ENGLISH NATURE

Bryophyte monitoring at Naddle Low Forest, Cumbria

No. 17 - English Nature Research Reports

working today
for nature tomorrow

BRYOPHYTE MONITORING AT NADDLE LOW FOREST, CUMBRIA

A.B.G.Averis

January 1992

English Nature contract no. F72-08-09

C O N T E N T S

1. INTRODUCTION 1

2. METHODS 6

3. RESULTS 7

4. DISCUSSION 25

5. ACKNOWLEGMENTS 33

6. REFERENCES 33

APPENDICES

1. INTRODUCTION

Naddle Low Forest is a birch/oak/ash/hazel wood situated on steep, rocky, NW-E facing slopes 200-400m a.s.l. above Haweswater Reservoir, in the eastern part of the English Lake District (OS Grid Reference NY 4813-5015) (Map 1).

In 1986 a 36 hectare block in the eastern part of the wood was fenced into 12 compartments (Map 2), for the purposes of a Nature Conservancy Council/Macaulay Land Use Research Institute study to examine the effects of sheep-grazing on the vegetation of upland woods. Sheep grazing varies in intensity (low, medium or heavy) and season (summer or winter) between the 12 compartments. Scattered around the wood are also 6 small plots fenced off to completely eliminate grazing. The results of the NCC/MLURI study in the period 1986-1989 have been reported (Mitchell, 1991). The grazing system set up in 1986 will continue until 1994, by when it is hoped that relationships between grazing intensity/season and vegetation will be more apparent.

Frequency and abundance of bryophytes were recorded in the NCC/MLURI study, but with no indication of the species present, so in October 1986 I set up 130 quadrats to monitor changes in the species composition of the bryophyte flora. I revisited the wood in October 1988, and wrote a short report based on the changes I found when comparing the 1986 and 1988 data. I revisited the wood again in January 1992, and the results of this visit are reported here.

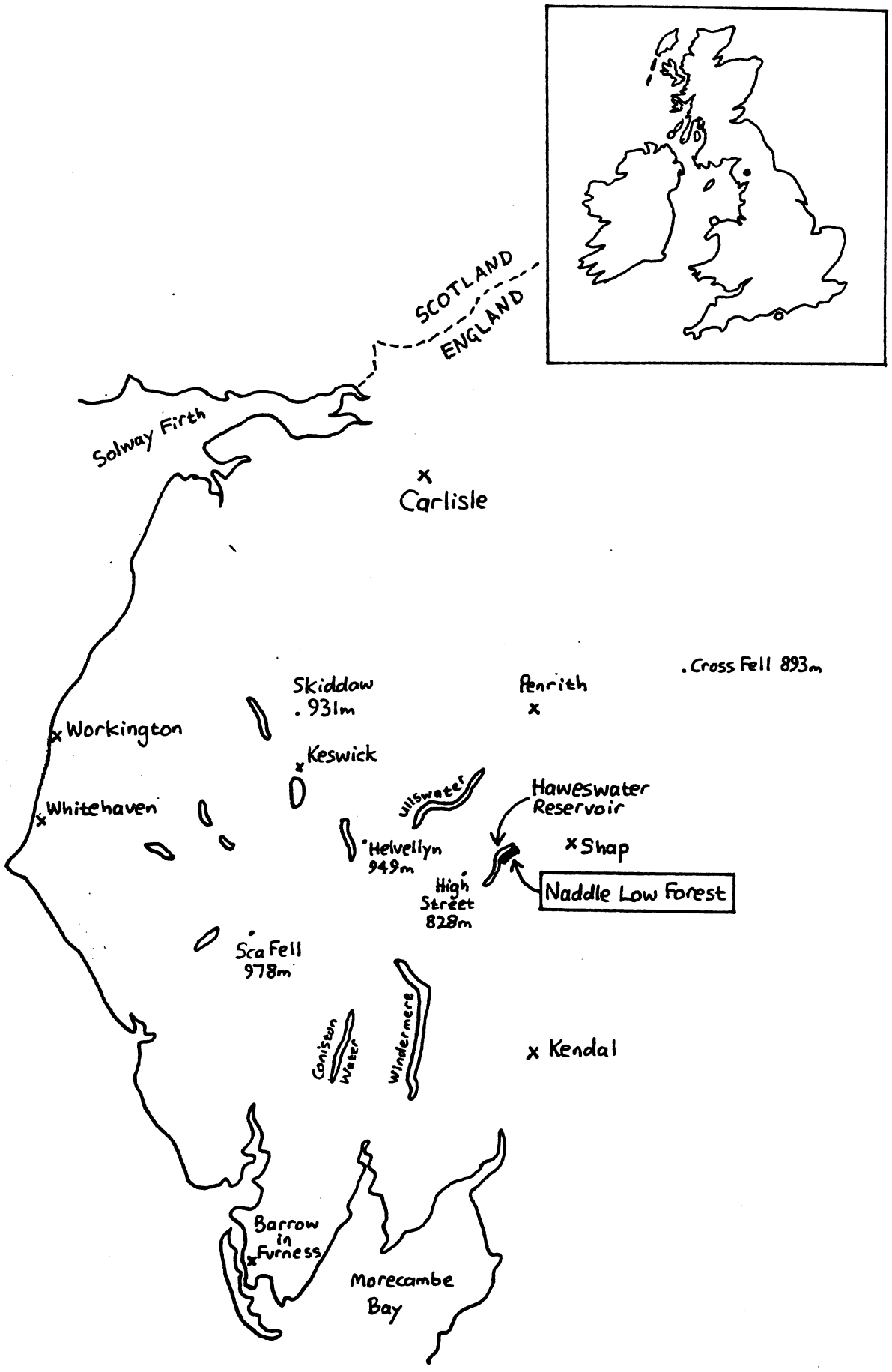
1.1 Climate

The climate is wet, but less so than in the western-central parts of the Lake District. Annual rainfall is c.2000mm compared with up to c.5000mm about 25-30km further west (Climatological Atlas, 1952). There are c.180 wet days(>1mm rain) annually, compared with over 200 wet days further west in the Lake District, and over 220 in parts of western Scotland and Ireland (Ratcliffe, 1968).

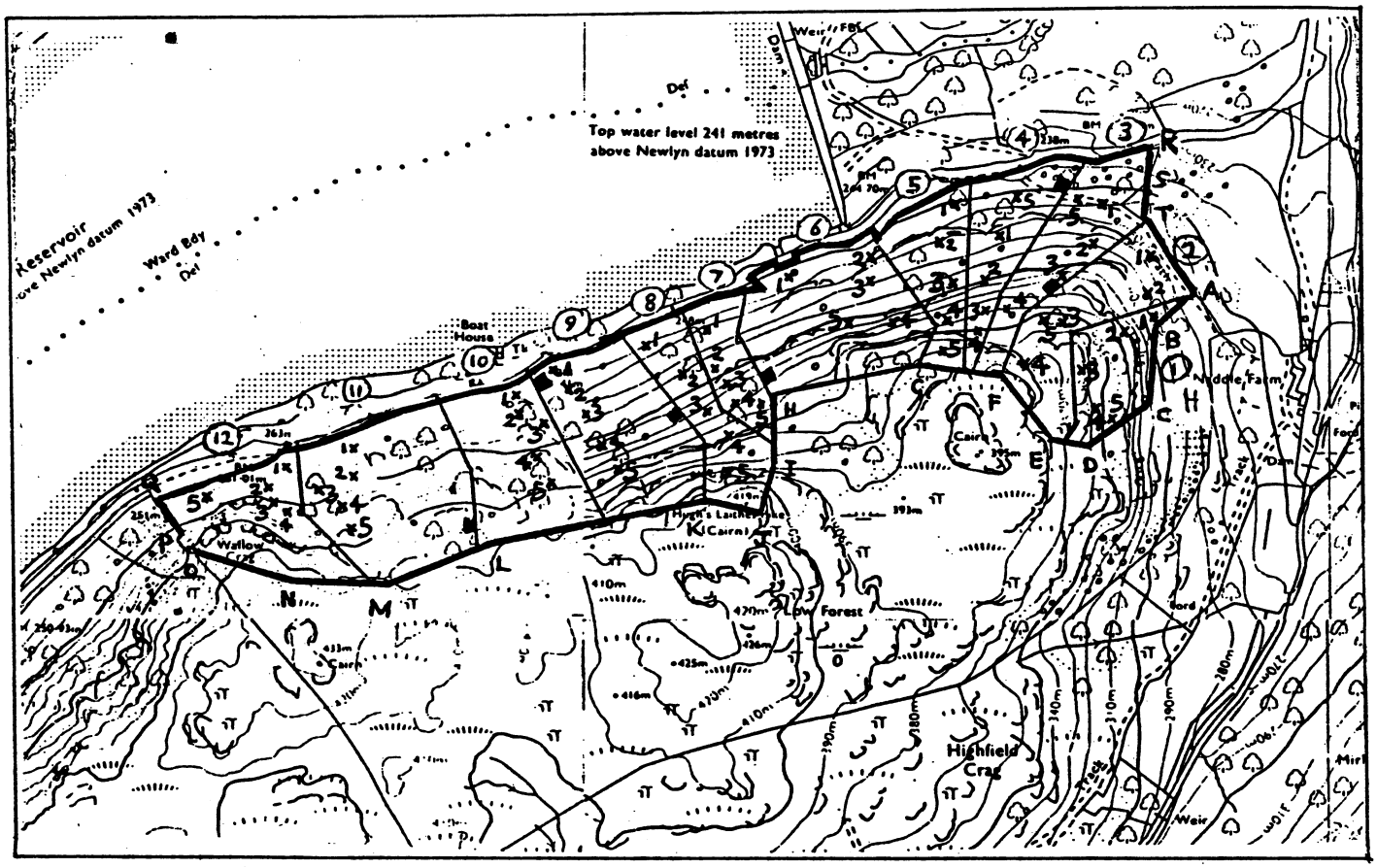
The February mean daily minimum temperature in this area is c.-1.2°C, and the July mean daily maximum temperature c.17.5°C (Meteorological Office, 1975). Because of the northerly aspect, the temperatures (especially the summer maximum) are probably lower than the values given above.

Mean annual windspeed in this area is c.12.5 m.p.h. (Climatological Atlas, 1952). This figure is less than in more westerly parts of Britain.

Map 1. Location of Naddle Low Forest



Map 2. Management compartments and location of 1x1m bryophyte quadrats at Naddle Low Forest



Sulphur dioxide is at a low concentration (Page, 1982), but there is much nitrate deposition by rain (Pitcairn & Fowler, 1989). Nitrate deposition is high in the Lake District, mid and south Pennines, parts of Wales and Southern Scotland, and the part of the Highlands nearest to Glasgow (Pitcairn & Fowler, 1989) - all areas which combine high rainfall with close proximity to urban and industrial areas.

1.2 Vegetation

The upper slopes are mostly acidic birchwood with abundant bryophytes, *Deschampsia flexuosa* and *Vaccinium myrtillus* (National Vegetation Classification type W17b - *Quercus petraea-Betula pubescens-Dicranum majus* woodland, typical sub-community, and, very locally, the more western, bryophyte-rich W17a - *Isothecium myosuroides-Diplophyllum albicans* sub-community). Lower down, the canopy is mostly oak and birch, and the ground flora is grass and fern-dominated, but still with an abundance of bryophytes (NVC type W11a - *Quercus petraea-Betula pubescens-Oxalis acetosella* woodland, *Dryopteris dilatata* sub-community, locally showing transitions towards the more north-western, bryophyte-rich W11b - *Blechnum spicant* sub-community). There are several areas of ash/hazel wood with a more herb-rich ground flora (NVC type W9b - *Fraxinus excelsior-Sorbus aucuparia-Mercurialis perennis* woodland, *Crepis paludosa* sub-community) forming narrow bands running down the slope. The vegetation of the wood has been mapped in detail, using the National Vegetation Classification, by John Day (Royal Society for the Protection of Birds warden).

1.3 Bryophyte flora

Bryophytes are abundant on the ground, rocks and trees. At least 134 bryophyte species have been recorded at Naddle woods (Appendix 1). Most of these are nationally common species. The bulk of the bryo-mass is also made up of common species, especially large mosses.

Some oceanic (sensu Averis, 1991) liverworts occur here Atlantic groups of Ratcliffe (1968) are given in brackets): *Plagiochila punctata, Saccogyna viticulosa, Lepidozia cupressina* (all Widespread Atlantic), *Lepidozia pearsonii* (Northern Atlantic), *Breutelia chrysocoma, Scapania gracilis, Plagiochila spinulosa, Anastrepta orcadensis, Lejeunea patens, L.ulicina* and *Douinia ovata* (all Sub-Atlantic). These all occur in small quantity only, except *Scapania gracilis* and *Plagiochila spinulosa*, which are quite frequent. *Lepidozia cupressina* is of particular interest in being surprisingly rare (only one other known site) in the Lake District.

Less oceanic on a European scale, but western in the British Isles (defined as Western British by Ratcliffe, 1968), are *Hylocomium umbratum*, *Hypnum callichroum*, *Sphagnum quinquefarium*, *Thuidium delicatulum*, *Barbilophozia atlantica*, *Bazzania tricrenata*, *B.trilobata*, *Cololejeunea calcarea*, *Frullania fragilifolia*, *Metzgeria fruticulosa*, *Riccardia palmata* and *Scapania umbrosa*.

Although Cumbria is relatively rich in oceanic and Western British bryophytes, these plants are not as well represented at Naddle as in some woods further west, especially in the Borrowdale area, where the climate is more favourable (wetter, with milder winters and cooler summers). An index of oceanicity calculated by dividing the annual number of wet days by the annual temperature range (July mean daily maximum temperature minus February mean daily minimum temperature), gives values of c.10 and >11 in the Naddle and Borrowdale areas respectively. In the British Isles as a whole, values of this oceanicity index range from below 6 (SE England) to over 15 (extreme NW Scotland and W Ireland). Not surprisingly, the latter areas are richer than Cumbria in oceanic bryophytes and lichens. The scarcity or absence of lichens of the Lobarion community (James et al, 1977) and some bryophytes at Naddle (and in the Lake District as a whole) when compared with the western Scottish Highlands, appears to be at least partly a result of the higher degree of acidification in the Lake District. The epiphytic flora at Naddle is not rich, but does include very small quantities of *Lobaria pulmonaria*.

2. METHODS

130 bryophyte quadrats were set up and recorded in October 1986. 66 of these are 1 x 1m quadrats on the ground. The remaining 64 quadrats measure 21 x 21cm, and are located on tree trunks and rocks.

2.1 Ground quadrats

Five of these 1 x 1m quadrats were recorded in each of the twelve compartments. The remaining six 1 x 1m ground quadrats were located in the six small ungrazed plots (one quadrat in each plot). In each of these 66 quadrats, the estimated per cent cover of each bryophyte species was recorded (maximum per cent cover of 100% for all species together in a quadrat).

2.2 Rock and tree quadrats

44 of these 21 x 21cm quadrats were located on tree trunks (height up the trunk varying from 20 to 150cm above ground), and 64 quadrats were located on the lower parts of steep rock faces, 20-40cm above the ground. In both tree and rock quadrats, bryophytes (and, where present, lichens) were recorded by drawing the extent of each species, to produce a "map" of the quadrat. This method was found to be more appropriate on trees and rocks because bryophytes here often form discreet patches of just one or two species, and the patterns of their extent are not obscured by vascular plants.

3. RESULTS

3.1 Revisit in 1988

I revisited the wood in October 1988, and refound 55 of the 66 ground quadrats, 18 of the 20 rock quadrats, and 39 of the 44 tree quadrats.

3.1.1 Ground quadrats

On the ground, increases in total per cent cover and number of species of bryophytes were mostly recorded in heavily grazed plots. This is consistent with the NCC/MLURI study (Mitchell, 1991) and the general observation by many people that bryophytes are especially prominent on the ground in heavily-grazed upland woods. Associations between individual species and grazing intensity were found for *Polytrichum formosum*, *Thuidium tamariscinum*, *Rhytidiadelphus loreus*, *Plagiothecium undulatum* and *Mnium hornum* (positive association), *Pseudoscleropodium purum*, *Plagiochila asplenioides*, *Dicranum majus* and *Lophocolea bidentata* (negative association). Summer grazing appeared to have had more effect on the bryophytes than winter grazing.

3.1.2 Rock quadrats

Total per cent cover of bryophytes in rock quadrats was found to have increased in heavily-grazed compartments, and decreased in lightly-grazed compartments (similar pattern to that on the ground). About half of the more marked increases or decreases in extent of a bryophyte species involved one species taking over from another. The mosses *Rhytidiadelphus loreus*, *Polytrichum formosum* and *Dicranum scoparium* showed increases on rocks where heavily-grazed. *Mnium hornum* showed decreases associated with increases in *R.loreus*. On some rocks, the smal *Heterocladium heteropterum*, *Diplophyllum albicans* and *Plagiochila porelloides* had become taken over by the larger *R.loreus*, *P.formosum* and *M.hornum* - similar to the bryophyte succesion noted by Richards (1938) in Derrycunihy Wood, Co. Kerry, SW Ireland.

3.1.3 Tree quadrats

Total per cent bryophyte cover in tree quadrats had mostly increased, especially where lightly-grazed or more than 20cm up the tree trunk. Most increases of a bryophyte species involved colonisation of previously bare bark. Most decreases involved plants having broken away from the tree trunk. No notable relationships were found between grazing intensity or season and the behaviour of individual bryophyte species, although *Mnium hornum* had only increased on trees in heavily-grazed plots (consistent with the results for this species on the ground and on rocks).

3.2 Revisit in 1992

I visited the wood again in January 1992, and refound 47 of the 66 ground quadrats, 13 of the 20 rock quadrats, and 27 of the 44 tree quadrats (see raw data in Appendices 2-7).

3.2.1 Ground quadrats

The raw data for ground quadrats is in Appendix 3. Table 1 gives the number of bryophyte species, and per cent bryophyte cover in the ground quadrats, from both the 1986 and 1992 data. Table 2 gives the mean number of bryophyte species and mean per cent bryophyte cover in ground quadrats in 1986 and 1992, indicating the amount of change in the five year period. Table 3 summarizes the data in Table 2 for each grazing intensity/season class (seven classes based on combinations of grazing intensity and season). Table 4 shows changes of 5% cover or more between 1986 and 1992, of bryophyte species. Recorded changes of less than 5% are likely to be within the limits of expected recording error. Only one of the six quadrats in ungrazed plots was refound in 1992, so the results for the ungrazed class are very tentative.

The mean number of bryophyte species per quadrat is overall very slightly higher (0.16 spp) in the 1992 data than in the 1986 data. In relation to grazing intensity this increase is greatest in the heavily-grazed quadrats (0.3 spp), and least in the lightly-grazed and ungrazed quadrats (0.15 spp increase and 2 spp decrease respectively). In relation to grazing season the increase is greatest in the quadrats with summer grazing (0.22 spp). Of the seven classes based on combinations of grazing intensity and season, the highest increases in mean number of bryophyte species per quadrat are for medium summer grazing (0.67 spp) and heavy summer grazing (0.63 spp). The ungrazed quadrat showed a loss of 2 species and the light summer grazed quadrats a loss of 0.20 species.

The mean per cent cover of bryophytes per quadrat is overall 2.51% lower in the 1992 data. In relation to grazing, this increase is greatest (2.69%) in the lightly-grazed quadrats. The heavily-grazed quadrats show a mean increase of only 0.06% bryophyte cover, and the medium-grazed quadrats a mean loss of 9.93% cover. In relation to grazing season, there is a recorded increase of 0.42% bryophyte cover in quadrats with summer grazing, and a loss of 4.66% cover in those with winter grazing. Of the seven classes based on combinations of grazing intensity and season, the highest increases in mean per cent cover of bryophytes per quadrat are for light summer grazing (9.5%) and heavy summer grazing (4.13%). The greatest losses recorded are for medium winter grazing (13.23%) and medium summer grazing (5%). The ungrazed quadrat refound in 1992 showed no change in the per cent bryophyte cover.

Table 1 Number of species and per cent bryophyte cover in 1m² ground quadrats, 1986 and 1992.

Com par.	Graz -ing		Quadrats 1 '86	1 '92	2 '86	2 '92	3 '86	3 '92	4 '86	4 '92	5 '86	5 '92
1	HS	No.of spp	3	4	8	7	9	-	5	7	5	5
		% cover	95	95	65	88	100	-	100	100	4	4
2	LW	No.of spp	3	-	6	7	3	2	4	4	10	-
		% cover	100	-	85	100	1	1	100	100	100	-
3	HW	No.of spp	8	9	15	14	8	5	5	-	2	6
		% cover	95	95	70	68	100	100	95	-	60	70
4	MS	No.of spp	9	9	7	8	9	-	3	-	5	7
		% cover	95	95	90	60	50	-	3	-	100	100
5	MW	No.of spp	12	11	4	5	3	-	8	9	3	3
		% cover	90	76	95	85	99	-	100	100	100	100
6	LS	No.of spp	11	11	9	7	8	-	11	-	12	-
		% cover	100	100	95	98	80	-	95	-	100	-
7	HW	No.of spp	11	10	11	10	15	15	6	7	9	9
		% cover	95	100	60	26	90	79	95	95	95	95
8	MS	No.of spp	11	-	6	7	9	9	2	-	8	8
		% cover	90	-	95	95	100	100	75	-	100	100
9	MW	No.of spp	7	6	11	11	7	8	8	9	14	12
		% cover	95	100	80	80	100	100	100	100	100	100
10	LS	No.of spp	6	7	18	-	13	13	9	9	13	-
		% cover	50	47	85	-	95	100	100	100	95	-
11	LW	No.of spp	7	9	10	11	17	16	9	8	14	16
		% cover	100	100	90	100	100	100	95	100	100	100
12	HS	No.of spp	8	10	10	10	9	9	10	11	11	-
		% cover	100	100	100	100	100	100	90	100	100	-
			Comp.3		Comp.4		Comp.6		Comp.9E		Comp.9W	
	U	No.of spp	8	-	1	-	6	-	8	6	6	-
		% cover	100	-	100	-	90	-	95	95	95	-
			Comp.11									
	U	No.of spp	8	-								
		% cover	90	-								

H heavy grazing M medium grazing L light grazing
S summer grazing W winter grazing U ungrazed

Table 2 Mean number of species and mean per cent bryophyte cover in 1m² ground quadrats, 1986 and 1992.

