Ratio	14.26	13.59	12.62	13.77	12.94	13.41
Ca (meq/100g)	2.96	1.67	1.11	1.49	1.01	1.23
Na (meq/100g)	0.15	0.14	0.13	0.13	0.12	0.12
K (meq/100g)	0.61	0.65	0.58	0.62	0.62	0.81
Mg (meq/100g)	1.59	0.95	0.67	0.75	0.58	0.8
% Moisture loss	5.15	4.90	4.46	4.74	4.29	4.61
% Loss on Ignition	17.56	17.96	15.33	15.92	14.60	17.09
pH(H_2O)	4.82	4.53	4.59	4.47	4.45	4.45
pH($CaCl_2$)	4.05	3.88	3.91	3.96	3.84	3.64

(e)

VEGETATION SURVEY OF RIGG FOOT, SOURHOPE : BLOCK 4

PLOT 4A																								
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
A		2	11							3							3	2	3				1		
F		3	7								2						10	2					1		
H			11							7		4							2					1	
M		4	11							6							2							2	
N			8									6					2		4				1	4	
Species totals	0	9	48	0	0	0	0	0	0	16	2	10	0	0	0	0	17	4	9	0	0	0	3	7	0

PLOT 4B																								
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
C		4															12		5				4		
E		8	3							5									2					7	
G			12	1						7									3					2	
N		2	9								2				1		3	5					3		
Q	5	3	2							6							7	1					1		
Species totals	5	17	26	1	0	0	0	0	0	18	2	0	0	0	1	0	22	6	10	0	0	0	8	9	0

PLOT 4C																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
B		3	14														7	1							
D			16														4	5							
J	4	3	8							5	1				4										
M		3	8							6		4			2			2							
P		3	8								1	2			1		6	2	1				1		
Species totals	4	12	54	0	0	0	0	0	0	11	2	6	0	0	7	0	17	10	1	0	0	0	1	0	0

PLOT 4D																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
C		6	6											3	2		8								
E		4	9							7					1		4								
J		3	9							6		5						2							
K		7	10				2			3									3						
P			11							5		2							7						
Species totals	0	20	45	0	0	0	2	0	0	21	0	7	0	3	3	0	12	2	10	0	0	0	0	0	0

PLOT 4E																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
B		8								5							7	1	4						
C			17							3							5								
H		5	1							6							12	1							
K			11							3							9	2							
P		2	11							8	1							2					1		
Species totals	0	15	40	0	0	0	0	0	0	25	1	0	0	0	0	0	33	6	4	0	0	0	1	0	0

PLOT 4F																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
B		2	9							4							3		7						
F		3	13							6							2	1							
H		3	10							7								2	3						
K		3	8							2							7	3						2	
N		5	10							4						6									
Species totals	0	16	50	0	0	0	0	0	0	23	0	0	0	0	0	6	12	6	10	0	0	0	0	2	0

TABLE 5

BLOCK 5 SOIL AND VEGETATION DATA

(a)

SITE DETAILS OF RIGG FOOT, SOURHOPE : BLOCK 5	
Grid reference	NT8544019520
Altitude	315 m
Slope description	5°
Soil drainage	Imperfect
Series	SH 74714 Sourhope, Bellshill
Parent material	
Major soil subgroup	Brown forest soil with gleying
Rock type	60 77: undifferentiated intermediate igneous and andesite
Base of profile pit	Lowest horizon continues

(b)