Com par.	Graz -ing		Mean 1986a*	Mean 1986b*	Mean 1992	Change since 1986 a*	Change since 1986 b*
n 1	HS (4)	No.of spp	6.00	5.25	5.75	-0.25	+0.50
		% cover	72.80	66.00	71.75	-1.05	+5.75
2	LW (3)	No.of spp	5.20	4.33	4.33	-0.87	0.00
		% cover	77.20	62.00	67.00	-10.20	+5.00
3	HW (4)	No.of spp	7.60	8.25	8.50	-1.10	+0.25
		% cover	84.00	81.25	83.25	-0.75	+2.00
4	MS (3)	No.of spp	6.60	7.00	8.00	+1.40	+1.00
		% cover	67.60	95.00	85.00	+17.40	-10.00
5	MW (4)	No.of spp	6.00	6.75	7.00	+1.00	+0.25
		% cover	96.80	96.25	90.25	-6.55	-6.00
6	LS (2)	No.of spp	10.20	10.00	9.00	-1.20	-1.00
		% cover	94.00	65.00	66.00	-28.00	+1.00
7	HW (5)	No.of spp	10.40	10.40	10.20	-0.20	-0.20
		% cover	87.00	87.00	79.00	-8.00	-8.00
8	MS (3)	No.of spp	7.20	7.67	8.00	+0.80	+0.33
		% cover	92.00	98.33	98.33	+6.33	0.00
9	MW (5)	No.of spp	9.40	9.40	9.20	-0.20	-0.20
		% cover	95.00	95.00	96.00	+1.00	+1.00
10	LS (3)	No.of spp	11.80	9.11	9.22	-2.58	+0.11
		% cover	65.00	81.67	82.33	+17.33	+0.66
11	LW (5)	No.of spp	11.40	11.40	12.00	+0.60	+0.60
		% cover	97.00	97.00	100.00	+3.00	+3.00
12	HS (4)	No.of spp	9.60	9.25	10.00	+0.40	+0.75
		% cover	98.00	97.50	100.00	+2.00	+2.50
	U (1)	No.of spp	6.17	8.00	6.00	-0.17	-2.00
		% cover	95.00	95.00	95.00	0.00	0.00

H heavy grazing M medium grazing L light grazing
S summer grazing W winter grazing U ungrazed
The number of quadrats refound in 1992 is given in brackets
* a calculated using data from all 1986 quadrats
b calculated using data only from quadrats which were refound in 1992 (therefore more meaningful than "a")

Table 3. Mean number of bryophyte species and mean per cent bryophyte cover in 1m² ground quadrats in 1986 and 1992, in classes based on grazing intensity and season.

Graz -ing		1986a*	1986b*	1992	Change since 1986 a*	Change since 1986 b*
HS (8)	No.of spp	7.80	7.25	7.88	+0.08	+0.63
	% cover	85.40	81.75	85.88	+0.48	+4.13
HW (9)	No.of spp	9.00	9.44	9.44	+0.44	0.00
	% cover	85.50	84.40	80.89	-4.61	-3.51
MS (6)	No.of spp	6.90	7.33	8.00	+1.10	+0.67
	% cover	79.80	96.67	91.67	+11.87	-5.00
MW (9)	No.of spp	7.70	8.22	8.22	+0.52	0.00
	% cover	95.90	95.56	82.33	-13.57	-13.23
LS (5)	No.of spp	11.00	9.60	9.40	-1.60	-0.20
	% cover	79.50	88.00	89.00	+1.00	+9.50
LW (8)	No.of spp	8.30	8.75	9.13	+0.83	+0.38
	% cover	87.10	83.88	87.63	+3.75	+0.53
U (1)	No.of spp	6.17	8.00	6.00	-0.17	-2.00
	% cover	95.00	95.00	95.00	0.00	0.00
H (17)	No.of spp	8.40	8.41	8.71	+0.31	+0.30
	% cover	85.45	83.18	83.24	-2.21	+0.06
M (15)	No.of spp	7.30	7.87	8.13	-0.83	+0.26
	% cover	87.85	96.00	86.07	-1.78	-9.93
L (13)	No.of spp	9.65	9.08	9.23	-0.42	+0.15
	% cover	83.30	85.46	88.15	+4.85	+2.69
S (19)	No.of spp	13.53	7.89	8.11	-5.42	+0.22
	% cover	128.79	88.11	88.53	-40.26	+0.42
W (26)	No.of spp	9.77	8.81	8.92	-0.85	+0.11
	% cover	103.27	88.12	83.46	-19.81	-4.66

H heavy grazing M medium grazing L light grazing
S summer grazing W winter grazing U ungrazed
The number of quadrats refound in 1992 is given in brackets
* a calculated using data from all 1986 quadrats
b calculated using data only from quadrats which were refound in 1992 (therefore more meaningful than "a")

Table 4 Changes of 5% cover or more between 1986 and 1992, of bryophyte species in 1m² ground quadrats, with compartments grouped by grazing intensity and season.

Heavy summer grazing	Compartment 1					Compartment 12				
	Q1	Q2	*Q3*	Q4	Q5	Q1	Q2	Q3	Q4	*Q5*
Cpil								+15		
Dmaj				-10			+6	-8		
Epra									-5	
Mhor						-15			-10	
Pfor				+15						
Pm.u						-6				
Ppur	-5					+15	+15			
Pund				-5		-5				
Rlor							-8		+7	
Rsqu		+24				+10	-31	-20	-17	
Ttam							+5	+10	+34	

Heavy winter grazing	Compartment 3					Compartment 7				
	Q1	Q2	Q3	*Q4*	Q5	Q1	Q2	Q3	Q4	Q5
Epra									+9	
Estr							-20			
Imyu							-7			
Pfor	-8									
Psch			-9							
Rlor	+7		-25					+17		
Rsqu	-20	-5	-35		+6	+19		-48	-22	
Rtri						-15				
Ttam	+19	+15								
Lbid		-6				+5				

Medium summer grazing	Compartment 4					Compartment 8				
	Q1	Q2	*Q3*	*Q4*	Q5	*Q1*	Q2	Q3	*Q4*	Q5
Dmaj										-8
Epra					+5					
Hcup	-5									
Hspl										+8
Mhor		-5								
Ppur							+15	+9		
Psch	-7							+14		
Pund	-9	-5					-5			
Rlor	+7	-15					+10	+5		-11
Rsqu	+16	-25			-14		-18	-34		+23
Ttam					+10					
Pasp		-10								

Quadrat numbers in italics are those not refound in Jan.1992.
See Appendix 2 for key to abbreviated names of species.

Table 4 (cont.)

Medium winter grazing	Compartment 5 Q1	Q2	*Q3*	Q4	Q5	Compartment 9 Q1	Q2	Q3	Q4	Q5
Epra		+5								
Estr	-32							-40		
Hspl				+5						
Mhor							-26			
Pm.u							+5			
Ppur					-9	+10			+6	
Rlor				-28		+10	+13			+14
Rsqu		-20			+7	-40		-36	-9	-8
Ttam	+17					+27	+10	+8		
Lbid										-8

Light summer grazing	Compartment 6 Q1	Q2	*Q3*	*Q4*	*Q5*	Compartment 10 Q1	*Q2*	Q3	Q4	*Q5*
Epra		-10								
Humb	-10									
Mhor						-20			-5	
Pcri								+10		
Pfor						+12				
Ppur		+25						+10		
Psch									-6	
Pund	-5	-10						-5		
Rlor									+10	
Squi								+5		
Squi								+5		
Ttam		+5				+5				
Lbid		-14								
Pasp	+7	+10								

Quadrat numbers in italics are those not refound in Jan.1992
See Appendix 2 for key to abbreviated names of species.

Table 4 (cont.)

Light winter grazing	Compartment 2					Compartment 11				
	Q1	Q2	Q3	Q4	*Q5*	Q1	Q2	Q3	Q4	Q5
Dmaj						+15			+6	
Epra		+10								
Estr								-7		
Hcup										-10
Hspl								-10		
Pund						-15	-10		-55	-5
Rlor		+15		+9						+5
Rsqu		-8							+46	
Rtri								+16		
Ttam							-5	+10		

Ungrazed	Compartment					
	C3	*C4*	*C6*	C9E	*C9W*	*C11*
Ppur				+68		
Pund				-29		
Rsqu				-30		

Quadrat numbers in italics are those not refound in Jan.1992
See Appendix 2 for key to abbreviated names of species.

Table 5 (based on the data in table 4) lists the bryophyte species showing changes of at least 10% cover in at least one ground quadrat, in relation to grazing intensity and season.

In relation to intensity of grazing, *Cirriphyllum piliferum*, *Hypnum cupressiforme*, *Hylocomium splendens*, *H.umbratum*, *Plagiothecium undulatum* and *Lophocolea bidentata* appear to prefer heavy grazing, while *Dicranum majus*, *Eurhynchium praelongum*, *E.striatum*, *Ptilium cristacastrensis*, *Rhytidiadelphus triquetrus* and perhaps *R.loreus* appear to prefer light grazing. *Pleurozium schreberi* shows an increase in association with medium-intensity grazing. *Mnium hornum*, *Polytrichum formosum*, *Pseudoscleropodium purum*, *Rhytidiadelphus squarrosus* and *Thuidium tamariscinum* show sufficiently varied associations in table 5 as to appear relatively indifferent to grazing intensity. *R.squarrosus* has decreased much more than it has increased in heavily-grazed (-194%, +69%) and medium-grazed (-203%, +46%) quadrats, and has increased more (+46%) than it has decreased (-8%) in the lightly-grazed quadrats (table 4), suggesting a preference for lighter grazing. *P.purum* has shown its most dramatic increase in an ungrazed quadrat.

In relation to grazing season, *Cirriphyllum piliferum*, *Eurhynchium striatum*, *Hypnum cupressiforme*, *Hylocomium splendens*, *Ptilium cristacastrensis*, *Polytrichum formosum* and *Pleurozium schreberi* appear to prefer summer grazing, while *Dicranum majus*, *Eurhunchium praelongum*, *Hylocomium umbratum*, *Mnium hornum*, *Lophocolea bidentata* and *Plagiochila asplenioides* appear to prefer winter grazing. In table 5, *Pseudoscleropodium purum*, *Plagiothecium undulatum*, *Rhytidiadelphus loreus*, *R.squarrosus*, *R.triquetrus* and *Thuidium tamariscinum* appear indifferent to grazing season. Of these 6 species, *P.purum* shows some bias in favour of summer grazing, and *R.loreus* a bias in favour of winter grazing (table 4).

Table 6 summarizes the apparent grazing preferences mentioned above, for each species.

Table 5 Species showing changes of at least 10% cover in at least one ground quadrat, in relation to grazing intensity and season.

Species	heavy grazing	medium grazing	light grazing	summer grazing	winter grazing
Cpil	H			S	
Dmaj			Ll		Ww
Epra	h		Ll		Ww
Estr		x	l	s	
Hcup	h			s	
Hspl	h	M		Ss	
Humb	h				w
Mhor	h	x	l		w
Pcri			L	S	
Pfor	H		L	S	
Ppur	H	M	L	S	W
Psch		M		S	
Pund	h			s	w
Rlor		Mx	L	S	Ww
Rsqu	H	Mx	Ll	Ss	Ww
Rtri			Ll	s	W
Ttam	H	M	l	S	W
Lbid	h				w
Pasp		x			w

Upper case = increase associated with this grazing class
Lower case = decrease associated with the opposite grazing class (i.e. heavy/light; summer/winter)
x = decrease associated with medium grazing intensity (this could mean either "h" or "l")
See Appendix 2 for key to abbreviated names of species.

Table 6 Summary table of apparent grazing preferences shown by bryophyte species in ground quadrats

Species	Grazing intensity	Grazing season
Cirriphyllum piliferum	heavy	summer
Dicranum majus	light	winter
Eurhynchium praelongum	light	winter
Eurhynchium striatum	light	summer
Hypnum cupressiforme	heavy	summer
Hylocomium splendens	medium-heavy	summer
Hylocomium umbratum	heavy	winter
Mnium hornum	?	winter
Ptilium cristacastrensis	light	summer
Polytrichum formosum	?	summer
Pseudoscleropodium purum	?	summer?
Pleurozium schreberi	medium	summer
Plagiothecium undulatum	heavy	?
Rhytidiadelphus loreus	medium-light	?
Rhytidiadelphus squarrosus	light	?
Rhytidiadelphus triquetrus	light	?
Thuidium tamariscinum	?	?
Lophocolea bidentata	heavy	winter
Plagiochila asplenioides	?	winter

? = situation is confused by associations with both heavy and light grazing, or both summer and winter grazing, or (*P.asplenioides*) change recorded only in the medium-grazed intensity class.

3.2.2 Rock quadrats

Appendix 4 gives the area (expressed as hundredths of a quadrat; one-hundredth of a quadrat = 4.84 cm^2) of each bryophyte species in each rock quadrat in October 1986 and January 1992. Quadrats not refound in January 1992 are omitted. Appendix 6 gives the original drawings (1986 and 1992) for rock quadrats.

Table 7 shows the number of bryophyte species and per cent bryophyte cover in each rock quadrat (again, quadrats not refound in 1992 are omitted). Rock quadrats were recorded only in compartments 6 (light summer grazing) and 7 (heavy winter grazing). The mean number of bryophyte species has risen slightly since 1986 in rock quadrats in compartments 6 and 7, with a slightly greater increase in compartment 6 (+1.2spp.) than in compartment 7 (+0.13spp.). The mean per cent bryophyte cover has increased by 5.6% in rock quadrats in compartment 6, and decreased by 2.5% in rock quadrats in compartment 7.

Table 8 shows the summed per cent increase and decrease in rock quadrats between 1986 and 1992, with compartments (6 and 7) treated separately. *Dicranum majus*, *Pleurozium schreberi*, *Rhytidiadelphus loreus* and, to a lesser extent *Dicranum scoparium*, *Hypnum cupressiforme* and *Sphagnum quinquefarium* show an apparent preference for heavy winter grazing. *Isopterygium elegans*, *Thuidium tamariscinum*, *Diplophyllum albicans*, *Lepidozia reptans*, *Scapania gracilis*, *Parmelia saxatilis* and, to a lesser extent *Plagiothecium undulatum* show an apparent preference for light summer grazing.

Table 7 Number of bryophyte species and per cent bryophyte cover in rock quadrats in October 1986 and January 1992.

Compartment 6 (light summer grazing)

Quadrat	Number of species 1986	1992	DIFF	Per cent plant cover 1986	1992	DIFF
2	4	5	+1	100	100	0
4	4	6	+2	100	90	-10
5a	6	6	0	88	98	+10
5b*	5	7	+2	38	66	+28
5c	3	4	+1	100	100	0
Mean*	4.40	5.60	+1.20	85.2	90.8	+5.6

Compartment 7 (heavy winter grazing)

Quadrat	Number of species 1986	1992	DIFF	Per cent plant cover 1986	1992	DIFF
1a	7	7	0	91	86	-5
1b	6	4	-2	100	100	0
2	4	5	+1	96	90	-6
3	5	7	+2	87	84	-3
4	5	5	0	85	84	-1
5a	3	3	0	95	90	-5
5b	3	3	0	94	100	+6
5c	5	5	0	99	93	-6
Mean	4.75	4.88	+0.13	93.4	90.9	-2.5

DIFF = Change since 1986
* = includes the lichen *Parmelia saxatilis*, found in quadrat 5b, compartment 6, in January 1992.

Table 8 Total increase and decrease of bryophyte species in rock quadrats, between October 1986 and January 1992.

Species	Compartment 6 light summer graz. decrease	Compartment 6 light summer graz. increase	Compartment 7 heavy winter graz. decrease	Compartment 7 heavy winter graz. increase	apparent preference
Campylopus parad.	2	-	-	-	-
Dicranum majus	13	-	-	-	hw
Dicranum scoparium	3	2	-	5	HW?
Heterocladiom het.	-	-	7	8	-
Hypnum cupressif.	-	10	5	2	-
Isopterygium eleg.	-	-	-	8	HW?
Isothecium myosu.	-	7	33	-	ls
Mnium hornum	3	-	34	43	-
Plagiothecium suc.	-	-	-	3	-
Plagiothecium und.	-	7	3	-	LS?
Pleurozium schreb.	1	-	-	-	-
Polytrichum form.	43	-	-	3	hw
Racomitrium heter.	0	0	-	-	-
Rhizomnium puncta.	-	-	-	3	-
Rhytidiadelph.lor.	6	14	9	62	HW
Sphagnum quinque.	6	-	-	-	hw?
Thuidium tamarisc.	-	30	1	2	LS
Diplophyllum alb.	-	8	48	-	ls
Lepidozia reptans	-	10	-	-	LS
Plagiochila asple.	-	-	-	3	-
Plagiochila porel.	-	-	1	-	-
Scapania gracilis	-	43	1	-	LS
Parmelia saxatilis	-	10	-	-	LS

HW = heavy winter grazing; SL = light summer grazing
Upper case = increase associated with this grazing class
Lower case = decrease associated with the other grazing class
? = total of <10% increase or decrease

3.2.3 Tree quadrats

As well as bryophytes, lichens are an important component of the epiphytic vegetation in many quadrats, so they are included in the analysis of these quadrats. Tree quadrats were recorded only in compartments 2 (light winter grazing), 3 (heavy winter grazing), 6 (light summer grazing), 7 (heavy winter grazing) and 8 (medium-intensity summer grazing).

Appendix 5 gives the area (expressed as hundredths of a quadrat; one-hundredth of a quadrat = 4.84 cm^2) of each bryophyte and lichen species (also in a few cases some vascular plants) in each tree quadrat in October 1986 and January 1992. Quadrats not refound in January 1992 are omitted. Appendix 7 gives the original drawings (1986 and 1992) for tree quadrats.

Table 9 shows the number of species (bryophytes and lichens) and per cent cover of bryophytes and lichens in each tree quadrat (again, quadrats not refound in 1992 are omitted). The mean number of bryophyte + lichen species, and per cent bryophyte + lichen cover in tree quadrats have both increased in just over 50% of quadrats, but the changes that have taken place show no clear relationships with grazing intensity or season.

Table 10 shows the summed per cent increase and decrease in tree quadrats between 1986 and 1992, with each compartment (2, 3, 6, 7 and 8) treated separately. *Cladonia coniocraea*, *Hypogymnia physodes*, *Ochrolechia sp.*, *Rhytidiadelphus loreus*, *Thuidium tamariscinum* and, to a lesser extent, *Dicranum majus* have increased in compartments with light summer grazing. *Isothecium myosuroides* and *Dicranum scoparium* have increased in compartments with light summer grazing and compartments with light winter grazing. The lichen *Peltigera* sp. has increased in a heavily-grazed compartment. *Polytrichum formosum* and *Lophocolea bidentata* have decreased in lightly-grazed compartments.

Table 9 Number of bryophyte and lichen species and per cent bryophyte and lichen cover in tree quadrats in October 1986 and January 1992.

Compartment 2 (light winter grazing)

Quadrat	Number of species 1986	1992	DIFF	Per cent plant cover 1986	1992	DIFF
1c	2	1	-1	32	96	+64
1d	2	3	+1	57	97	+40
Mean	2.00	2.00	0	44.5	96.5	+52.0

Compartment 3 (heavy winter grazing)

Quadrat	Number of species 1986	1992	DIFF	Per cent plant cover 1986	1992	DIFF
2	1	1	0	100	75	-25
3	3	3	0	100	100	0
5b	2	4	+2	73	95	+22
6	3	5	+2	67	84	+17
Mean	2.25	3.25	+1.00	85.0	88.5	+3.5

Compartment 6 (light summer grazing)

Quadrat	Number of species 1986	1992	DIFF	Per cent plant cover 1986	1992	DIFF
1a	4	6	+2	62	90	+28
1b	5	6	+1	90	91	+1
1c	3	4	+1	62	83	+21
2	3	6	+3	52	91	+39
3a	1	1	0	100	100	0
4	4	4	0	100	85	-15
5a	3	4	+1	100	100	0
5b	2	3	+1	100	100	0
6	3	2	-1	98	90	-8
Mean	3.11	4.00	+0.89	84.9	92.2	+7.3

DIFF = Change since 1986

Table 9 (cont.)

Compartment 7 (heavy winter grazing)

Quadrat	Number of species 1986	1992	DIFF	Per cent plant cover 1986	1992	DIFF
2	2	2	0	100	100	0
3	1	1	0	70	81	+11
4	2	2	0	82	98	+16
5a	1	2	+1	80	96	+16
6	3	4	+1	40	38	+6
7	2	2	0	80	86	+6
9b	3	4	+1	77	100	+23
10	4	3	-1	85	82	-3
12	3	3	0	54	54	0
Mean	2.33	2.56	+0.23	74.2	92.8	+18.6

Compartment 8 (medium-intensity summer grazing)

Quadrat	Number of species 1986	1992	DIFF	Per cent plant cover 1986	1992	DIFF
2	4	4	0	100	100	0
4a	4	5	+1	100	100	0
4c	2	2	0	100	100	0
Mean	3.33	3.67	+0.34	100.0	100.0	0

DIFF = Change since 1986

Table 10 Total increase and decrease of bryophyte and lichen species in tree quadrats between October 1986 and January 1992.

Species	Comp.2 (LW)		Comp.3 (HW)		Comp.6 (LS)		Comp.7 (HW)		Comp.8 (MS)		Poss. preference
	-	+	-	+	-	+	-	+	-	+	
Imyo		83	33	4	32	123	4	147	9	1	Ll
Ccon	2	-	-	5	-	26	-	1	-	-	LS
Dsco	-	9	11	-	5	14	14	1	-	9	Ll
Hphy	-	-	9	-	-	15	-	-	-	-	LS
Psul	-	-	-	10	-	11	-	-	-	-	-
Hcup	-	-	16	28	75	37	55	-	-	-	-
Mhor	-	-	-	15	13	-	19	6	4	-	-
Ftam	-	-	-	-	4	-	14	3	1	-	-
Pund	-	-	-	-	-	3	-	-	-	-	-
Dmaj	-	-	-	-	-	8	1	-	-	-	LS?
Hspl	-	-	-	-	-	1	-	-	-	-	-
Oand	-	-	-	-	-	10	-	-	-	-	LS
Pfor	-	-	-	-	70	-	-	-	-	-	hw
Rlor	-	-	-	-	-	25	-	-	-	4	LS
Fovi	-	-	-	-	-	8	-	-	-	-	-
Lbid	-	-	-	-	30	-	-	-	-	-	hw
Ttam	-	-	-	-	-	34	-	-	2	-	LS
Pelt	-	-	-	-	-	-	-	20	-	-	HW
Ffra	-	-	-	-	-	-	5	-	-	-	-
Oace	-	-	-	-	-	-	-	-	-	2	-

HW/hw = heavy winter grazing; SL = light summer grazing
Upper case = increase associated with this grazing class
Lower case = decrease associated with opposite grazing class
? = total of <10% increase or decrease
See Appendix 2 for key to abbreviated names of species.

4. DISCUSSION

Table 11 summarizes the changes found between 1986 and 1992 in the mean number of bryophyte species and mean per cent bryophyte cover per quadrat in different habitats, in relation to grazing intensity and season. Table 12 gives a summary of apparent grazing preferences shown by bryophyte and lichen species in relation to grazing intensity and season, based on changes recorded between 1986 and 1992.

It should be noted that some of the changes recorded in these quadrats are likely to be influenced by variation in acidity (which varies considerably in the study area), wetness, aspect and other factors which certainly affect the distribution of bryophyte species within the site and may also affect their responses to grazing. I have not attempted to deal with these factors here.

Table 11 Summary of main changes between 1986 and 1992 in the mean number of bryophyte species and mean per cent bryophyte cover per quadrat in different habitats.

		Greatest increase	Greatest loss
Mean number of species per quadrat	ground	HS MS	LS U
	rocks*	LS	no loss
	trees	-	-
Mean per cent bryophyte cover per quadrat	ground	LS HS	MW MS
	rocks*	LS	HW
	trees	-	-

H heavy grazing M medium grazing L light grazing
S summer grazing W winter grazing U ungrazed

* LS and HW only
\-

Table 12 Summary of apparent grazing preferences shown by bryophyte and lichen species in relation to grazing intensity and season, based on changes recorded in quadrats between 1986 and 1992.

Mosses	Ground	Rocks	Trees
Cirriphyllum piliferum	HS		
Dicranum majus	LW	HW	LS?
Dicranum scoparium	-	HW?	L
Eurhynchium praelongum	LW		
Eurhynchium striatum	LS		
Hylocomium splendens	MS,HS		
Hylocomium umbratum	HW		
Hypnum cupressiforme	HS	-	-
Isopterygium elegans		HW?	
Isothecium myosuroides	-	LS	L
Mnium hornum	W	-	-
Plagiothecium undulatum	H	LS	-
Pleurozium schreberi	MS		
Polytrichum formosum	S	HW	HW
Pseudoscleropodium purum	S?		
Ptilium cristacastrensis	LS		
Rhytidiadelphus loreus	M-L	HW	LS
Rhytidiadelphus squarrosus	L		
Rhytidiadelphus triquetrus	L		
Sphagnum quinquefarium	-	HW?	
Thuidium tamariscinum	-	HW	LS
Liverworts			
Lepidozia reptans	-	LS	
Lophocolea bidentata	HW		HW
Plagiochila asplenioides	W	-	
Scapania gracilis		LS	
Lichens			
Cladonia coniocraea			LS
Diplophyllum albicans	-	LS	
Hypogymnia physodes			LS
Ochrolechia sp.			LS
Parmelia saxatilis		LS	-
Peltigera sp.			HW

H heavy grazing M medium grazing L light grazing
S summer grazing W winter grazing U ungrazed

- recorded in quadrats (excluding those not refound in 1992) in this habitat but not showing any noticeable change in relation to grazing

4.1 Bryophytes on the ground

In the NCC/MLURI study at Naddle, Mitchell (1991) found an increase in bryophyte cover on the ground in compartments with heavy winter, heavy summer and medium summer grazing, and a decrease in compartments with light summer, light winter and medium winter grazing, and also in the ungrazed plots. This positive association with heavy grazing and, to a lesser extent, summer grazing (which reduces vascular plant growth, and, therefore, competition for several bryophyte species, more than winter grazing), is to be expected given the prominence of bryophytes on the ground in heavily-grazed upland woods. My results do not show such a clear pattern, and actually show the highest mean increase in lightly-grazed compartments. The NCC/MLURI study had many more quadrats than my study, and was carried out over a period of 3 years (5 years in my study). After two years, my quadrats did show a mean increase in per cent bryophyte cover in quadrats in heavily-grazed compartments only, but after five years the situation appears to have reversed. This may be at least partly a result of the decreasing sample size as some quadrats refound in 1988 were not refound in 1992. However, I have found the overall differences in relation to grazing season (bryophyte cover increased in compartments with summer grazing, as was found in the NCC/MLURI study) have become more marked after 5 years than after 2 years. These recorded changes are only small in relation to the very high mean per cent bryophyte cover in quadrats in compartments of all grazing types. It should also be noted that in less grazed woodland, bryophyte cover may still be 90-100%, but is more hidden beneath grass and herbs, and often composed of a different assemblage of species. The mean number of bryophyte species per quadrat in my study is positively associated with medium and heavy summer grazing, and therefore fits the expected pattern better than does the mean per cent cover of bryophytes.

The change in mean per cent cover of bryophytes is not positively associated with the intensity of grazing, but the greatest increase is in compartments with summer grazing. The grazing intensity may have more effect on the species-richness of the bryophyte flora than on the amount of bryophyte cover.

The changes I have recorded in the species composition of the bryophyte flora on the ground show several relationships with grazing which accord with the habitats of bryophyte species in the British Isles. The apparent preference for heavy grazing shown by the calcifuge mosses *Hypnum cupressiforme*, *Hylocomium splendens*, *H.umbratum* and *Plagiothecium undulatum* is consistent with their prominence in grazed acidic woodland in the British uplands. These plants are also able to grow among or beneath quite lush vascular plant growth, such as tall heather, and indeed *P.undulatum* is often well-hidden

beneath dense grass, heather and bryophytes. The apparent preference for light grazing by the non-calcifuge mosses *Eurhynchium praelongum*, *E.striatum*, *Rhytidiadelphus squarrosus* and *R.triquetrus* is consistent with their association with lusher, less acidic vegetation. The calcifuge moss *Dicranum majus* appears here to favour light winter grazing, and, although common in many grazed upland woods, it is usually most plentiful among vascular plants or other large bryophytes on steeper banks, which are probably less grazed than most parts of the woodland floor.

Some other apparent grazing preferences are not as one might expect, i.e. *Cirriphyllum piliferum* (heavy summer grazing), *Lophocolea bidentata* (heavy winter grazing), *Ptilium cristacastrensis* (light summer grazing) and *Rhytidiadelphus loreus* (medium-light grazing). For *L.bidentata*, which is common beneath quite tall vascular plant growth in a variety of habitats, winter grazing may be important in not reducing vascular cover too much. Conversely, for *P.cristacastrensis*, which is common on the ground in many grazed woods in the Scottish Highlands, grazing in summer may be beneficial (in reducing vascular plant growth more than winter grazing), although this species can be found in quantity beneath tall heather. *Polytrichum formosum* and *Pleurozium schreberi* show no noticeable relationship with grazing intensity, but their apparent preference for summer grazing may be related to an intolerance of too much vascular plant growth (although *P.schreberi* is often very plentiful beneath tall heather).

Most bryophytes recorded in ground quadrats are nationally common, except for a few records of the western *Hylocomium umbratum*, *Lepidozia pearsonii* and *Anastrepta orcadensis*, and the boreal moss *Ptilium cristacastrensis*.

4.2 Bryophytes on rocks

The mean number of bryophyte species per quadrat has increased more in the compartment with light summer grazing than in that with heavy winter grazing (rock quadrats were only recorded in compartments with these two grazing regimes). The mean per cent cover of bryophytes per quadrat has increased in the compartment with light summer grazing, but decreased in that with heavy winter grazing. The vascular plant growth resulting from light summer grazing may provide a good balance of reduced competition for rock-dwelling bryophytes and enough grass/fern/herb growth to help keep humidity high around the lower parts of rock faces. This is consistent with the increase of *Scapania gracilis* associated with light summer grazing. From its habitats in the British Isles, this oceanic liverwort appears to need at least moderate levels of both light and humidity, though not to such a marked degree as some other oceanic bryophytes.

The apparent preference shown by *Rhytidiadelphus loreus*, *Polytrichum formosum*, *Dicranum scoparium* and, to a lesser extent, *Sphagnum quinquefarium* for heavy grazing is consistent with their abundance in grazed woods, although in the ground quadrats *R.loreus* appears to prefer medium to light grazing. *Dicranum majus* appears to prefer heavier grazing in rock quadrats than in ground quadrats, but this is because it decreased in rock quadrats with light summer grazing - possibly an effect of summer grazing reducing the vascular plant cover too much, which would be consistent with its increase in lightly-grazed ground quadrats.

Many of the changes in rock quadrats (in both compartments sampled) appear to indicate a cyclical succession. Thin mats of small "pioneer" species (*Diplophyllum albicans*, *Heterocladium heteropterum*, *Plagiochila porelloides*, *Parmelia saxatilis*, *Isothecium myosuroides*, *Hypnum cupressiforme* and *Isopterygium elegans*) later become taken over by the larger *Mnium hornum*, *Polytrichum formosum*, *Plagiochila asplenioides*, *Dicranum scoparium* and *Rhytidiadelphus loreus*, *Dicranum majus* and *Thuidium tamariscinum*, with *M.hornum* usually an earlier coloniser than *R.loreus*, *D.majus* and *T.tamariscinum*. The larger species eventually fall off, leaving a bare rock face for the cycle to begin again. This cyclical succession is shown diagramatically in Figure 1, and must be a major factor governing changes in the bryophyte flora of rock faces, and may be at least as important as the grazing regime.

Most bryophytes recorded in rock quadrats are nationally common, but there are a few records for the western, oceanic liverworts *Scapania gracilis* and *Plagiochila spinulosa*. Neither of these species show a clear response to grazing in these rock quadrats, although an increase of *S.gracilis* might be related to light grazing (see above), or may just be part of a process of bryophyte succession.

4.3 Bryophytes and lichens on trees

The changes in mean number of bryophyte and lichen species per quadrat and mean per cent cover of bryophytes and lichens per quadrat do not show any clear relationship with grazing intensity or season.

Among the 11 individual species for which there is a change in abundance associated with a particular grazing class, more species have increased in the lightly-grazed compartments. These include *Dicranum majus*, for which there is also an increase in lightly-grazed ground quadrats (consistent with its habitats in British woods generally), but a decrease in lightly-grazed rock quadrats. *Polytrichum formosum* has decreased in rock and tree quadrats in heavily-grazed compartments. Although it showed no noticeable preference for heavy grazing in the ground quadrats, there was there an

increase in compartments with summer grazing, which reduces vascular plant growth more than winter grazing. From its habitats generally, *P.formosum* might be expected to favour little competition from vascular plants, and, therefore, heavy and/or summer grazing. It seems unlikely that the increases of *Cladonia coniocraea, Hypogymnia physodes, Ochrolechia sp., Rhytidiadelphus loreus, Thuidium tamariscinum, Dicranum majus, D.scoparium* and *Isothecium myosuroides* in compartments with light grazing are a direct result of taller vascular plant growth and the shade it casts, but there may be an indirect effect through an increase in humidity at, and just above ground level, caused by lusher plant growth. Such an increase in humidity (which is likely to be greater if there is also an increased growth of the shrub layer) would probably be beneficial to the growth of epiphytic bryophytes generally. Epiphytic bryophyte communities are much richer and more luxuriant in sheltered woodlands in the western Scottish Highlands. *Lophocolea bidentata* and *Peltigera* sp. show a possible preference for heavy winter grazing in tree quadrats, but this does not clearly match any known aspects of their ecology.

It may well be expected that many associations found between grazing type and change in epiphytic communities will be merely coincidental, as (i) the epiphytic communities sampled are mostly above the direct influence of vascular plant growth (it is also assumed that these bryophytes and lichens were not eaten by sheep in this study), and (ii) these communities appear to be subject to a cyclical succession, similar to that described above on rocks. In this bryophyte and lichen succession, the small "pioneer" species which mostly form thin mats are *Isothecium myosuroides* (growing first in thin mats, but later becoming thicker and bushier), *Hypnum cupressiforme* (often taken over later by *I.myosuroides*, but the reverse was found in two quadrats), *Frulania tamarisci, Cladonia coniocraea* and *Hypogymnia physodes*. These species grow a long way up the tree trunks, but in the bottom 50cm or so, can be taken over by the larger *Mnium hornum, Dicranum scoparium* and *Polytrichum formosum*. These last three sometimes die away and/or fall off, leaving the process to begin again, or sometimes are taken over by *Rhytidiadelphus loreus, Thuidium tamariscinum* and vascular plants. *R.loreus* and *T.tamariscinum* may eventually break away from the tree base. This cycle is shown diagramatically in Figure 2.

The only uncommon species found in these tree quadrats was the small western liverwort *Frullania fragilifolia*. It was present in very small quantity on an ash trunk in 1986 and 1988, high up enough the trunk to be above the expected influence of grazing. It had gone by 1992, having been taken over by the larger *F.tamarisci* and *Isothecium myosuroides*. *F.fragilifolia* was found on a few other ash trees (not in quadrats) in January 1992.

Figure 1 Cyclical succession of bryophytes on rocks at Naddle Low Forest, 1986-1992.

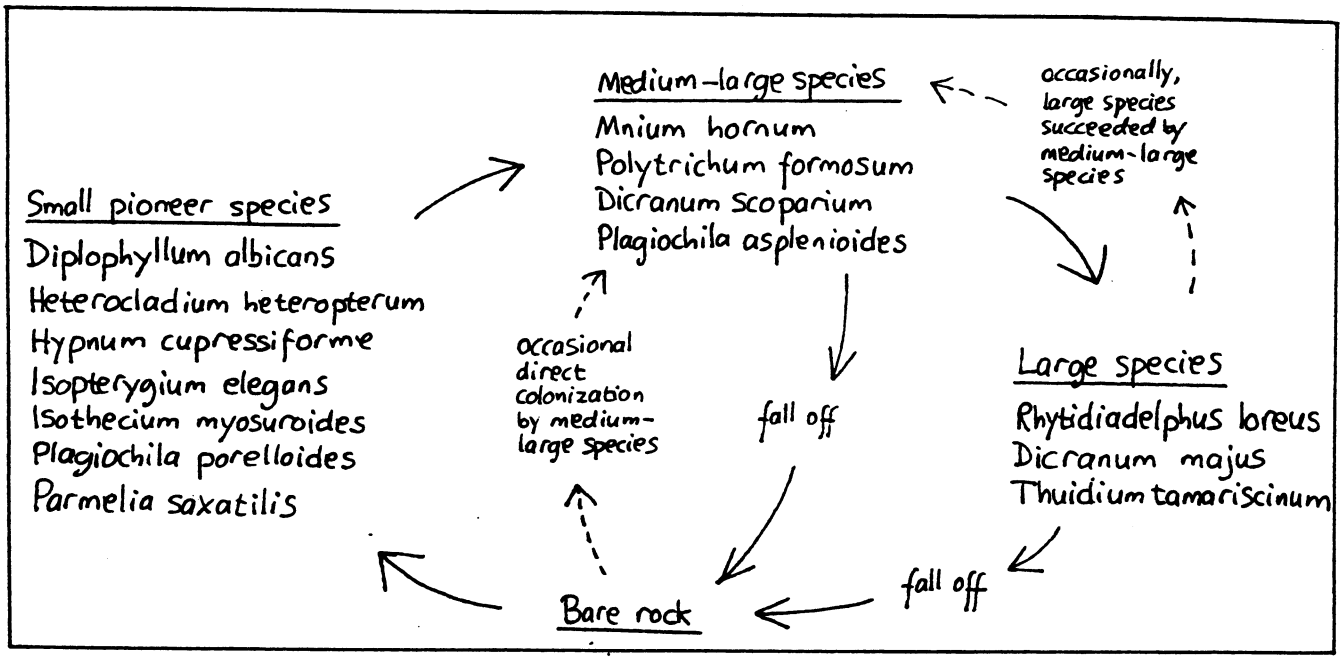
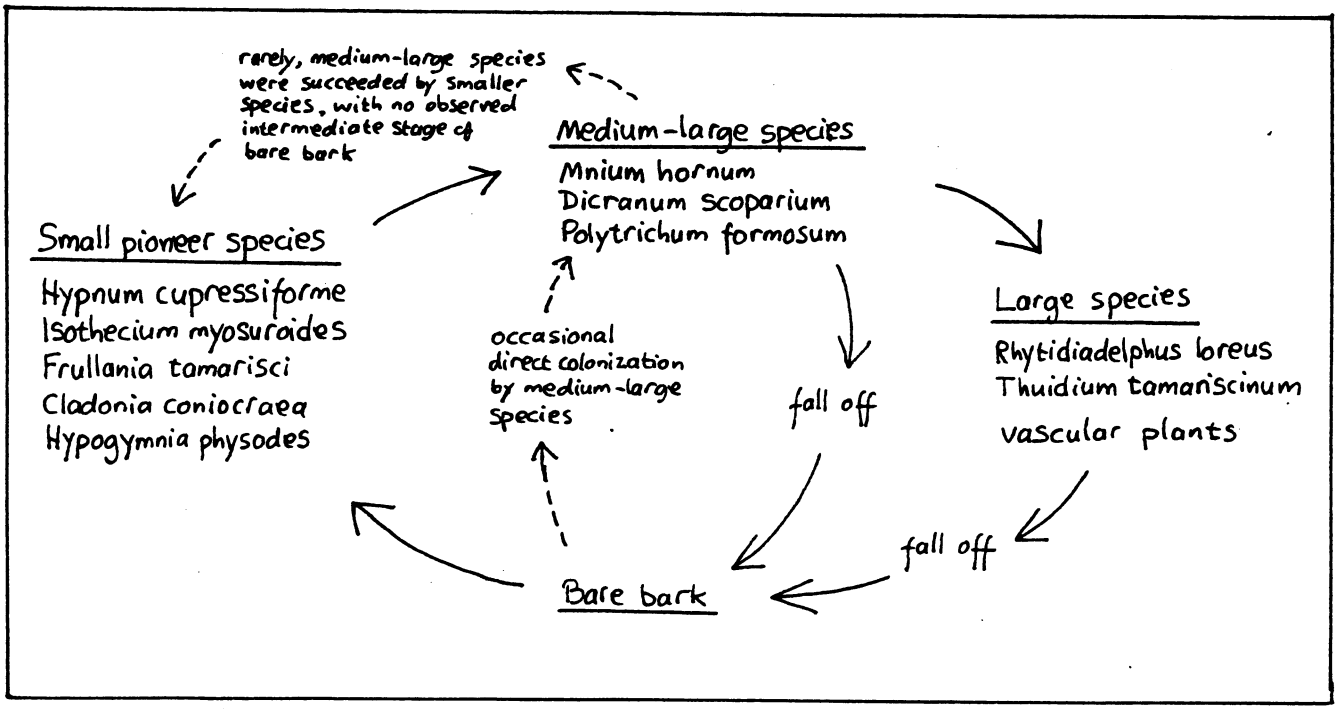


Figure 2 Cyclical succession of bryophytes on tree trunks at Naddle Low Forest, 1986-1992.



4.4* Re-measuring of management compartment areas

The areas of the management compartments at Naddle Low Forest have recently been re-measured by John Day (RSPB warden), who found some differences between his results and the area measurements given by Mitchell (1991), particularly for compartments 1 (J.Day's result is greater), 4 (JD = lower), 11 (JD = lower) and possibly 12/13 (JD = lower).

Compartment 12 was fenced internally into two different sized areas between 1986 and 1992. Mitchell's area for compartment 12 is too high to be realistically comparable with Day's figure for the smaller part (which Day calls compartment 12) and too low to be likely to refer to either the larger part (which Day calls compartment 13) or to both areas taken together. The measurements of compartment 12 are therefore rather confusing. In this bryophyte study compartment 12 refers to both areas, taken together.

In the light of John Day's area measurements the following compartments might be equally well or better placed in a different grazing intensity class:

Compartment 1 heavily-grazed, but could be medium-grazed
Compartment 4 medium-grazed, but could be heavily-grazed
Compartment 11 lightly-grazed, but could be medium-grazed
Compartment 12 (12+13) heavily-grazed but could be medium -grazed

If the grazing intensity of these compartments is changed as above, it does not appear to change the results in this study so as to make the relationships with grazing intensity any clearer. Indeed it appears to make them if anything less clear because the sample sizes for the relevant lightly-grazed and heavily-grazed classes are smaller, giving resluts which are probably less meaningful, while the increased sample size in other grazing intensity classes does not clarify matters because they have medium-intensity grazing.

* This has been included because of a query raised by John Day re the area of the plots. This will be resolved this summer.

Keith Kirby
21/4/92

5. ACKNOWLEGMENTS

I thank Dr. K.J. Kirby (English Nature) for making the necessary arrangements for this work to be carried out, and Dr. F.J.G. Mitchell (who, working for the Macaulay Land Use Research Institute, carried out the NCC/MLURI study of grazing and vegetation at Naddle) for help and encouragement while I was working there.

6. REFERENCES

Averis, A.B.G. (1991). *A Survey of the Bryophytes of 448 Woods in the Scottish Highlands.* Scottish Field Survey Unit Report No.S54. Nature Conservancy Council, Edinburgh.

Climatological Atlas of The British Isles (1952). Meteorological Office, London.

James, P.W., Hawksworth, D.L. & Rose, F. (1977). Lichen Communities in the British Isles: A Preliminary Conspectus. Pp.322-327 in *Lichen Ecology,* edited by M.R.D.Seaward, Academic Press, London.

Meteorological Office (1975). *Climatological Memorandum No.73.* Maps of mean and extreme temperature over the United Kingdom, 1941-1970. Bracknell, Berks.