SOIL PROFILE OF RIGG Foot, Sourhope : BLOCK 5		
Horizon	**Depth (cm)**	**Soil description**
LF	0 - 1	No identifiable mineral grains; fibrous; moist; no stones; clear smooth boundary.
FH	1 - 5	No identifiable mineral grains; semi-fibrous; moist; abundant very fine fibrous roots; common fine fleshy roots; no stones; sharp smooth boundary.
H	5 - 7	Black, 10yr 2/1 matrix colour; no identifiable mineral grains; semi-fibrous; moist; weak medium angular blocky structure; abundant very fine fibrous roots; common fine fleshy roots; no stones; sharp wavy boundary.
A h	7 - 25	Very dark brown, 10yr 2/2 matrix colour; sandy silt loam; no mottles; moderate medium subangular blocky structure tending to moderate fine granular structure; moist; friable; many very fine fibrous roots; common fine fleshy roots; many medium subangular andesite stones; few large subangular andesite stones; clear smooth boundary.
AB	25 - 35	Grey, 5yr 5/1 matrix colour; coarse sandy silt loam; no mottles; weak medium subangular blocky structure tending to moderate fine subangular blocky structure; moist; friable; abundant fine fleshy roots; many very fine fibrous roots; very abundant very small angular undifferentiated intermediate igneous stones; common medium subangular andesite stones; clear smooth boundary.
B g	35 - 49	Reddish brown, 5yr 5/3 matrix colour; yellowish red, 5yr 5/6 mottle colour; sandy clay loam; many medium prominent clear mottles; moderate medium angular blocky structure; moist; firm; many very fine fibrous roots; common fine fleshy roots; very abundant very small angular undifferentiated intermediate igneous stones; many small subangular undifferentiated intermediate igneous stones; clear smooth boundary.
BCg	49 - 70	Reddish brown, 2.5yr 5/4 matrix colour; yellowish red, 5yr 5/6 mottle colour; clay loam; many medium prominent clear mottles; massive structure tending to weak medium angular blocky structure; moist; firm; common very fine fibrous roots; few fine fleshly roots; abundant very small angular undifferentiated intermediate igneous stones; common medium subangular undifferentiated intermediate igneous stones; clear smooth boundary.
C g	70 - 100	Light reddish brown, 5yr 6/3 matrix colour; yellowish red, 5yr 5/6 mottle colour; clay loam; many medium prominent clear mottles; massive structure; moist; firm; no roots; very abundant very small angular undifferentiated intermediate igneous stones; common medium subangular andesite stones.

(c)

SOIL ANALYSIS OF RIGG FOOT, SOURHOPE : BLOCK 5 PROFILE							
Horizon	**FH**	**H**	**Ah**	**AB**	**Bg**	**BCg**	**Cg**
MLURI Barcode	603957	603958	603959	603960	603961	603962	603963
Wt (mg)	6.218	5.717	5.488	5.464	5.592	5.618	5.372
%N	2.05	2.17	0.65	0.27	0.06	0.04	0.01
%C	33.81	31.06	9.36	3.17	0.72	0.43	0.12
C:N Ratio	16.46	14.31	14.36	11.61	11.58	10.20	10.45
Ca (meq/100g)	11.91	12.54	2.38	0.35	0.19	0.64	5.08
Na (meq/100g)							
K (meq/100g)	3.3	1.5	0.59	0.13	0.05	0.14	0.32
Mg (meq/100g)	5.92	5.5	1.52	0.27	0.15	0.64	3.5
% Moisture loss	8.16	9.43	5.42	2.97	2.79	3.17	3.21
% Loss on Ignition	67.00	59.64	19.27	8.78	6.05	4.83	4.12
pH(H_2O)	4.66	5.2	4.34	4.87	4.66	4.79	4.94
pH($CaCl_2$)	4.48 (5g)	4.41 (5g)	3.88	3.95	4.02	3.84	3.97

(d)

SOIL ANALYSIS OF RIGG FOOT, SOURHOPE : BLOCK 5 AUGER SAMPLES						
Plot No.	**5A**	**5B**	**5C**	**5D**	**5E**	**5F**
MLURI Barcode	603924	603925	603926	603927	603928	603929
Wt (mg)	5.961	5.947	5.243	5.915	6.009	5.219
%N	0.58	0.60	0.53	0.57	0.53	0.62
%C	7.66	8.07	7.48	7.51	7.01	9.07
C:N Ratio	13.24	13.45	14.13	13.13	13.23	14.74
Ca (meq/100g)	3.32	2.58	3.41	5.07	3.86	3.12
Na (meq/100g)	0.15	0.14	0.16	0.16	0.14	0.17
K (meq/100g)	0.59	0.67	0.65	0.83	0.71	0.68
Mg (meq/100g)	1.66	1.51	2.14	2.89	2.21	1.88
% Moisture loss	4.72	4.94	5.05	4.60	4.69	5.19
% Loss on Ignition	15.99	17.07	17.71	16.34	16.42	20.10
pH(H_2O)	4.75	4.70	4.93	4.95	4.77	4.73
pH($CaCl_2$)	3.96	3.76	3.94	4.14	3.70	3.53