Mitchell, F.J.G. (1991). *Grazing in upland woods.* Nature Conservancy Council/Macaulay Land Use Research Institute Contract report no. HF3-03-319.

Page, C.N. (1982). *The Ferns of Britain and Ireland.* Cambridge University Press.

Pitcairn, C.E.R. & Fowler, D. (1989). *Changes in species composition of semi-natural vegetation associated with the increase in atmospheric inputs of nitrogen.* Unpublished interim report to the Nature Conservancy Council. ITE, Penicuik.

Ratcliffe, D.A. (1968). An Ecological Account of Atlantic Bryophytes in the British Isles. *New Phytol.* 67, 365-439.

Richards, P.W. (1938). The bryophyte communities of a Killarney oakwood. *Annls. bryol.* 11, 108.

Rodwell, J.S. (Ed.) (1991). *British Plant Communities. Volume 1 - Woodlands and Scrub.* Cambridge University Press, Cambridge.

APPENDICES

Appendix 1	Bryophyte species list for Naddle Low Forest
Appendix 2	List of bryophyte and lichen species recorded in quadrats, also giving abbreviations of species names used in this report
Appendix 3	Ground quadrat data (1986, 1988 and 1992)
Appendix 4	Rock quadrat data (1986 and 1992)
Appendix 5	Tree quadrat data (1986 and 1992)
Appendix 6	Rock quadrat drawings (1986 and 1992)
Appendix 7	Tree quadrat drawings (1986 and 1992)

BRYOPHYTES

Site name: Naddle Low Forest, Cumbria, England

Grid ref.: NY 500152

Date(s): Oct'86 + Oct'88

Recorder(s): ABG Averis

Habitat(s): NNW-NE facing oak-birch wood with some ash, hazel and rowan. Rocky. Mostly acidic (NVC W11a, W17b). Some N-S orientated more basic areas (W9b).

Altitude

Aspect(s): NNW-N-NE

Site code no.

Mosses

336	Ampl	fluv		187		palu		373	Lesk	poly		525		ianu	R
366		ripa		185		rufe		374	Leuc	glau	R	516	Rhab	cren	
19		serp		186		schr				juni		517		cris	
337		tena		189		vari		375	Leuc	sciu		518		fuga	
20		vari		190	Dicr	aspe		383	Rhiv	horn	A	388	Rhiz	pseu	
22	Amph	moug	R	191		denu		1080		marg		389		punc	O
23	Anom	alpi				subp		394		stel		527	Rhod	rose	
		aegi		192		unci			Rhyn	hoch		530	Rhyn	tees	
		sinu		193	Dicr	cirr	R	461	Neck	comp		531		tene	
1057		rotn		197	Dicr	bonj		402		cris	R	245	Rhyn	conf	
1066		rupe	R	201		fusc	O	404		puni		244		lusi	
27	Anom	dest		203		maju	A	406	Oedi	grif		248		mura	
		varo		206		scop	A	407	Olig	herc		251		ripa	R
29	Anom	fili		207		scot			Orth	grac		532	Rhyt	lore	A
33	Ance	viti		210		taur		411		line		533		squa	A
34	Anti	curt		211	Diph	foli		412	Orth	intr		534		trio	O
36	Atri	cris		213	Dist	capi		413		rufe		289	Schi	alpi	
40		undu	O	216	Ditr	flex		414	Orth	affi	R	291		apoc	R
41	Aula	anor		217		hete		415		anom		306		mari	
42		palu	R	222	Drep	adun		416		cupu		537	Schi	penn	
45	Barb	conv		223		exan		417		diap		538	Scle	cesp	
47		cyli		224		flui		418		lyel				tour	
48		fall		226		revo		421		pulc		541	Scor	scor	
49		ferr		228		unci	R	422		rivu		545	Seli	donn	
54		recu		311	Dryp	pate		427		spru		547		pusi	
57		rigi		231	Enca	cili		428		stra		548		recu	
59		spad		233		stre	R	429		stri			Sema	oemi	
60		toon		234		vulg		430		tene		551		mica	
62		ungu							Oxys	hibe		578	Spha	auri	R
63		vine		242	Epip	toze		627		sinu		573		capi	R
64	Bart	hall		243	Eucl	vert		628		tenu		554		comp	
65		itay		249	Eurh	prae	F	437	Phil	calc		555		cont	
66		pomi	O	255		stri	O	439		font		556		cusp	
	Bart	wils		256		swar	R	446	Plag	zier		557		fimb	
69	Blin	acut		257	Fiss	adia	R	379	Plag	affi	O	558		fusc	
71	Brac	tric		260		bryo				elat		559		girg	R
72	Brac	alpi		1000		celt				elli		560		imbr	
75		glar		262		cris	R	383		rost		562		mage	
76		mild		263		curv		395		undu	F	566		palu	O
77		plum	R			mong		447	Plag	oede		567		papi	R
78		oedu		269		osmu	R		Plag	cavi		569		pulc	
80		rivu	R			poly		448		curv		570		quin	O
81		ruta	O	274		taxi	R	449		dent	R	571		recu	
84		velu		275		viri				laet		575		squa	
85	Breu	chry	R	276	Font	anti		451		late		576		stri	
87	Bryu	alpi		281		squa		456		nemo		568		suba	
89		arge		282	Funa	atte		453		plat		579		tene	
90		bico		284		hygr		455		ruth		580		tere	
94		capi	O	286		obtu		458		succ	R	581		warn	
110		pall			Glyp	dave		459		undu	A	582	Spla	aapu	
113		pseu	R	298	Grim	donn			15 Plat	jung		356	Taxi	wiss	
		ripa		301		funa		460	Pleu	acum		588	Tetr	brow	
	3 Call	cord		302		hart		461		subu		589	Tetr	pell	O
	4	cusp	R	312		pulv	R	463	Pleu	schr	A		Tetr	angu	
	5	giga		313		retr		470	Pohl	carn		591		anio	
	6	sarm		1079		tric		468		crud	R	592	Thaa	alop	R
	7	stra		321	Gymn	aeru		1081		elon		594	Thui	delo	
1078	Caso	stel		322		calc		475		nuta	R	535		deli	O
137	Caso	atro				insi		465		wahl		597		phil	
138		brev		323.3		recu		479	Pogo	alop	R			reco	
140		frag		328	Hedw	cili		486		nanu		599		tama	A
141		intr		329		inte		489		urni	O	602	Tort	flav	
139		para	O	331	Hete	hete	F	480	Poly	alpe		607		tort	R
142		piri	R	126	Homa	lute		481		apli		610	Tort	inte	
145		schw		128		seri	R	482		comm	O	611		laev	
143		seti		335	Hook	luce		483		form	A	612		lati	
		shaw		333	Homa	tric		485		juni		614		aura	R
147		subu		339	Hygr	eugy		484		long		620		subu	
151	Cera	purp	R	340		luri		488		pili	R	624	Tric	brac	
153	Cinc	font		342		ochr		501	Pott	trun		625		cris	
156	Cirr	cras		344	Hylo	brev	R	607	Pseu	puru	F		Ulot	calv	
157		pili	O	346		sple	A	508	Pter	grac		635		coar	
158	Clim	dend		347		umbr	O	511	Pter	fili		1052		cris	O
161	Crat	cono	R	348	Hyoc	arno		512	Ptil	cris	O	634		drum	
163		fili		350	Hypn	cali	O	514	Ptyc	poly		630		hutc	
164	Cryp	hete		351.1		cupr	A	515	Pyla	poly		637		phyl	
		lasy		351.2		jutl	F	519	Raco	acic	R	639	Weis	cont	
166	Cten	moll		351.5		mamm	F	1073		affi				pers	
	Cycl	laet		357	Isop	oleg	O	520		aqua	O	650	Zyg	cono	
169	Cyno	brun		359		pulc		521		cane		653.3		baum	
172		jenn		381	Isot	holt		522		elli		653.2		viri	
	Dalt	spla		382		eyes	A	1051		eric					
180	Dich	poll	R	383		myur	O	523		fasc	R				
184	Dicr	hete	O	368	Lept	flex		4072		hete	O				
						recu									

Liverworts

	Acro	wils		803		pate	R
681	Adel	deci		804		ulic	R
		lind		806	Lepi	cupr	R
683	Anas	orca	R	805		pear	O
684	Anas	donn		807		rept	F
		hell		853	Lept	cune	
		joer		1056	Loph	bide	A
952		minu		813		frag	
901	Aneu	ping	O	814		hete	
847	Apom	pube		816	Loph	bicr	
686	Anth	jula		823		gutt	
691	Apha	micr		819		inci	O
692	Barb	atla	O	824		vent	F
693		atte	O	826	Lunu	cruc	
694		barb		827	Marc	poly	
695		floe	F	828	Marc	mack	
696		hatc		834	Mars	emar	O
700	Bazz	pear		837		spha	
701		tric	R	642	Mast	wood	
702		trii	O	843	Metz	conj	
703	Blai	pusi		1043		frus	R
704	Blep	tric		845		furc	O
705	Caly	argu		846		lept	
706		fiss		969		temp	
707		muel	O	852	Myli	anom	
708		nees	R	854		tayl	O
		suec		856	Nard	comp	
714	Ceph	bicu	O	856		scal	R
715		cete		859	Nowe	curv	O
716		conn		860	Odon	oenu	
		hibe		863		spha	
718		leuc		868	Pell	endi	R
721		lunu	R	867		epip	O
732	Ceph	diva		869		nees	
986	Chil	poly	R		Plag	atla	
741	Colo	calc	R	872.2		aspl	F
742		minu				brit	
743		rose		786		carr	
744	Colu	caly		875		exig	
745	Cono	coni		874.2		kill	
747	Dipl	albi	A	872.1		porr	F
750	Doui	ovat	R	873		punc	R
751	Drep	hama		874.1		spin	F
	Dumo	hirs		881	Pleu	purp	
753	Erem	myri		883	Pore	arbo	
762	Foss	pusi		882		cord	
764	Frul	dila	O	886		obtu	
765		frag	O	884		pian	
767		micr		885		plat	
768		tama	A	887	Prei	quad	
766		tene		888	Ptil	cili	
772	Gymn	infl		889		pulc	
776	Gymn	cren		890	Radu	aqui	
777		obtu				carr	
	Geoc	grav		892		comp	
779	Harp	ovat				holt	
781	Harp	scut		894		lind	
783	Herb	adun				volu	
		bore		896	Rebo	hemi	
782		stra		902	Ricc	chsa	
784	Hygr	laxi		898		lati	
785	Jame	autu		899		mult	R
		undu		900		pale	R
788	Jubu	hutc		915	Ricc	soro	
947	Jung	atro		918	Sacc	viti	R
942		exse		919	Scap	aequ	
943		grac		920		aspe	
876		hyal		922		comp	
878		paro				cusp	
944		puni	R	927		grac	F
808	Kurz	pauc		929		irri	
809		sylv		930		nemo	F
810		tric		931		nimb	
794	Leio	alpe		932		orni	
790		bade		936		suba	
791		bant		938		umbr	O
		hete		939		undu	O
796		turb		730	Spho	pear	
797	Lejo	cavi	R		Tela	aema	
		flav		956	Tric	tene	
		hibe		957	Trit	exse	
		holt		958		ex'f	
801		lama		960		quin	O
		mand					

Lobarion and other interesting macrolichens

Cetr oliv
Loba ampl
pulm R
scro
vire
Nene tere
Neph laev
pari
Norm pulc
Para cape
laev
Para atla
plum
Pann pezi
rubi
samp
Plat norv
Pseu croc
intr
norv
Rama frax
Stic cana
dufo
limb
fuli
sylv
ful/syl

Oceanic ferns

Dryo aemu
Hyme tunb
wils R
Poly seti
Tric spec

A abundant
F frequent
O occasional
R rare

Bryophyte spp.total 134

Site name	Grid ref. NY 500152	
Naddle Low Forest, Cumbria, England.	Dates: Oct. 1986 + Oct. 1988	Rec. ABG Averis

Andr alpi		Ortn intr		Colo calc	E	pinn	
megi		rufe		minu		Raou acou	
sinu		Oxys nitc		Coiu caly		carr	
Anoe warb		tenu		Doui ovat	S ash	holt	
Anti curt		Plag zier		Drep hama		volu	
Bart hall		Plag oede		Dumo hirs		Ricc cham	
Bart wils		Plat jung		Erem myri		palm	
Breu chry	L	Pter grac		Frul frag	S ashes	Sacc viti	D
Bryu rubi		Pter fili		micr		Scap aequ	
Camp atro		Ptil cris	M	tene		aspe	
brev		Ptyc poly		Gymn cren		como	
para	EQ	Raco elli		Geoc grav		cusp	
schw		Rhab cren		Harp ovat		grac	EJ
seti		Rhod rose		Harp scut		nimb	
shaw		Rhyn tees		Herb adun		orni	
subu		Rhyn lusi		bore		umbr	EQ
Cryp lamy		Schi mari		stra		Sone pear	
Cyci laet		Sema demi		Hygr laxi		Tela nema	
Cyno jenn		mica		Jame autu		Tric tome	
Dalt spla		Spha imbr		Jubu hutc		Trit exse	
Dicr aspe		quic		Jung barc			
bonu		quin	JM	Kurz sylv			
subo		stri		tric			
unci		Taxi wiss		Leje flav		Cetr oliv	
Dicr scot		Tetr brow		hibe		Loba ampl	
Dist capi		Thui deli		holt		quim	S ash (halfway up slope in compartment 6)
Epip toze		reco		lama		scro	
Fiss celt		Ulot calv		mano		vire	
curn		coar		pate	B	Mene tere	
mong		drum		ulic	S oak, low, ash	Nech laev	
poly		hutc		Lepi cupr	J	pari	
Font squa		phyl		pear	J	Norm pulc	
Funa atte		weis pers		Lept cune		Parm cape	
obtu		Zygo conc		Lopn frag		laev	
Glyp dave				nete		Pann pezi	
Grim hart		Acro wils		Marc mack		rubi	
retr		Adel decl		Mast wood		samp	
Gymn insi		linc		Metz conj		Plat norv	
Hedw inte		Anas orca	J	frut	S eld	Pseu croc	
Hete hete	E	Anas donn		ieot		intr	
Hook lute		neil		temp		norv	
Hygr aqv		joer		Myli tayl	EJ	Rama frax	
Hylo umbr	JM	Apom ouce		Nowe curv	Q	Stic cana	
Hypn arme		Apha micr		Odon sona		dufo	
Hypn call	E	Barb atla	E	Plag atla		limb	
Isot pulc		barc		brit		fuli	
Isot holt		natc		carr		sylv	
Lept flex		Bazz pear		exig		fui/syl	
recu		tric	J	kili			
Leuc sciu		trii	EJ	punc			
Mniu marg		Caly argu		spin	EJ	Dryo aemu	
Myur hoch		suec		Pleu puro		Hyme tuno	
Neck pumi		Ceph cate		Pore arbo		wiis	E
Oedi grif		hibe		obtu		Poly seti	
						Tric spec	

Habitat codes used in Scottish woodland bryophyte survey

A shaded rocks by streams in ravines	F rocks by coast	K shaded demo ground	P logs in ravines
B rocks by streams outside rav.	G rocks by freshw.lochs	L open demo ground	Q logs outside rav.
C rocks 1-5m from streams in rav.	H well-lit rocks	M wood and fiber	R trees in ravines
D rocks 1-5m from streams outside rav.	I banks in ravines	N soil in ravines	S trees outside rav.
E rocks away from streams/ravines	J banks outside ravines	O soil outside ravines	

dow Bet.out., sil B.pen., ald *Alnus*, pin *Pinus syl.*, oak *Quercus*, row *Sorb.auc.*, naz *Cor.ave.*, ash *Fraxinus*, elm *Ulm.gla.*, hol *Ilex*, ear *Salix aur.*, gre *S.cin.*, goa *S.cap.*, naw *Crat.mon.*, bro *Prun.pad.*, che *P.avi.*, elo *Sambucus nig.*, asp *Populus tre.*, lim *Tilia*, syc *Acer pse.*, bee *Fag.syl.*, lar *Larix*, spr spruce/fir

APPENDIX 2

Bryophytes and lichens recorded in quadrats.

Abbreviations Ground	Rock/ Tree	Species name (mosses)	Presence in quadrats Ground	Rock	Tree
Aund		Atrichum undulatum	+		
Briv		Brachythecium rivulare	+		
Brut	Br	B.rutabulum	+		+
Bpse		Bryum pseudotriquetrum	+		
Ccus		Calliergon cuspidatum	+		
Cpar	Cp	Campylopus paradoxus	+	+	
Cpil		Cirriphyllum piliferum	+		
Cmol		Ctenidium molluscum	+		
Dmaj	Dm	Dicranum majus	+	+	+
Dsco	Ds	D.scoparium	+	+	+
Epra		Eurhynchium praelongum	+		
Estr	Es	E.striatum	+		+
Ftax		Fissidens taxifolius	+		
Hhet	Hh	Heterocladium heteropterum	+	+	
Hcup	Hc	Hypnum cupressiforme	+	+	+
Hjut		H.jutlandicum	+		
Hbre		Hylocomium brevirostre	+		
Hspl	Hs	H.splendens	+	+	+
Humb		H.umbratum	+		
	Ie	Isopterygium elegans		+	
Imyo	Im	Isothecium myosuroides	+	+	+
Imyu	Imu	I.myurum	+		+
Mhor	Mh	Mnium hornum	+	+	+
Pfor	Pf	Polytrichum formosum	+	+	+
Pm.a		Plagiomnium affine	+		
Pm.u	Pm.u	P.undulatum	+	+	
Pund	Pu	Plagiothecium undulatum	+	+	+
Pden	Pd	P.denticulentum	+		+
	Psuc	P.succulentum		+	
Psch	Ps	Pleurozium schreberi	+	+	
Ppur		Pseudoscleropodium purum	+		
Pcri		Ptilium cristacastrensis	+		
Raqu		Racomitrium aquaticum	+		
Rfas		R.fasciculare	+		
Rhet	Rh	R.heterostichum	+	+	
Rpun	Rp	Rhizomnium punctatum	+	+	
Rlor	Rl	Rhytidiadelphus loreus	+	+	+
Rsqu		R.squarrosus	+		
Rtri		R.triquetrus	+		
Squi	Sq	Sphagnum quinquefarium	+	+	
Tpel		Tetraphis pellucida	+		
Ttam	Tt	Thuidium tamariscinum	+	+	+

APPENDIX 2 (cont).

Abbreviations Ground	Rock/ Tree	Species name (liverworts)	Presence in quadrats Ground	Rock	Tree
Aorc		Anastrepta orcadensis	+		
Bflo		Barbilophozia floerkei	+		
Btri		Bazzania trilobata	+		
Cmue		Calypogeia muelleriana	+		
Cbic		Cephalozia bicuspidata	+		
Clun		Cephalozia lunulifolia	+		
Cpol		Chiloscyphos polyanthos var.pallescens	+		
Dalb	Da	Diplophyllum albicans	+	+	
	Ff	Frullania fragilifolia			+
	Ft	F.tamarisci			+
Lpea		Lepidozia pearsonii	+		
Lrep	Lr	L.reptans	+	+	+
Lbid	Lb	Lophocolea bidentata	+		+
Linc		Lophozia incisa	+		
Lven		L.ventricosa	+		
Mema		Marsupella emarginata	+		
Pepi		Pellia epiphylla	+		
Pasp	Pa	Plagiochila asplenioides	+	+	
Ppor	Pp	P.porelloides	+	+	+
	Ps	P.spinulosa		+	
Rmul		Riccardia multifida	+		
	Sg	Scapania gracilis		+	
Snem	Sn	S.nemorosa	+	+	
Sumb		S.umbrosa	+		
	Tq	Tritomaria quinquedentata		+	
		Lichens			
	Cc	Cladonia coniocraea			+
	Hp	Hypogymnia physodes			+
	Oa	Ochrolechia androgyna			+
	Pe	Peltigera sp.			+
	Pg	Platismatia glauca			+
	Psax	Parmelia saxatilis		+	+
	Psul	P.sulcata			+

Appendix 3

Ground quadrat data

These quadrats each measure 1 x 1m. There are 5 such quadrats in each compartment of the wood, plus one more quadrat in each of the six 20 x 30 m ungrazed plots (total of 66 ground quadrats).

These quadrats are marked with a wooden peg in the upper-left corner (viewed from down-slope). Some quadrats also have 3 small pegs in the other corners, but the small pegs have proved very difficult to refind on the ground.

The location of each ground quadrat is described, giving the distance into the compartment (at 90° to the fence) from a particular post along one of the margin fences.

The quadrats were placed on the ground, avoiding (as far as possible) rocks and boulders, but some quadrats contain small rocks.

The following data were recorded for each quadrat :-

- Estimated total per cent bryophyte cover
- Estimated per cent cover of each bryophyte species (cover totals adding up to a maximum of 100 %).
- General prominence of bryophytes in the quadrat, i.e. dominant, mixed with vascular plants, or hidden beneath vascular plants.

Abbreviations of species names are given in Appendix 2.

Plot 1, quadrat 1. 15m up-slope from "A". Large pegs "M1" and "Q2" mark top-left and bottom-right (seen from down-slope) corners of quadrat respectively. 95% cover (Oct'86), mixed with/beneath short grass.

	Oct'86	Oct'88	Jan'92
Pund	2	2	2
Ppur	10	10	5
Rsqu	83	83	87
Lbid	–	–	1
			95

Plot 1, quadrat 2. 6m in from 33rd post up N fence from "A". 65% cover (Oct'86), mixed with grass/litter/bracken.

	Oct'86	Oct'88	Jan'92
Epra	1		1
Mhor	<1		2
Psch	3		–
Pund	3		5
Rlor	6		6
Rsqu	46		70
Ttam	3		3
Lbid	3		–
Ppur	–		1
			88

Plot 1, quadrat 3. 3m in from 22nd post up W fence. 100% cover (Oct'86), bryophytes dominant. Occasional litter/grass.

	Oct'86	Oct'88	Jan'92
Dmaj	22	15	
Dsco	1	–	
Mhor	<1	–	
Psch	10	10	
Pund	12	15	
Pfor	5	15	
Rlor	40	35	
Squi	10	10	
Lbid	<1	<1	

Plot 1, quadrat 4. 6m in from 44th post (3 posts down from bend in fence) up W fence. 100% cover (Oct'86), bryo. dominant. Occ. litter/grass.

	Oct'86	Oct'88	Jan'92
Dmaj	20	10	10
Pfor	20	30	35
Pund	5	5	<1
Rlor	55	55	55
Lbid	<1	–	–
Psch	–	<1	<1
Pasp	–	<1	<1
Mhor	–	–	<1
			100

7th post down

Plot 1, quadrat 5. 8m in from SE fence, c.12m down from upper margin of wood. Holly tree 5m further along (& slightly up) slope into plot, c.12m from fence. 4% cover (Oct'86) on small, v.low rocks. Most of quadrat is soil, litter and short grass.

	Oct'86	Oct'88	Jan'92
Dmaj	<1	<1	<1
Hhet	<1	<1	<1
Hcup	2	2	1
Imyo	1	1	2
Mhor	1	1	1
			4

Plot 2, quadrat 1. 7m up-slope from 21st post SE along bottom fence. 4 pegs. 100% cover (Oct'86), well-hidden beneath grass.

	Oct'86	Oct'88	Jan'92
Epra	1	<1	
Rsqu	99	99	
Lbid	<1	<1	
Ppur	-	<1	

Plot 2, quadrat 2. 8m in from 14th post up SE fence from "A". 4 pegs. 85% cover (Oct'86), well-hidden beneath grass.

	Oct'86	Oct'88	Jan'92
Epra	15	20	25
Humb	4	2	1
Pund	3	1	3
Rsqu	58	50	50
Lbid	4	10	5
Pasp	1	2	1
Rlor	-	-	15
			100

Plot 2, quadrat 3. 8m in (along slope) from bend in SE fence. 1m up-slope from large oak tree. 4 pegs. 1% cover (Oct'86) beneath grass/litter.

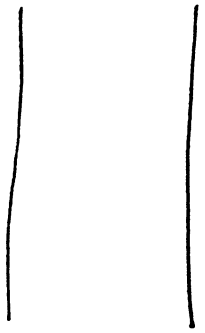
	Oct'86	Oct'88	Jan'92
Hcup	<1	<1	<1
Rsqu	<1	<1	<1
Lbid	<1	<1	-

Plot 2, quadrat 4. 10m in from 8th post down W fence from "F". 4 pegs. 100% cover (Oct'86), mixed with/beneath grass.

	Oct'86	Oct'88	Jan'92
Pfor	<1	-	-
Pund	4	-	3
Rlor	81	85	90
Rsqu	15	15	7
Hspl	-	<1	<1
Lpea	-	<1	-
			100

Plot 2, quadrat 5. 20m in from W fence c.60m down-slope from qyadrat 4. Standing dead tree trunk (4m x 45cms) just across fence, in plot 3. Quadrat is on sloping ground above v.steep, rocky bank. 4 pegs (large peg at top right corner of quadrat). 100% cover (Oct'86), mixed with grass.

	Oct'86	Oct'88	Jan'92
Hspl	1		
Hcup	1		
Ppur	1		
Pshr	25		
Pund	10		
Pcri	<1		
Rlor	25		
Rsqu	35		
Aorc	1		
Lbid	1		



Plot 3, quadrat 1. 40m up from road. 20m in from stone wall (E edge). 3m E of fallen rowan. 4 pegs. 95% cover (Oct'86), beneath grass.

	Oct'86	Oct'88	Jan'92	
Dmaj	1	1	1	
Pund	2	-	<1	
Psch	1	-	-	
Pfor	15	15	7	
Rlor	23	23	30	
Rsqu	50	50	30	
Ttam	1	4	20	
Pasp	2	3	4	
Humb	-	-	3	95
Mhor	-	-	<1	

Plat 3, quadrat 2. 12m in from 10th fence post up from "T". Near bottom of rock face. 4 pegs. 70% cover (Oct'86), mixed with/beneath grass/herbaceous/bracken.

	Oct'86	Oct'88	Jan'92
Dmaj	3	3	3
Mhor	5	5	2
Hcup	<1	-	<1
Hspl	1	2	1
Pfor	2	2	1
Pund	1	2	1
Rpun	<1	-	-
Rlor	15	15	15
Rsqu	6	5	1
Squi	1	1	<1
Hhet	<1	<1	<1
Ttam	25	35	40
Cmue	<1	-	-
Lbid	10	10	4
Pasp	1	2	<1
Lrep	-	<1	-
Dalb	-	-	<1
			68

Plot 3, quadrat 3. 1m NE of fence midway between N and S corners of 20 x 30m ungrazed plot in plot 3. 4 pegs. 100% cover (Oct'86), bryophytes dominant/mixed with grass/litter.

	Oct'86	Oct'88	Jan'92
Dmaj	<1	<1	-
Hspl	1	<1	1
Humb	<1	<1	<1
Psch	11	10	2
Pfor	<1	-	-
Pund	<1	-	-
Rlor	85	84	60
Rsqu	2	6	37
			100

Plot 3, quadrat 4. Midway between E and W fences, 8m up-slope from 20 x 30m ungrazed plot in plot 3. 4 pegs. 95% cover (Oct'86), beneath grass.

	Oct'86	Oct'88	Jan'92
Humb	4	6	
Ppur	15	15	
Rlor	2	-	
Rsqu	73	75	
Lbid	1	-	
Pfor	-	<1	
Pasp	-	3	

Plot 3, quadrat 5. 6m in from SE corner of 20 x 30m ungrazed plot in plot 4. 4 pegs. 60% cover (Oct'86), well-hidden beneath grass/herbaceous.

	Oct'86	Oct'88	Jan'92
Rsqu	58	60	64
Ttam	2	1	1
Pasp	-	2	2
Epra	-	3	1
Pund	-	1	1
Ppur	-	-	1
			70

Plot 4, quadrat 1. 40m in from 30th post up W fence. Very close to pegs marking vascular plant quadrat. 95% cover (Oct'86), mixed with grass.

	Oct'86	Oct'88	Jan'92
Humb	2	3	2
Hcup	5	4	-
Mhor	3	-	-
Pund	10	-	1
Psch	7	-	1
Pfor	3	-	3
Rlor	3	-	10
Rsqu	60	65	76
Pasp	2	-	1
Dmaj	-	-	1
Cbic	-	-	<1
			95

Plot 4, quadrat 2. 40m in from 50th post up W fence. c.30m up-slope from quadrat 1. On gently-sloping ground 3m below steep rock face. 90% cover (Oct'86), mixed with grass/litter.

	Oct'86	Oct'88	Jan'92	
Mhor	25	25	20	
Hcup	<1	<1	<1	
Pund	10	10	5	
Rsqu	35	30	10	
Rlor	<1	8	15	
Pasp	20	20	10	
Lbid	<1	<1	-	
Psch	-	-	<1	60
Pfor	-	-	<1	

Plot 4, quadrat 3. 12m in from point where stone wall within plot meets E fence (c.2/3 way up the slope). 50% cover (Oct'86), mixed with grass, bracken and fallen branches.

	Oct'86	Oct'88	Jan'92
Dmaj	<1	-	
Humb	3	3	
Hcup	<1	<1	
Mhor	6	6	
Pund	3	4	
Rsqu	29	15	
Rlor	1	1	
Ttam	2	2	
Lbid	6	6	

(red paint on fence post)

Plot 4, quadrat 4. 25m in from 30th post up E fence from point where stone wall meets fence (see quadrat 3, above). Midway between E and W fences. Just below remnants of old stone wall. 3& cover, mixed with grass/litter.

	Oct'86	Oct'88	Jan'92
Hcup	<1	-	
Pund	2	-	
Rsqu	1	-	

No bryophytes found in this quadrat in October 1988.

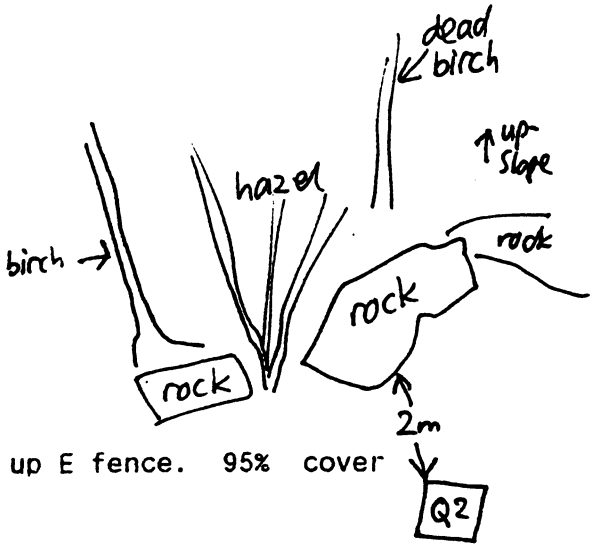
Plot 4, quadrat 5. 15m up-slope from fence at lay-by (road). 100% cover (Oct'86), mixed with grass/herbaceous/litter.

	Oct'86	Oct'88	Jan'92	
Epra	10	10	15	
Pm.u	2	2	<1	
Rlor	<1	<1	-	
Rsqu	73	72	59	
Ttam	15	15	25	
Pasp	-	1	1	
Aund	-	-	<1	
Rtri	-	-	<1	
				100

Plot 5, quadrat 1. C. 16m in from 17th post up E fence. Next to 70 x 40cms rock covered with Thuidium. 90% cover (Oct'86), mixed with grass/herbaceous/litter.

Quadrat is between 2 hazel bushes.

	Oct'86	Oct'88	Jan'92	
Aund	2	2	<1	
Brut	<1	<1	-	
Ftax	<1	<1	<1	
Estr	67	50	35	
Hcup	2	2	2	
Imyo	1	1	2	
Hspl	<1	<1	-	
Ttam	8	8	25	
Raqu	<1	-	-	
Pfor	2	6	5	76
Rtri	4	3	2	
Rpun	-	-	<1	
Imyu	-	-	1	Rbr 4



Plot 5, quadrat 2. 30m in from 37th post up E fence. 95% cover (Oct'86), beneath/mixed with grass/litter.

	Oct'86	Oct'88	Jan'92
Epra	3	-	8
Ppur	1	2	3
Rlor	1	2	2
Rsqu	90	90	70
Ttam	-	-	2
			85

Plot 5, quadrat 3. 10m in from 50th post up E fence. 99% cover (Oct'86), mixed with grass and occasional litter.

	Oct'86	Oct'88	Jan'92
Dmaj	<1	<1	
Rlor	97	97	
Rtri	2	2	

Plot 5, quadrat 4. 7m in from c.80th post up W fence. 30m in from c.80th post up E fence. 100% cover (Oct'86), beneath/mixed with grass and occasional liter.

	Oct'86	Oct'88	Jan'92	
Rlor	67	67	39	
Dmaj	10	10	20	
Pund	14	14	15	
Pcri	3	3	5	
Hspl	5	5	10	
Psch	<1	<1	10	
Pasp	1	1	1	
Lpea	<1	-	-	
Ncur	-	-	<1	on v. small log
Lbid	-	-	<1	
			100	

Plot 5, quadrat 5. About midway between E and W fences (c.10m from E fence, c.8m from W fence), just above vary large, old oak tree near upper (S) margin of wood. 1.5m up-slope from vascular plant quadrat. 100% cover (Oct'86), beneath grass/litter.

	Oct'86	Oct'88	Jan'92
Ppur	49	49	40
Rsqu	50	50	57
Rlor	1	1	3
			100

Plot 6, quadrat 1. 10m up-slope from fence at lay-by (straight up-slope from "no parking" sign). 100% cover (Oct'86) beneath grass/litter.

sign gone by Jan'1992.

	Oct'86	Oct'88	Jan'92
Hspl	2	5	4
Humb	30	25	20
Psch	<1	<1	1
Ppur	<1	<1	1
Pund	15	15	10
Pfor	3	3	1
Rlor	30	30	33
Rtri	<1	<1	<1
Rsqu	5	5	5
Lbid	1	1	1
Pasp	13	13	20
			100

Plot 6, quadrat 2. 20m in from 32nd post up E fence. 95% cover (Oct'86) beneath grass/litter.

	Oct'86	Oct'88	Jan'92
Epra	10	10	–
Ppur	20	30	45
Pund	10	5	–
Pm.u	1	–	–
Rlor	1	1	1
Rsqu	18	18	15
Ttam	20	20	25
Lbid	15	5	1
Pasp	–	10	10
Mhor	–	–	1
			98

Plot 6, quadrat 3. 30m in from 60th post up E fence. 80% cover (Oct'86) beneath grass/herbaceuous/male-ferns.

	Oct'86	Oct'88	Jan'92
Mhor	16		
Pund	16		
Pden	<1		
Pm.u	1		
Rsqu	10		
Rpun	<1		
Ttam	30		
Lbid	7		

Plot 6, quadrat 4. 50m in from 91st post up E. fence. 95% cover, beneath grass.

	Oct'86	Oct'88	Jan'92
Dmaj	2		
Dsco	1		
Mhor	1		
Pund	16		
Rlor	40		
Squi	2		
Ttam	30		
Dalb	<1		
Mema	<1		
Lbid	1		
Sumb	<1		

Plot 6, quadrat 5. 50m further into plot from from quadrat 4. 100% cover, mixed with a little grass and *Vaccinium myrtillus*.

	Oct'86	Oct'88	Jan'92
Dmaj	35		
Hspl	1		
Imyo	1		
Pfor	3		
Pund	2		
Psch	16		
Rlor	35		
Rtri	1		
Squi	4		
Aorc	1		
Lrep	1		
Pasp	<1		

Plot 7, quadrat 1. C?. 15m in from 10th post up W fence. 4 pegs. 95% cover, well-hidden beneath grass.

	Oct'86	Oct'88	Jan'92
Aund	<1	-	<1
Dmaj	2	<1	<1
Mhor	1	<1	<1
Pm.u	<1	<1	-
Ppur	4	<1	<1
Rsqu	1	15	20
Rtri	85	75	70
Ttam	1	<1	5
Dalb	<1	-	-
Lbid	<1	<1	5
Pasp	<1	<1	<1
Psch	-	-	<1
			100

Plot 7, quadrat 2. C. 9m in from 25th post up W fence. 60% cover, mixed with & beneath litter/herbaceous. Five small, low rocks/stones within the quadrat.

	Oct'86	Oct'88	Jan'92
Cmol	1	<1	1
Epra	1	<1	–
Estr	40	25	20
Hcup	5	<1	<1
Imyo	8	5	1
Imyu	1	<1	1
Mhor	<1	<1	<1
Raqu	<1	<1	–
Rlor	<1	<1	1
Ttam	5	<1	2
Ppor	<1	<1	<1
Hbre		1	<1
			26

Plot 7, quadrat 3. 25m in from 42nd post up W fence. 4 pegs. 90% cover, beneath/mixed with grass + 2 small rocks.

	Oct'86	Oct'88	Jan'92
Dmaj	6	<1	8
Hcup	<1	<1	4
Mhor	1	–	–
Pund	3	<1	5
Pfor	6	<1	5
Pcri	2	3	5
Rsqu	65	60	17
Rlor	1	3	18
Rhet	<1	<1	<1
Ttam	1	<1	4
Psch	2	<1	1
Dalb	<1	–	<1
Mema	<1	–	<1
Lbid	<1	<1	<1
Pasp	1	<1	1
Linc	–	–	<1
			78

Plot 7, quadrat 4. 16m in from 72nd post up W fence. 7m down-slope from W end of large, E-W-orientated fallen decaying tree trunk which is raised conspicuously (by rocks) c.1m above the ground. 95% cover, very well hidded beneath coarse grass and occasional bracken and leaf litter.

	Oct'86	Oct'88	Jan'92
Epra	1	5	10
Pm.u	<1	<1	3
Ppur	1	2	5
Rsqu	88	75	66
Lbid	5	8	1
Pasp	<1	-	-
Aund		<1	<1
Mhor		<1	-
Ttam		5	2
			95

Plot 7, quadrat 5. C. 30m in from 85th post up W fence. 2m W of N-S-orientated fallen tree trunk (ash?) which measures c.7m long and c.20cm diameter. 95% cover, beneath grass/herbaceous.

	Oct'86	Oct'88	Jan'92
Bpse	<1	-	1
Briv	1	<1	<1
Ccus	90	90	90
Paff	1	<1	3
Rpun	<1	<1	-
Ttam	<1	-	-
Rsqu	1	<1	-
Cpol	<1	<1	<1
Rmul	<1	-	<1
Sphag.sp.	-	1	1
Apin	-	<1	<1
Lbid	-	-	<1
			95

Plot 8, quadrat 1. 15m in from 15th post up W fence. 90% cover beneath grass/herbaceous/leaf litter.

	Oct'86	Oct'88
Dmaj	3	
Hspl	<1	
Hcup	2	
Imyo	<1	
Mhor	4	
Ppur	17	
Rsqu	55	
Rtri	<1	
Ttam	12	
Lbid	1	
Snem	<1	

In Oct'88, the quadrat marking post was found "uprooted", lying on the ground away from the quadrat (as judged from the very different kind of vegetation in which it was found. Bryophytes have grown on the post:
Rhytidiadelphus loreus (5cm),
Lophocolea bidentata (2cm) and
Hylocomium splendens (<1cm)

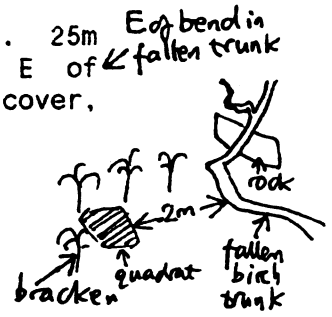
Plot 8, quadrat 2. 27m in from 40th post up W fence. 95% cover, well-hidden beneath grass/leaf-litter.

	Oct'86	Oct'88	Jan'92
Dmaj	<1	1	1
Ppur	50	65	65
Pund	10	5	5
Rlor	<1	10	10
Rsqu	33	10	15
Ttam	2	1	1
Psch	–	–	<1
			95

Plot 8, quadrat 3. 30m in from E and W fences (72nd post up W fence, = upper corner of 20m x 30m ungrazed area in Plot 9). 100% cover, mixed with grass, litter and fallen branches.

	Oct'86	Oct'88	Jan'92
Hspl	1	1	5
Hcup	<1	<1	<1
Psch	1	1	15
Pund	4	8	5
Pfor	20	20	20
Ppur	1	1	10
Rlor	3	5	8
Rsqu	70	55	36
Dalb	<1	–	–
DSco	–	–	1
			100

Plot 8, quadrat 4. 25m in from bend in W fence (i.e. 25m proceeding at right angles to W fence S of bend). 2m E of large fallen birch tree. 4 pegs (1 big, 3 small). 75% cover, beneath grass + a few fallen bracken stems.



	Oct'86	Oct'88	Jan'92
Ppur	5	5	
Rsqu	70	75	

Plot 8, quadrat 5. 15m in from 30th post up from bend along W fence. 4 pegs (1 big, 3 small). 100% cover (often lush), mixed with bilberry, grass and litter.

	Oct'86	Oct'88	Jan'92
Dmaj	28	20	20
Hspl	2	<1	10
Psch	30	25	20
Rlor	35	30	24
Rsqu	2	5	25
Squi	2	<1	<1
Lpea	<1	–	–
Lbid	1	–	1
Clun	–	–	<1
			100

Plot 9, quadrat 1. 15m in from 10th post up W fence. 6m up-slope from large sycamore tree.

	Oct'86	Oct'88	Jan'92
Humb	2	-	<1
Pund	2	<1	-
Ppur	5	<1	15
Rsqu	75	70	35
Ttam	8	15	35
Pasp	3	<1	5
Snem	<1	-	-
Epra	-	<1	-
Pm.u	-	<1	-
Rlor	-	-	10
			100

Plot 9, quadrat 2. 30m in from 26th post up W fence (SE corner of 20m x 30m ungrazed area in Plot 9). 4m SW of large ash tree. 80% cover, beneath herbaceous/grass/litter.

	Oct'86	Oct'88	Jan'92
Dsco	1	1	-
Estr	2	2	3
Epra	1	1	-
Aund	1	1	-
Mhor	40	40	14
Pfor	1	1	1
Rpun	<1	<1	<1
Ttam	30	30	40
Rlor	2	2	15
Lbid	<1	<1	<1
Pasp	1	1	2
Snem	<1	<1	<1
Pund	-	1	-
Pm.u	-	-	5
Rtri	-	-	<1
			80

Plot 9, quadrat 3. 50m in from 41st post up W fence. 3m SE of large (6m x 50cm) standing birch with top broken off. 100% cover, very well hidden beneath grass/litter (making it difficult to assess percentage cover of each species).

	Oct'86	Oct'88	Jan'92
Estr	45	35	5
Pund	1	1	-
Rlor	4	4	2
Rsqu	44	50	80
Ttam	2	2	10
Lbid	3	5	2
Pasp	1	-	<1
Cpil	-	2	1
Pm.u	-	1	<1
			100

Plot 9, quadrat 4. 20m in from 83rd post up W fence. 15m down-slope from partly-fallen rowan tree. 100% cover, well-hidden beneath grass/litter. Stick found broken, lying on ground, in Jan'92, but still managed to locate hole in ground where it had been.

	Oct'86	Oct'88	Jan'92
Pund	1	<1	1
Pfor	1	<1	5
Ppur	44	50	50
Rsqu	48	40	39
Ttam	1	<1	<1
Dalb	<1	<1(rock)	<1
Lbid	3	<1	5
Snem	<1	<1(rock)	<1
Psch	-	-	<1
			100

Plot 9, quadrat 5. 25m in from 103rd post up W fence. 12m SE of large oak with trunk divided (from 1m up) into two. 100% cover, beneath grass/bilberry/leaf-litter.

	Oct'86	Oct'88	Jan'92
Dmaj	<1	<1	2
Hjut	1	<1	-
Mhor	<1	-	<1
Pund	30	30	30
Psch	23	23	25
Rlor	6	6	20
Rsqu	23	23	15
Aorc	<1	<1	-
Cbic	<1	<1	-
Lbid	10	10	2
Lven	<1	<1	-
Lpea	<1	<1	-
Pasp	5	5	2
Pfor	-	<1	-
HSpl	-	-	4
Dalb	-	-	<1
Pfor	-	-	<1
Squi	-	-	<1
			100

Plot 10, quadrat 1. 20m in from 10th post up E fence. 50% cover, beneath/mixed with litter/grass/herbaceous.