(e)

VEGETATION SURVEY OF RIGG FOOT, SOURHOPE : BLOCK 5

PLOT 5A																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
B		6	7							4	1						3	1					2	1	
H		3	12							5	2				2			1							
K	2	5	10								1					3	4								
N		4	11							6				1	1									2	
Q		3	11							2							3		4					2	
Species totals	2	21	51	0	0	0	0	0	0	17	4	0	0	1	3	3	10	2	4	0	0	0	2	5	0

PLOT 5B																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
A		3	4							6	4						6		2						
F		2	6							8					2		3						1	3	
J			5							3				4	2		6	1	3				1		
L			8							4							6		4	3					
N		2	9							6	2				2								1	3	
Species totals	0	7	32	0	0	0	0	0	0	27	6	0	0	4	6	0	21	1	9	3	0	0	3	6	0

PLOT 5C																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
D		4	9							7									3				2		
H	2		7							6							3		3					4	
K		2	9							6					5		3								
M			8		1					5							3		1	3			1	3	
P		14								2					2		3	1	3						
Species totals	2	20	33	0	1	0	0	0	0	26	0	0	0	0	7	0	12	1	10	3	0	0	3	7	0

PLOT 5D																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
A			12							8									3	2					
E			7					12														2		4	
G		2	11					6									2	4							
L			5							8				1			3	2	3	3					
Q			7							9				2			3		4						
Species totals	0	2	42	0	0	0	0	18	0	25	0	0	0	3	0	0	8	6	10	5	0	2	0	4	0

PLOT 5E																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
B		2	4							8		2				2	2		5						
D		3	9							8									2		3				
F			5					2									11		3	4					
L		4	6							11							2	1						1	
Q		2	11													4	8								
Species totals	0	11	35	0	0	0	0	2	0	27	0	2	0	0	0	6	23	1	10	4	3	0	0	1	0

PLOT 5F																									
Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	***Gs***	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
C		4	9							6		3				2								1	
E			11							3							5		3	2				1	
J		7	10				2	6																	
K		3	11							7							2			2					
P		3	9							7						4	2								
Species totals	0	17	50	0	0	0	2	6	0	23	0	3	0	0	0	6	9	0	3	4	0	0	0	2	0

TABLE 6

ECOTRON SOIL SITE

(a)

SOIL ANALYSIS OF RIGG FOOT, SOURHOPE : ECOTRON PLOT	
MLURI Barcode	603930
Wt (mg)	6.089
%N	0.59
%C	8.22
C:N Ratio	13.83
Ca (meq/100g)	2.76
Na (meq/100g)	0.15
K (meq/100g)	0.62
Mg (meq/100g)	1.7
% Moisture loss	4.79
% Loss on Ignition	17.42
pH(H_2O)	4.79
pH($CaCl_2$)	3.82

(b)

VEGETATION SURVEY OF RIGG FOOT, SOURHOPE : ECOTRON PLOT

Subplot	***Ac***	***Ao***	***At***	***Br***	***Cp***	***Cxp***	***Dc***	***Df***	***Fo***	***Fr***	**Gs**	***Hm***	***Je***	***Lm***	***Lzm***	***Mc***	***Ns***	***Pe***	***Pp***	***Pt***	***Ra***	***Rr***	***Rs***	***Tr***	***Vc***
A		9	5						3		2						4						2		
B		4	7						11		2												1		
C		6	9				3		3								2				1		1		
D		4	6						5		2						7						1		
E		11	4																8		2				
F		8	10				2												5						
G		5	6						11															3	
H		5	8						7		2						2						1		
J		6	9						5						2						2		1		
K			8				2		6		6							2					1		
L		6	11						4		2						2								
M		5	9						7		2				1	1									
N		4	8						7		4												2		
P			3	2					2		3						11						4		
Q		4					2		6		3			1			6						2	1	
Species totals	0	77	103	2	0	0	9	0	77	0	28	0	0	1	3	1	34	2	13	0	5	0	16	4	0