	Oct'86	Oct'88	Jan'92
Dmaj	1	1	1
Mhor	40	35	20
Pfor	3	5	15
Pund	5	4	1
Rlor	1	2	5
Ttam	<1	1	5
Pasp	-	1	<1
			47

Plot 10, quadrat 2. 35m in from 26th post up E fence. 3m NW of W end of large (10m x 45cm) fallen ash trunk. 85% cover, beneath grass. 2 small rocks in quadrat.

	Oct'86	Oct'88	Jan'92
Dmaj	1	1	
Epra	<1	-	
Humb	<1	<1	
Hcup	4	-	
Hhet	<1	-	
Imyo	<1	-	
Mhor	41	20	
Pm.u	10	15	
Pund	6	6	
Rpun	<1	-	
Rsqu	2	2	
Rlor	2	-	
Ttam	6	6	
Cbic	<1	<1	
Dalb	3	<1	
Lbid	2	<1	
Pasp	6	20	
Snem	<1	<1	
Hspl	-	1	

Plot 10, quadrat 3. 7m in from 50th post up E fence. 95% cover, mixed with/beneath grass.

	Oct'86	Oct'88	Jan'92
Hspl	2	2	3
Humb	<1	<1	<1
Hcup	<1	<1	<1
Mhor	5	5	5
Ppur	33	33	43
Pfor	8	8	8
Pund	20	20	15
Rsqu	10	10	10
Rlor	1	1	2
Squi	2	4	7
Ttam	7	7	6
Dalb	<1	<1	<1
Lbid	1	1	1
			100

Plot 10, quadrat 4. 50m in from 68th post up E fence. 5m up-slope from large oak. 100% cover, mixed with grass/litter.

	Oct'86	Oct'88	Jan'92
Cpar	<1	<1	<1
Dmaj	17	12	10
Mhor	5	5	<1
Pcri	30	30	40
Psch	16	16	10
Pund	1	1	<1
Rlor	30	35	40
Bflo	<1	<1	<1
Clun	<1	<1	<1
			100

Plot 10, quadrat 5. 30m up-slope from quadrat 4. 5m down-slope from fairly large exposed rocks with cave-like hole in middle. 95% cover, mixed with/beneath grass/male fern/herbaceous/litter.

	Oct'86	Oct'88	Jan'92
Dmaj	1		
Epra	<1		
Hspl	20		
Mhor	4		
Pund	10		
Pfor	5		
Psch	30		
Rpun	<1		
Rlor	5		
Rsqu	16		
Ttam	2		
Dalb	<1		
Lbid	1		

Plot 11, quadrat 1. 10m in (up-slope) from 36th post E along bottom fence. 4 pegs. 100% cover, beneath grass/litter.

	Oct'86	Oct'88	Jan'92
Dmaj	<1	<1	15
Mhor	2	2	2
Pfor	1	1	1
Pund	~~5~~5	35	~~40~~
Rlor	~~42~~	25	38
Dalb	<1	<1	<1
Pasp	<1	<1	<1
RSqu	–	–	4
Lbid	–	–	<1
			100

Plot 11, quadrat 2. 25m up-slope from quadrat 1. 5m up-slope from fallen birch. 5m NNW from birch with main trunk at 45° (N) and thinner, white-barked vertical branch/trunk arising from tree-base. 4 pegs. 90% cover, beneath grass/litter/bracken.

	Oct'86	Oct'88	Jan'92
Dmaj	<1	<1	<1
Hcup	<1	-	1
Mhor	2	2	1
Pund	60	40	50
Rsqu	23	23	25
Ttam	1	1	6
Clun	<1	<1	<1
Bflo	<1	<1	<1
Dalb	1	1	<1
Lbid	1	20	11
Pasp	—	—	6
			100

Plot 11, quadrat 3. "C". 4m in from point along W fence 40m down-slope from bend in (W) fence. Under hawthorn just up-slope from large fallen ash. 4 pegs. 100% cover, beneath herbaceous/grass/litter.

	Oct'86	Oct'88	Jan'92
Aund	2	-	-
Cpil	<1	<1	<1
Dmaj	3	3	2
Epra	1	1	<1
Estr	10	10	3
Hspl	20	10	10
Hcup	<1	-	-
Mhor	<1	<1	<1
Pund	1	1	<1
Rlor	2	2	2
Rsqu	21	21	20
Rtri	4	4	20
Ttam	10	10	20
Lbid	20	30	20
Pepi	1	1	1
Pasp	5	5	2
Snem	<1	<1	<1
Ppur	—	—	<1
			100

Plot 11, quadrat 4. 40m in from bend in W fence. 4n ENE of fairly large birch with trunk sloping at 45° towards N. 4 pegs. 95% cover, well-hidden beneath grass.

	Oct'86	Oct'88	Jan'92
Dmaj	2	2	8
Hcup	<1	-	-
Pund	60	25	5
Psch	1	-	3
Pfor	2	2	1
Rlor	2	2	2
Rsqu	27	40	73
Bflo	<1	-	-
Lbid	1	20	5
Ttam	—	—	3
		Small	100

(20th post up = another bend in fence)

Plot 11, quadrat 5. 15m in from 20th post up from bend in W fence. 6m down-slope from oak tree. 4 pegs. 100% cover, mixed with grass/bilberry/litter.

	Oct'86	Oct'88	Jan'92
Dmaj	2	2	3
Dsco	1	1	1
Hcup	15	15	5
Hspl	15	15	15
Pund	30	30	35
Pfor	2	2	2
Psch	15	15	16
Rlor	15	15	20
Cmue	<1	<1	<1
Clun	1	1	1
Lpea	<1	1	1
Linc	1	1	<1
Lven	1	1	<1
Dalb	1	1	<1
Btric	-	<1	-
Squi	—	—	1
Mtay	—	-	<1
			100

Plot 12, quadrat 1. 5m in from 7th post up E fence. 4 pegs. 100% cover, mixed with grass/leaf litter.

	Oct'86	Oct'88	Jan'92
Mhor	25	25	10
Pm.u	10	10	4
Pund	25	25	20
Ppur	3	5	18
Rsqu	30	26	40
Rlor	1	1	-
Ttam	2	2	5
Pasp	5	5	1
Cpil	-	1	1
Epra	-	1	1
Imyo	-	-	<1
			100

Plot 12, quadrat 2. 30m in from 26th post up E fence. 1m below 1 x 1.5m boulder covered with *Polytrichum formosum.* 4 pegs. 100% cover, beneath grass/litter.

	Oct'86	Oct'88	Jan'92
Dmaj	<1	<1	6
Hcup	<1	<1	<1
Pfor	<1	1	2
Ppur	5	5	20
Pund	2	2	4
Rlor	10	10	2
Rsqu	36	36	5
Squi	<1	<1	10
Ttam	45	45	50
Lbid	1	1	1
			100

(c.53rd post up = junction with internal fence (see below))

Plot 12, quadrat 3. 25m in from 57th post up E fence. 2m NE from large ash. 7m ENE from large sycamore. 4 pegs. 100% cover. mixed with/beneath grass/litter. Quadrat = c.9m up-slope from internal fence which runs ± along slope, within plot 12.

	Oct'86	Oct'88	Jan'92
Cpil	10	30*	25
Dmaj	10	2	2
Epra	7	5	5
Mhor	2	2	2
Pm.u	<1	<1	<1
Rsqu	60	48	40
Ttam	10	7*	20
Lbid	4	5	5
Pasp	2	1	1
			100

* Ttam & Cpil had grown [illegible] up [illegible] of the [illegible] post by October [illegible].

Post has become completely overgrown with Thuidium tamariscinum by January 1992.

Plot 12, quadrat 4. At bottom of steep rock face 12m in from fence point near bend in E .6m up from triangular, skyward-pointing 2x2x2m slab of rock. 90% cover, mixed with/beneath grass/herbaceaous/litter.

	Oct'86	Oct'88	Jan'92
Dmaj	3	3	5
Epra	10	10	5
Hcup	<1	<1	<1
Mhor	15	15	5
Rlor	8	20	15
Rsqu	52	40	35
Rfas	<1	<1	-
Dalb	2	2	1
Mema	<1	<1	<1
Snem	<1	<1	<1
Ttam	-	10	34
Pfor	-	1	<1
			100

Plot 12, quadrat 5. 6m up-slope from 44th post W along bottom fence. 3m from rather dead rowan tree 4m tall. 100 % cover, mixed with/beneath grass/bilberry/litter.

	Oct'86	Oct'88	Jan'92
Dmaj	6	6	-
Dsco	5	5	5
Mhor	4	4	3
Pund	25	15	10
Psch	12	12	10
Rsqu	25	25	20
Tpel	<1	<1	-
Cmue	<1	<1	<1
Cmed	<1	<1	<1
Btril	18	18	15
Lbid	5	10	-
Ppur	-	1	-
Lrep	-	<1	<1
Dalb	—	—	15 (on rock)
Hcup	—	—	2
Squi	—	—	4
			84

↖ between 2nd & 3rd posts up internal fence which runs diagonally up-slope towards SE. Quadrat straddles this internal fence.

Ground quadrats in 20x30m ungrazed plots (cont.)

Compartment 9 (E)

95% cover, fairly well-hidden beneath tall grass / bracken.

	Oct'86	Oct'88	Jan '92
Mhor	2	–	–
Ppur	10	35	78
Pund	34	30	5
Pfor	2	–	–
Rsqu	35	20	5
Dalb	1	1	1
Lbid	1	–	–
Snem	<1	1	1
Hspl	–	2	–
Ttam	–	5	5

Pund, Ppur & Ttam had grown 10cm up marker post by Oct '88.

Compartment 9 (W)

95% cover, well-hidden beneath grass/litter.

	Oct86	Oct88	Jan'92
Epra	18		
Ppur	27		
Rsqu	27		
Ttam	20		
Lbid	2		
Pasp	1		

Compartment 11

100% cover, well-hidden beneath grass/herbaceous.

	Oct'86	Oct'88	Jan'92
Hspl	2	–	
Hcup	3	–	
Ccus	15	15	
Pfor	<1	–	
Ppur	20	20	
Rsqu	57	57	
Ttam	2	2	
Lbid	1	1	
Aund	–	<1	
P'mn·u	–	5	

Ground quadrats in 20x30m ungrazed plots

Compartment 3 — 100% cover, dominant/mixed with grass.

	Oct '86	Oct '88	Jan '92
Humb	20		
Pfor	15		
Pund	<1		
Psch	11		
Hspl	1		
Rlor	85		
Rsqu	2		
Dmaj	<1		

Compartment 4 — 100% cover, well-hidden beneath grass/litter.

	Oct '86	Oct '88	Jan '92
Rsqu	100		

Compartment 6 — 90% cover, beneath grass/bracken

	Oct '86	Oct '88	Jan '92
Hspl	1		
Psch	5		
Ppur	5		
Rlor	1		
Rsqu	58		
Lbid	20		

APPENDIX 4

Rock quadrat data (1986 and 1992)

Compartment 6 rock 2	Oct'86	Jan'92	Change since 1986
Dmaj	66	55	-11
Mhor	23	7	-16
Pfor	11	6	-5
Rlor	0	2	+2
Ttam	0	30	+30

Compartment 6 rock 4	Oct'86	Jan'92	Change since 1986
Cpar	2	0	-2
Dalb	0	4	+4
Dmaj	2	0	-2
Imyo	0	5	+5
Lrep	0	10	+10
Mhor	86	70	-16
Pund	0	1	+1
Squi	10	4	-6
Rock/soil	0	10	+10

Compartment 6 rock 5a	Oct'86	Jan'92	Change since 1986
Dalb	0	4	+4
Dsco	8	10	+2
Pfor	14	14	0
Psch	1	0	-1
Rhet	4	4	0
Rlor	16	10	-6
Sgra	45	56	+12
Rock/soil	12	2	-10

Compartment 6 rock 5b	Oct'86	Jan'92	Change since 1986
Dsco	12	9	-3
Hcup	0	10	+10
Imyo	0	2	+2
Pfor	4	3	-1
Psax	0	10	+10
Rhet	1	0	-1
Rlor	2	2	0
Sgra	19	30	+11
Rock/soil	62	34	-28

Compartment 6 rock 5c	Oct'86	Jan'92	Change since 1986
Pfor	48	10	-38
Pund	4	10	+6
Rlor	48	60	+12
Sgra	0	20	+20

Compartment 7 rock 1a	Oct'86	Jan'92	Change since 1986
Dalb	18	0	-18
Hcup	3	2	-1
Hhet	8	14	-7
Imyo	18	8	-10
Mhor	42	49	+7
Pasp	0	2	+2
Pund	1	2	-1
Rlor	1	16	+15
Rock/soil	9	14	+5

Compartment 7 rock 1b	Oct'86	Jan'92	Change since 1986
Hcup	3	0	-3
Imyo	6	0	-6
Mhor	25	0	-25
Pasp	0	<1	+1
Pund	2	<1	-2
Rlor	60	96	+36
Ttam	4	3	-1

Compartment 7 rock 2	Oct'86	Jan'92	Change since 1986
Dalb	40	32	-8
Hcup	0	2	+2
Hhet	4	8	+4
Imyo	31	19	-12
Mhor	15	29	+14
Rock/soil	4	10	+6

Compartment 7 rock 3	Oct'86	Jan'92	Change since 1986
Dalb	63	60	-3
Hcup	1	0	-1
Hhet	0	4	+4
Iele	0	6	+6
Imyo	7	3	-4
Mhor	5	4	-1
Pfor	1	4	+3
Rpun	0	3	+3
Rock/soil	13	16	+3

Compartment 7 rock 4	Oct'86	Jan'92	Change since 1986
Dalb	14	8	-4
Dsco	2	7	+5
Imyo	54	50	-4
Mhor	13	18	+5
Sgra	2	1	-1
Rock/soil	15	16	+1

Compartment 7 rock 5a	Oct'86	Jan'92	Change since 1986
Dalb	2	0	-2
Iele	0	2	+2
Mhor	17	13	-4
Rlor	76	75	-1
Rock/soil	5	10	+5

Compartment 7 rock 5b	Oct'86	Jan'92	Change since 1986
Dalb	3	0	-3
Mhor	4	0	-4
Rlor	87	98	+11
Ttam	0	2	+2
Rock/soil	6	0	-6

Compartment 7 rock 5c	Oct'86	Jan'92	Change since 1986
Dalb	15	5	-10
Imyo	7	0	-7
Mhor	3	20	+17
Ppor	10	9	-1
Psuc	0	3	+3
Rlor	64	56	-8
Rock/soil	1	7	+6

APPENDIX 5

Tree quadrat data (1986 and 1992)

Compartment 2 tree 1c	Oct'86	Jan'92	Change since 1986
Imyo	30	96	+66
Ccon	2	0	-2
Bark	68	4	-64

Compartment 2 tree 1d	Oct'86	Jan'92	Change since 1986
Imyo	53	70	+17
Dsco	4	13	+9
Digitalis pur.	0	14	+14
Bark	43	3	-40

Compartment 3 tree 2	Oct'86	Jan'92	Change since 1986
Imyo	100	75	-25
Bark	0	25	+25

Compartment 3 tree 3	Oct'86	Jan'92	Change since 1986
Imyo	37	37	0
Hphy	52	43	-9
Psul	11	20	+9

Compartment 3 tree 5b	Oct'86	Jan'92	Change since 1986
Dsco	0	1	+1
Imyo	38	30	-8
Psul	0	1	+1
Hcup	35	63	+28
Bark	27	5	-22

Compartment 3 tree 6	Oct'86	Jan'92	Change since 1986
Dsco	44	53	-11
Hcup	17	1	-16
Mhor	6	21	+15
Imyo	0	4	+4
Ccon	0	5	+5
Bark	33	16	-17

Compartment 6 tree 1a	Oct'86	Jan'92	Change since 1986
Ftam	22	18	-4
Dsco	3	7	+4
Hcup	34	14	-20
Imyo	3	39	+36
Psul	0	11	+11
Ccon	0	1	+1
Bark	38	10	-28

Compartment 6 tree 1b	Oct'86	Jan'92	Change since 1986
Imyo	36	31	-5
Dsco	29	34	+5
Mhor	14	6	-8
Pund	2	5	+3
Dmaj	9	14	+5
Hspl	0	1	+1
Bark	10	9	-1

Compartment 6 tree 1c	Oct'86	Jan'92	Change since 1986
Ftam	4	4	0
Dsco	5	2	-3
Imyo	53	67	+14
Ochrolechia sp.?	0	10	+10
Bark	38	17	-21

Compartment 6 tree 2	Oct'86	Jan'92	Change since 1986
Hcup	22	0	-22
Pfor	21	6	-15
Dsco	9	14	+5
Ccon	0	25	+25
Rlor	0	23	+23
Hphy	0	15	+15
Festuca ov.	0	8	+8
Bark	48	9	-39

Compartment 6 tree 4	Oct'86	Jan'92	Change since 1986
Lbid	30	<1	-30
Mhor	13	8	-5
Imyo	21	74	+53
Hcup	36	3	-33
Bark	0	15	+15

Compartment 6 tree 5a	Oct'86	Jan'92	Change since 1986
Pfor	53	13	-40
Imyo	45	54	+9
Dsco	2	0	-2
Dmaj	0	3	+3
Ttam	0	30	+30

Compartment 6 tree 5b	Oct'86	Jan'92	Change since 1986
Pfor	26	11	-15
Imyo	74	85	+11
Ttam	0	4	+4

Compartment 6 tree 6	Oct'86	Jan'92	Change since 1986
Imyo	34	7	-27
Hcup	46	83	+37
Bark	2	10	+8

Compartment 7 tree 2	Oct'86	Jan'92	Change since 1986
Mhor	18	10	-8
Imyo	82	90	+8

Compartment 7 tree 3	Oct'86	Jan'92	Change since 1986
Imyo	70	81	+11
Bark	30	19	-11

Compartment 7 tree 4	Oct'86	Jan'92	Change since 1986
Ftam	10	9	-1
Imyo	72	89	+17
Bark	18	2	-16

Compartment 7 tree 5a	Oct'86	Jan'92	Change since 1986
Imyo	80	76	-4
Peltigera sp.	0	20	+20
Bark	20	4	-16

Compartment 7 tree 6	Oct'86	Jan'92	Change since 1986
Dsco	5	2	-3
Imyo	30	33	+3
Ftam	5	2	-3
Ccon	0	1	+1
Bark	60	62	+2

Compartment 7 tree 7	Oct'86	Jan'92	Change since 1986
Ftam	30	23	-7
Imyo	50	63	+13
Bark	20	14	-6

Compartment 7 tree 9b	Oct'86	Jan'92	Change since 1986
Mhor	5	11	+6
Hcup	69	14	-55
Ftam	3	0	-3
Dsco	0	1	+1
Imyo	0	74	+74
Bark	23	0	-23

Compartment 7 tree 10	Oct'86	Jan'92	Change since 1986
Dmaj	1	0	-1
Mhor	21	10	-11
Dsco	22	10	-12
Imyo	41	62	+21
Bark	15	18	+3

Compartment 7 tree 12	Oct'86	Jan'92	Change since 1986
Ftam	27	30	+3
Ffra	5	0	-5
Imyo	22	22	0
Psax	0	2	+2
Bark	46	46	0

Compartment 8 tree 2	Oct'86	Jan'92	Change since 1986
Dsco	3	10	+7
Mhor	8	4	-4
Rlor	1	5	+4
Imyo	88	81	-7

Compartment 8 tree 4a	Oct'86	Jan'92	Change since 1986
Dsco	4	6	+2
Ttam	9	7	-2
Mhor	48	48	0
Imyo	39	37	-2
Oxalis acetosella	0	2	+2

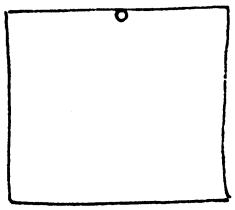
Compartment 8 tree 4c	Oct'86	Jan'92	Change since 1986
Ftam	16	15	-1
Imyo	84	85	+1

Appendices 6 and 7

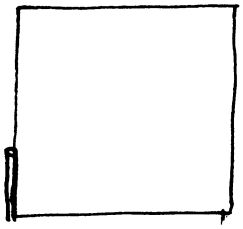
Rock and tree quadrats

The wooden posts used to mark the ground quadrats came in bundles, held together by square metal strips, each measuring 21 x 21 cm. These were found to make ideal quadrats for use on rocks and trees, so the quadrat size here is 21x21 cm.

Tree quadrats, first recorded on 20-21 October 1986, are each marked with a wooden peg (much smaller than those used for ground quadrats) in the middle of the top edge of the quadrat. The metal frame can be hung from this wooden peg.



Rock quadrats, first recorded on 22 October 1986, are each marked with a small wooden peg in the ground, at the bottom-left corner of the quadrat.

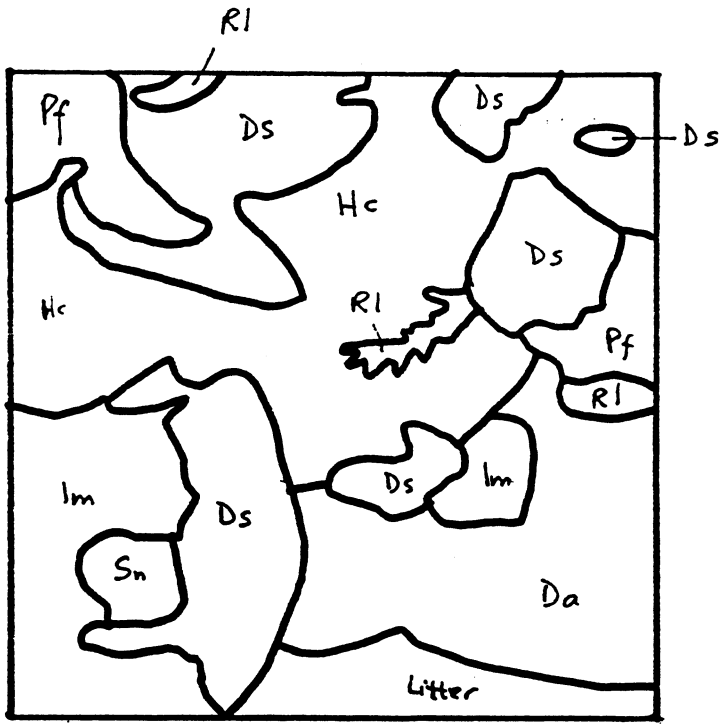


In rock and tree quadrats the extent of each species was drawn, as accurately as possible, so making a kind of 'map' of the plants in the quadrat.

Abbreviations of species names are given in Appendix 2.

APPENDIX 6

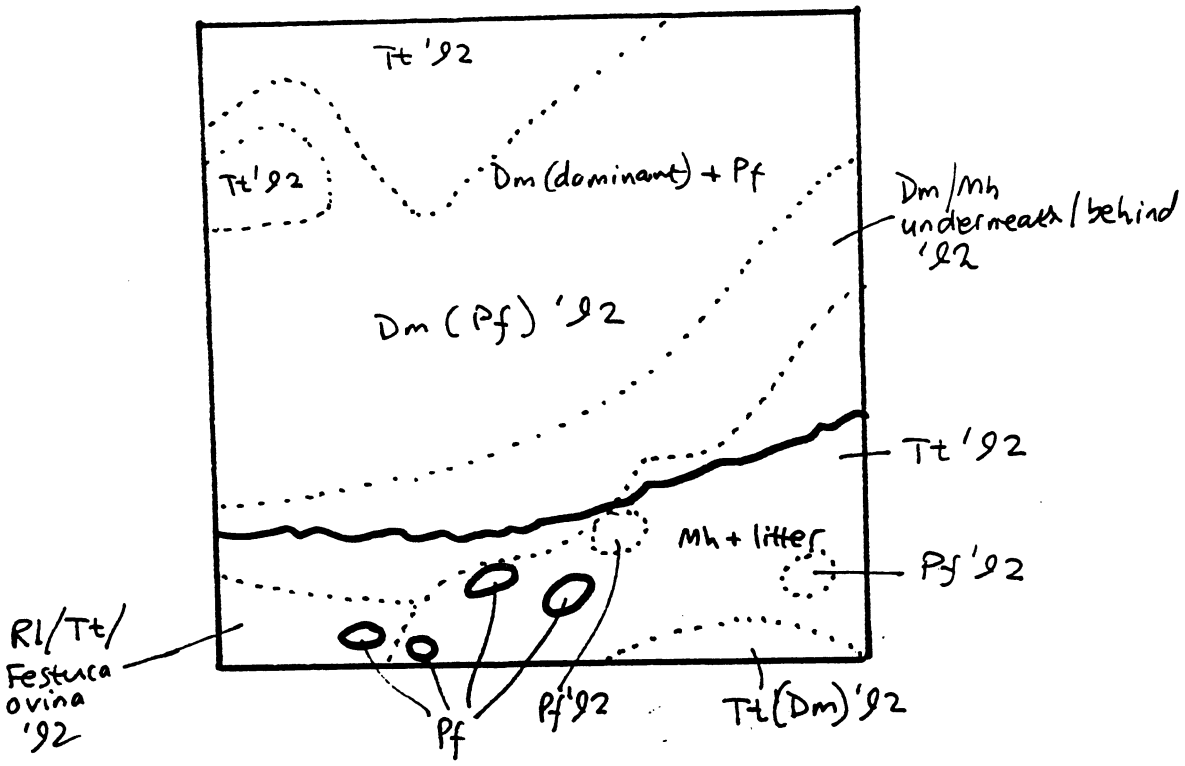
Rock quadrat drawings (1986 and 1992)



Plot 6, rock 1, quadrat a.

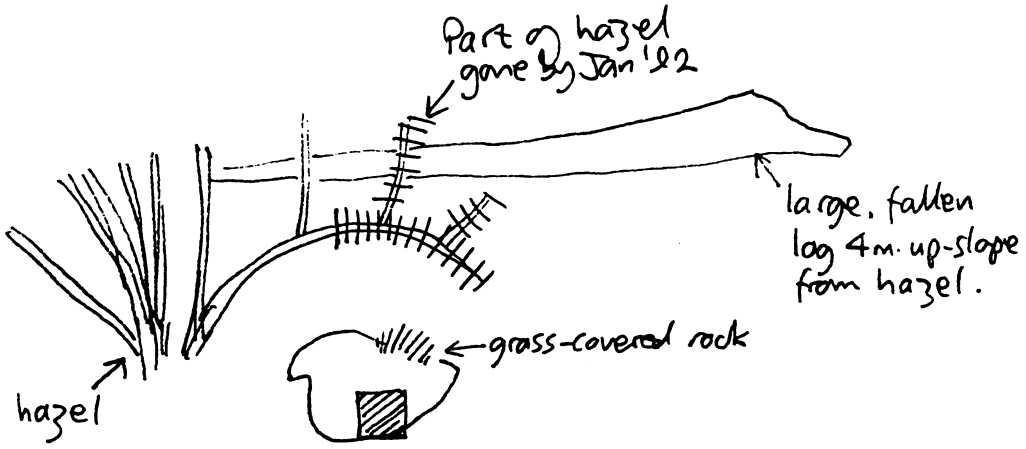
Under hawthorn 6m. up-slope from 9th post E. along N. fence.

Jan '12 - couldn't refind quadrat exactly, but <u>Diplophyllum albicans</u> appears to have gone; probably overgrown by larger species.

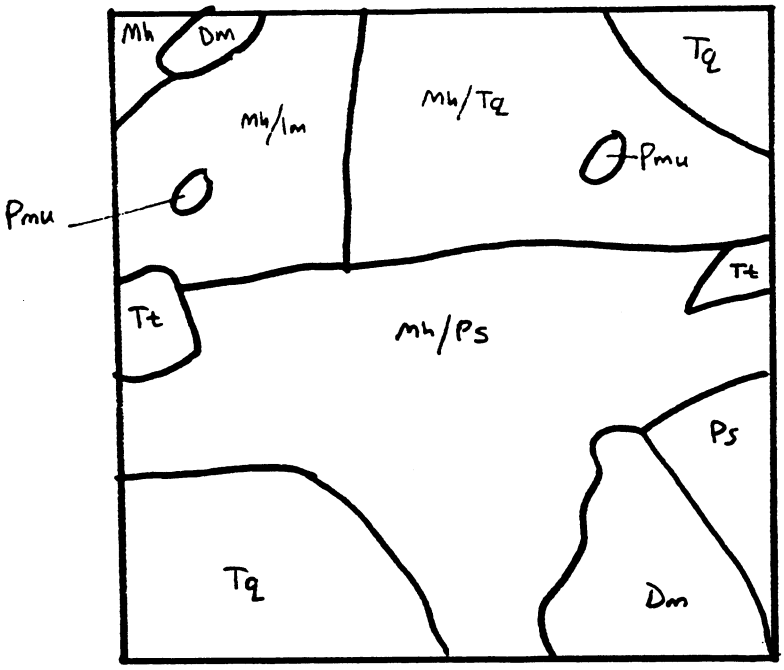


Plot 6, rock 2.

8m. up-slope (+ slightly E.) from rock 1.

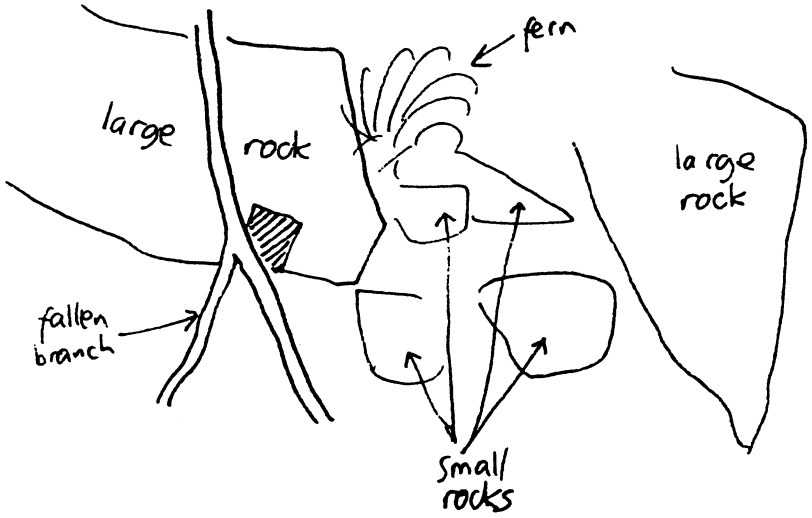


View from N.

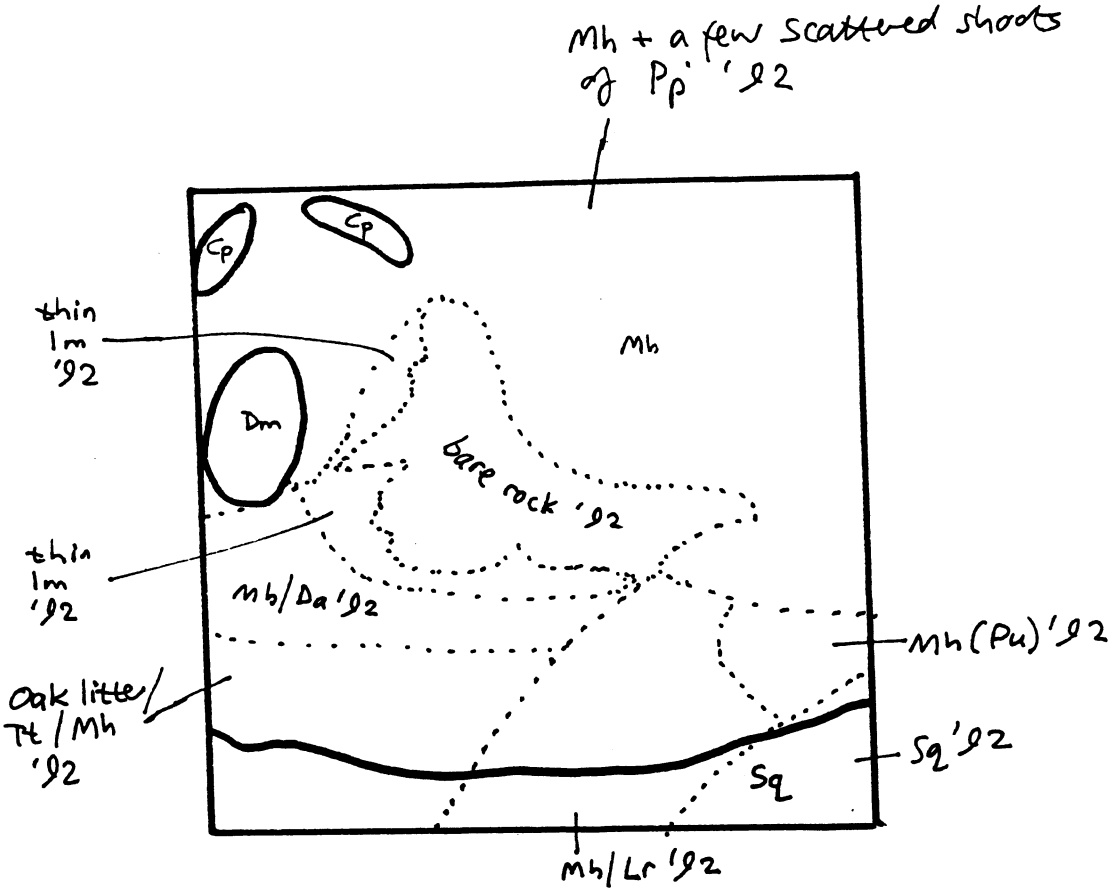


Plot 6, rock 3.

6m. in from 23rd post up W. fence.



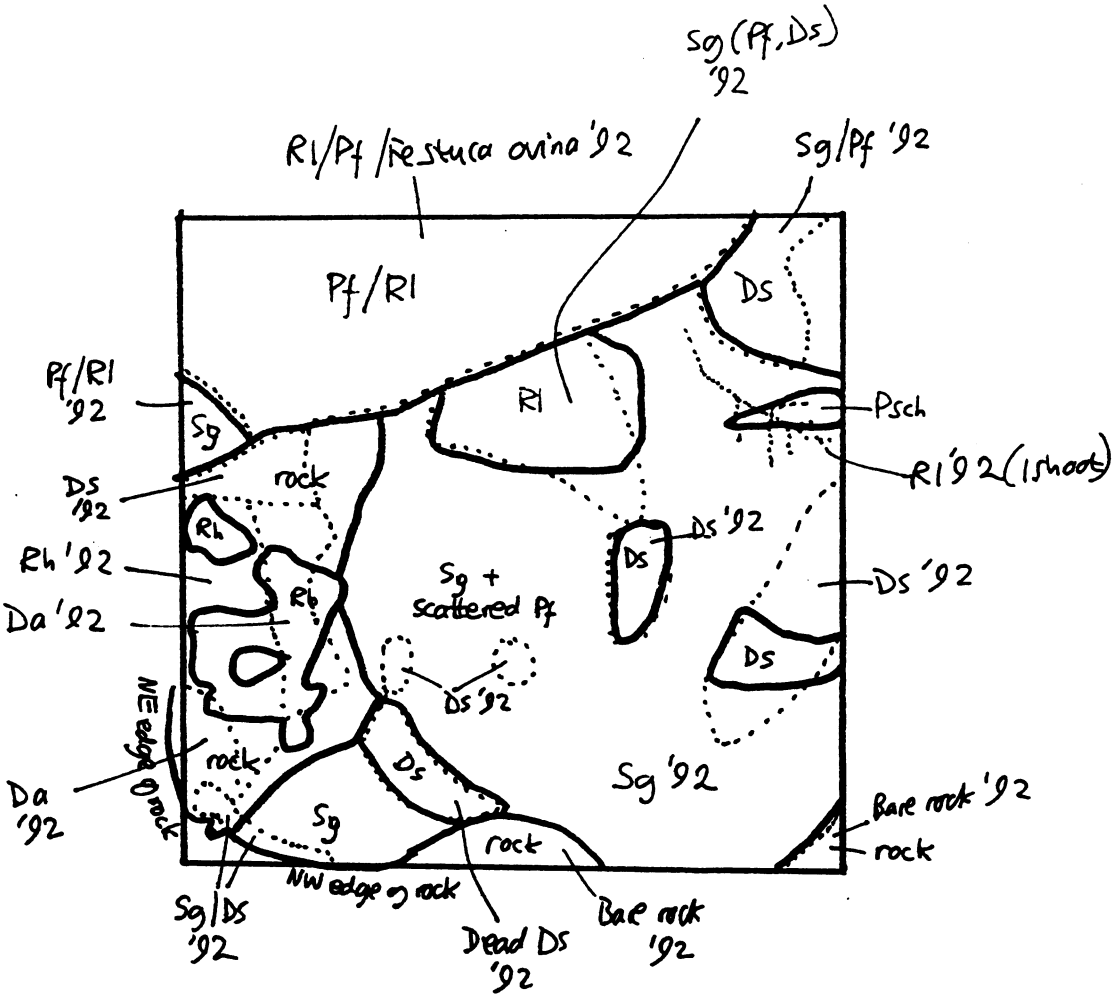
Jan '92 - Quadrat not refound exactly, because base of rock has become partly smothered by a (another) fallen branch, and litter.



Plot 6, rock 4.

7m. further in (E) from rock 3.

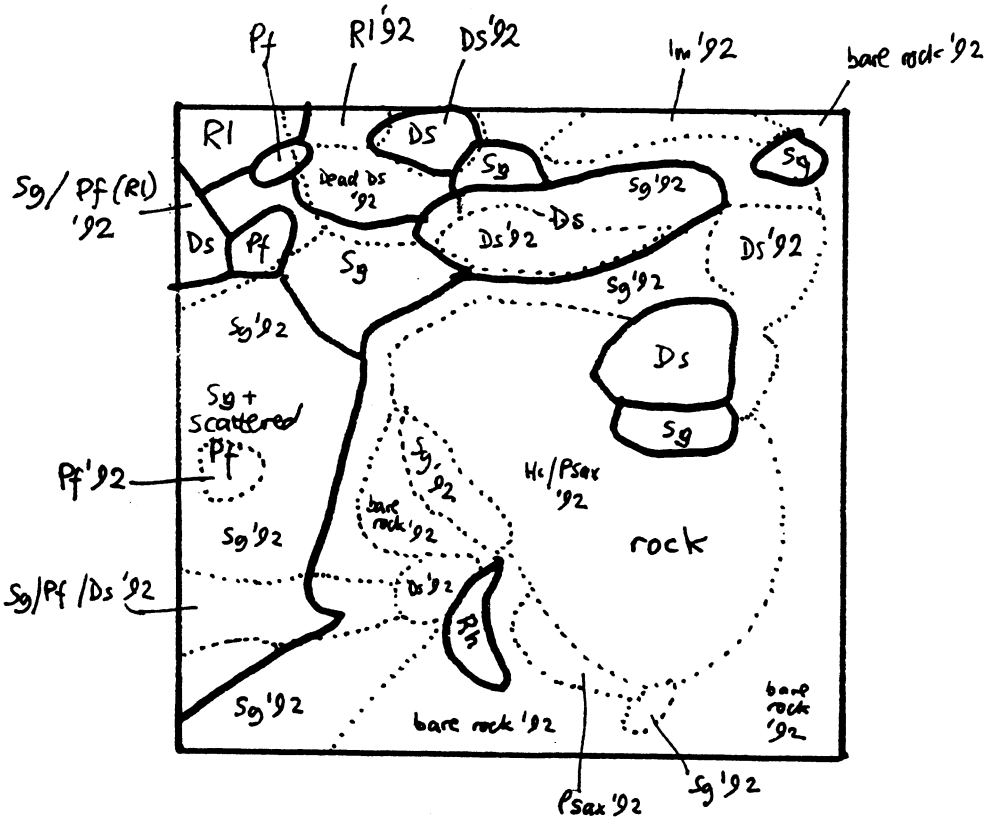
5m. SW. of a large oak tree.



Plot 6, rock 5, quadrat a.

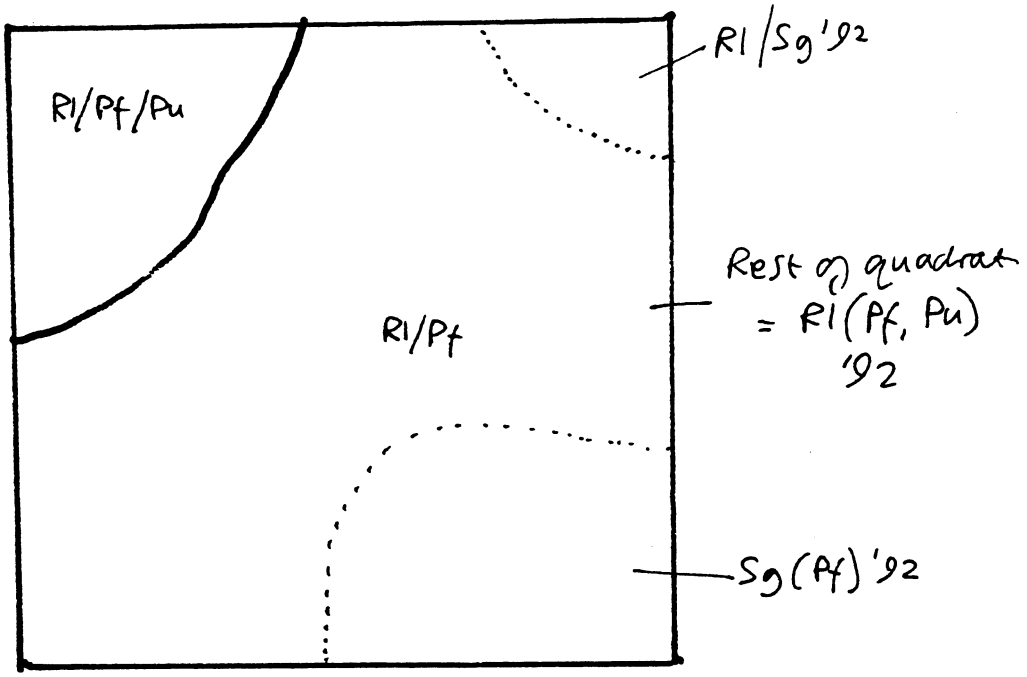
5m. SE of large oak NE of rock 4.
10m. up-slope from 5m x 45cm Standing, dead birch trunk.

fallen by Jan '92



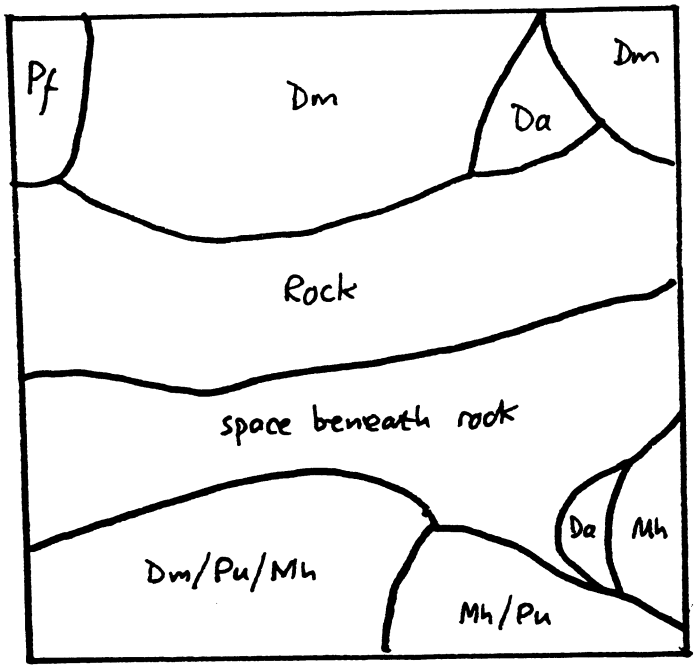
Plot 6, rock 5, quadrat b.

Quadrat b = immediately right of quadrat a.



Plot 6, rock 5, quadrat c.

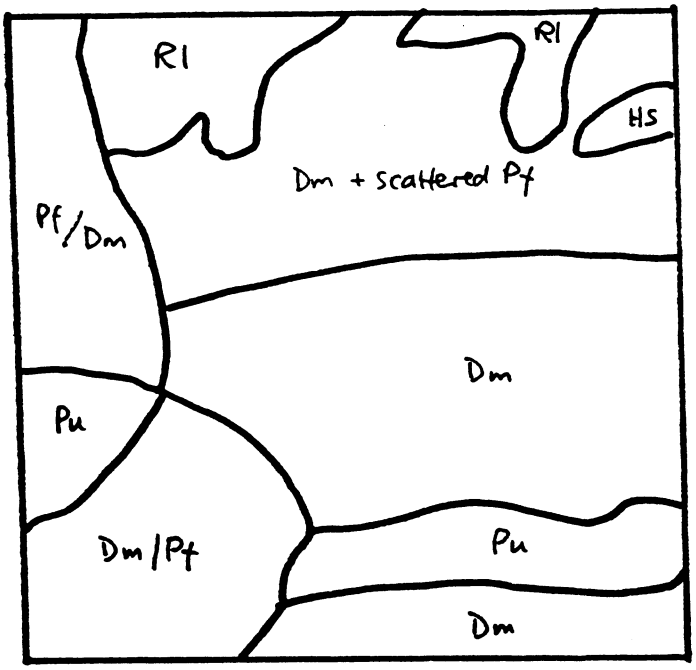
Quadrat c = immediately above quadrat a.



Plot 6, rock 7, quadrat a.

7m. in from 16th post up W. fence.

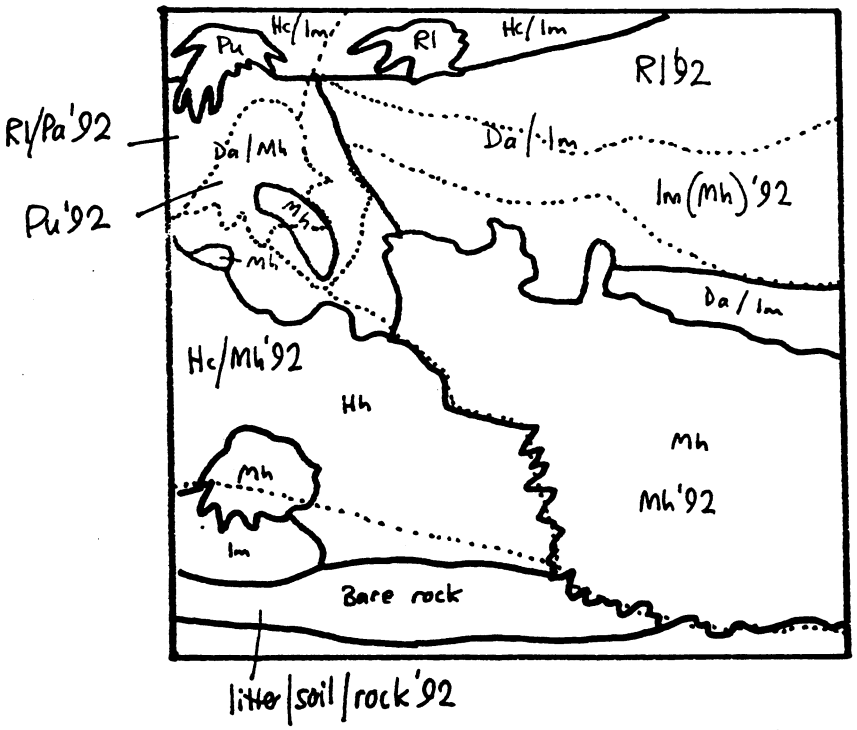
Jan '92 - couldn't refind quadrat



Plot 6, rock 7, quadrat b.

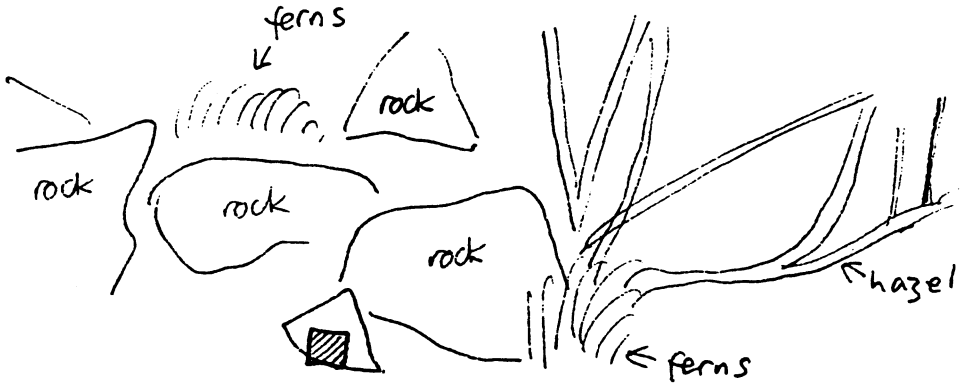
Quadrat b = immediately above quadrat a.

Jan '92 - couldn't refind quadrat

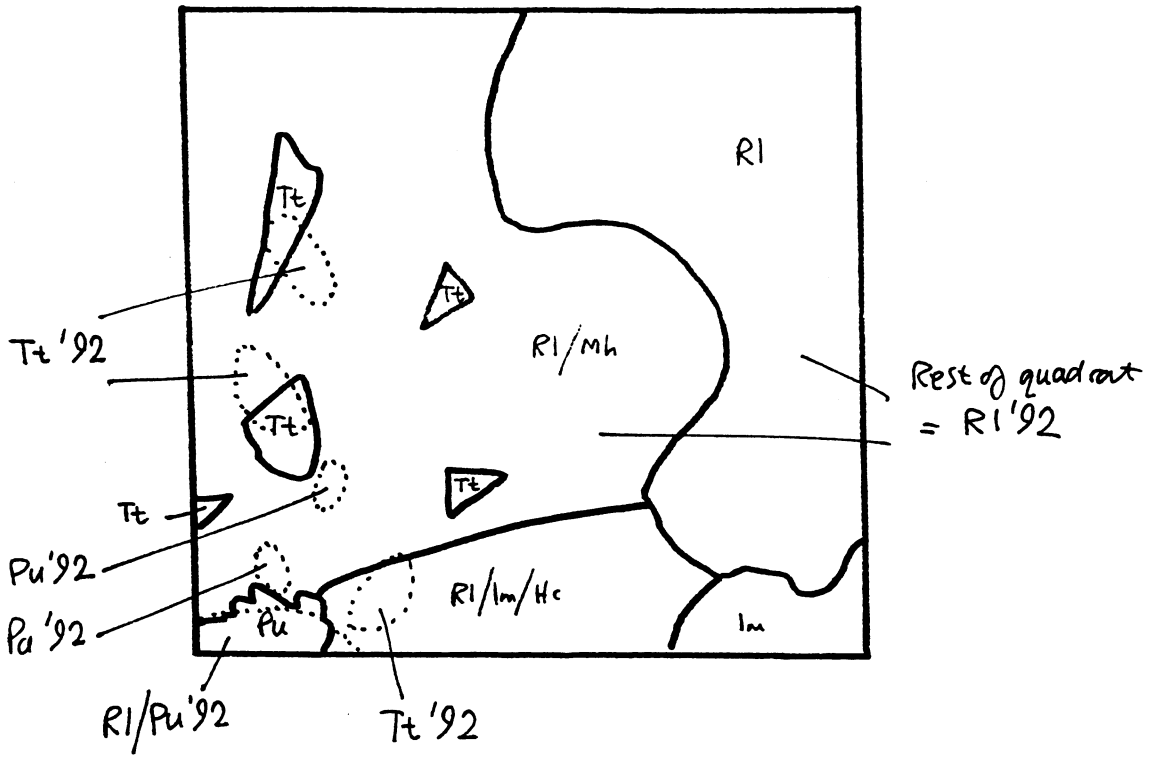


Plot 7, rock 1, quadrat a.

On E. side of small rock 15m. in from 9th post up E. fence.

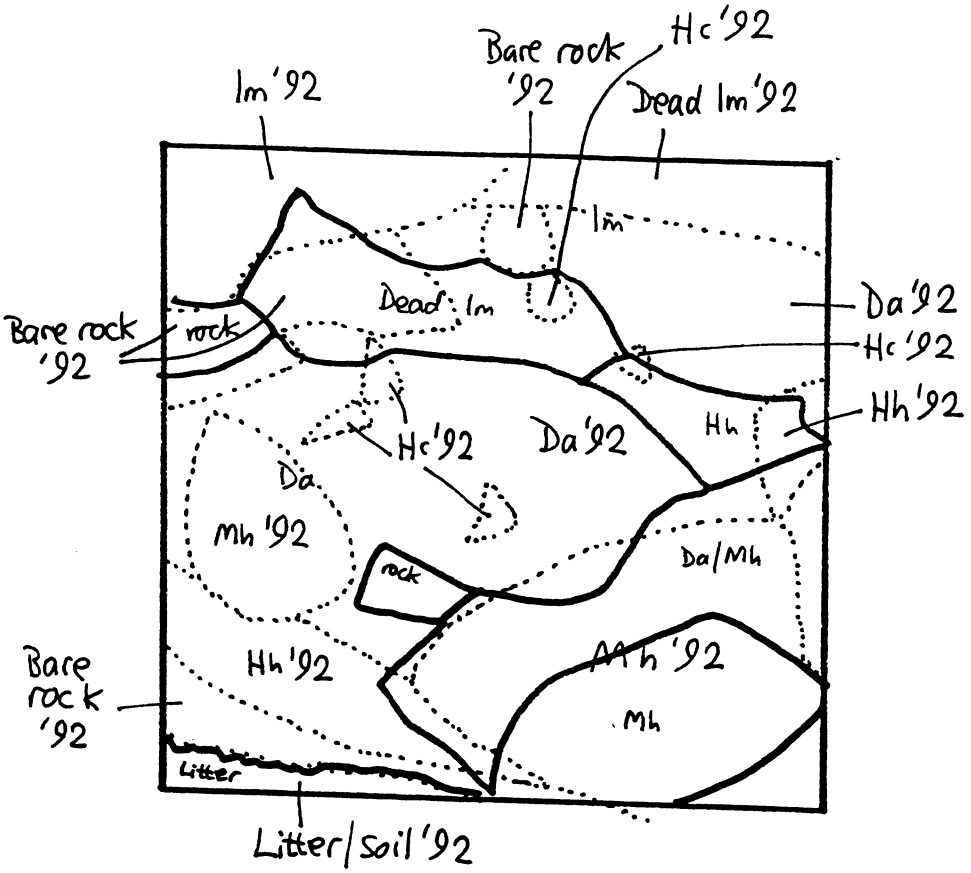


Location of quadrat, seen from E.



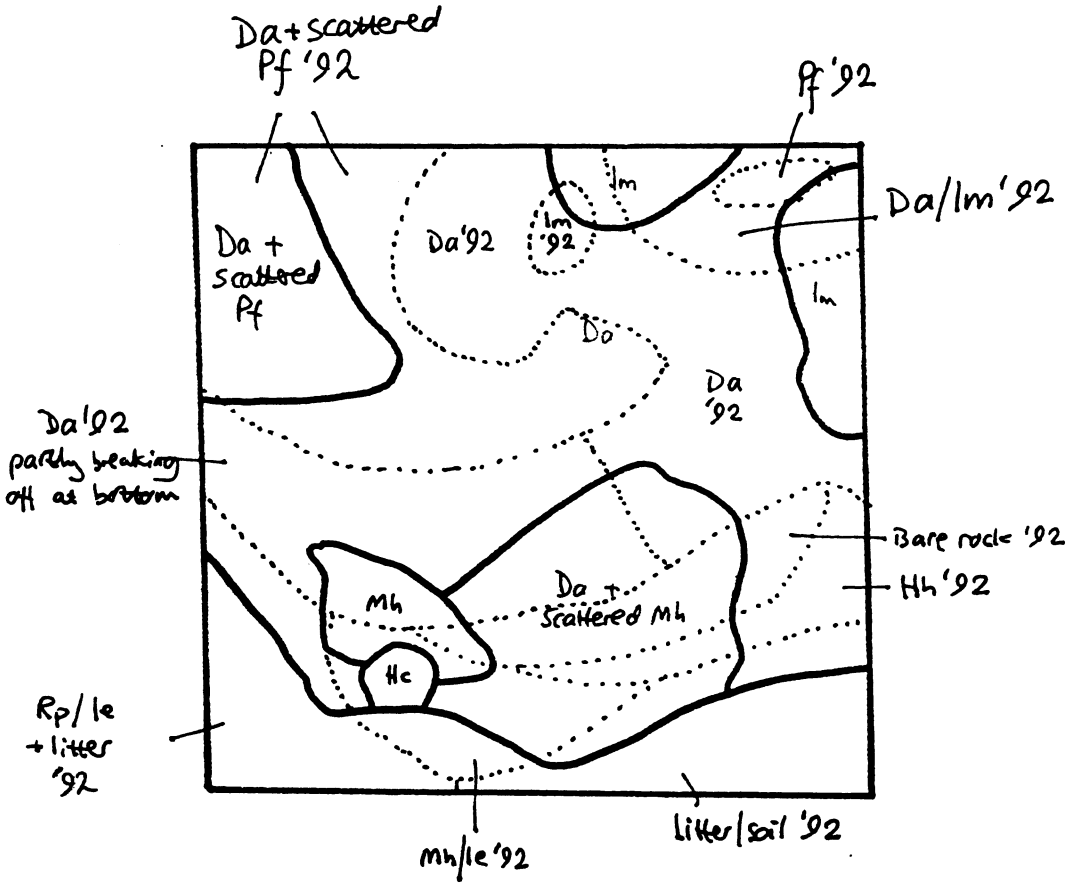
Plot 7, rock 1, quadrat b.

On top of rock, immediately above quadrat a.



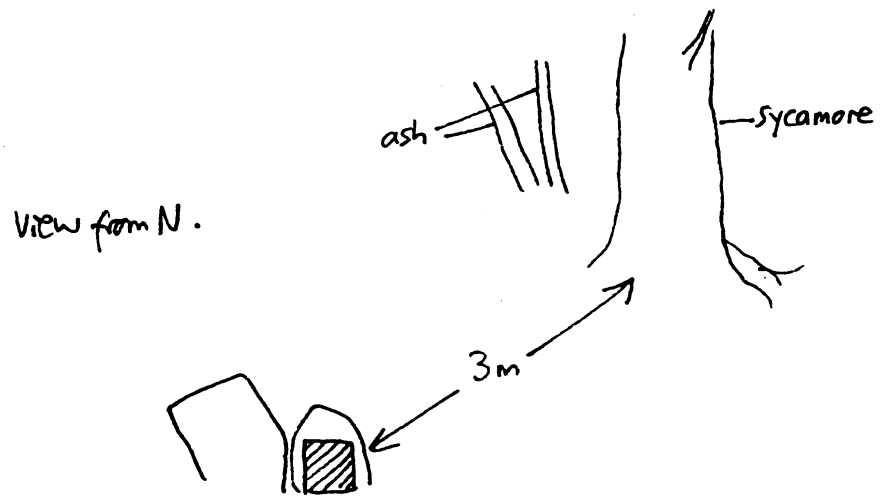
Plot 7, rock 2.

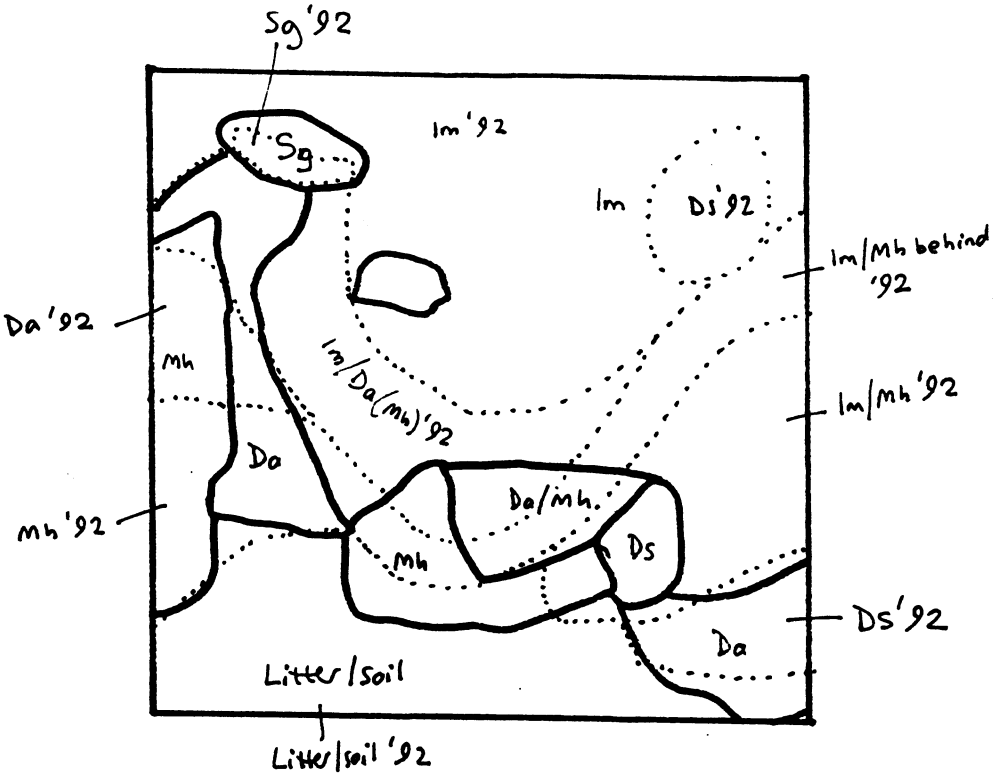
5m. up from 10th post W. along N. fence.



Plot 7, rock 3

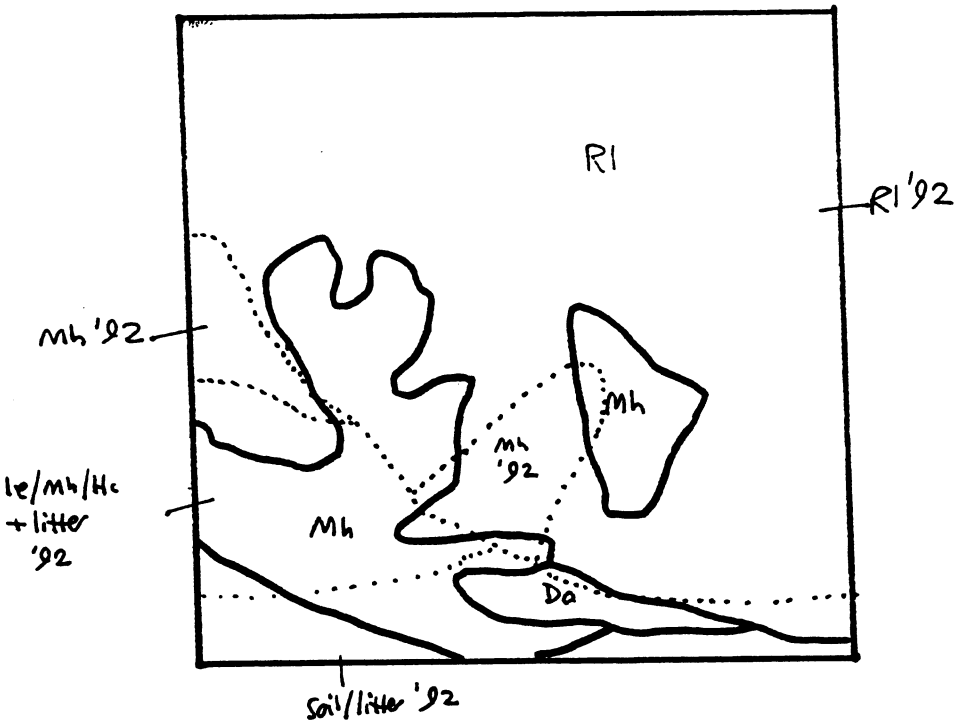
10m. up-slope from 12th post E. along N. fence.





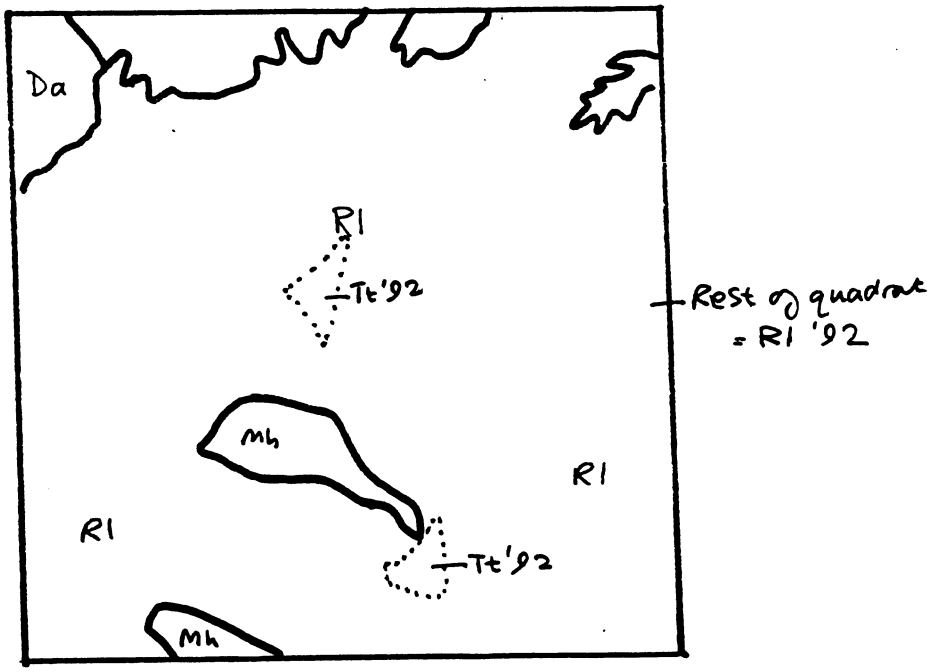
Plot 7, rock 4.

Rock 4 = 35cm. E. of rock 3.



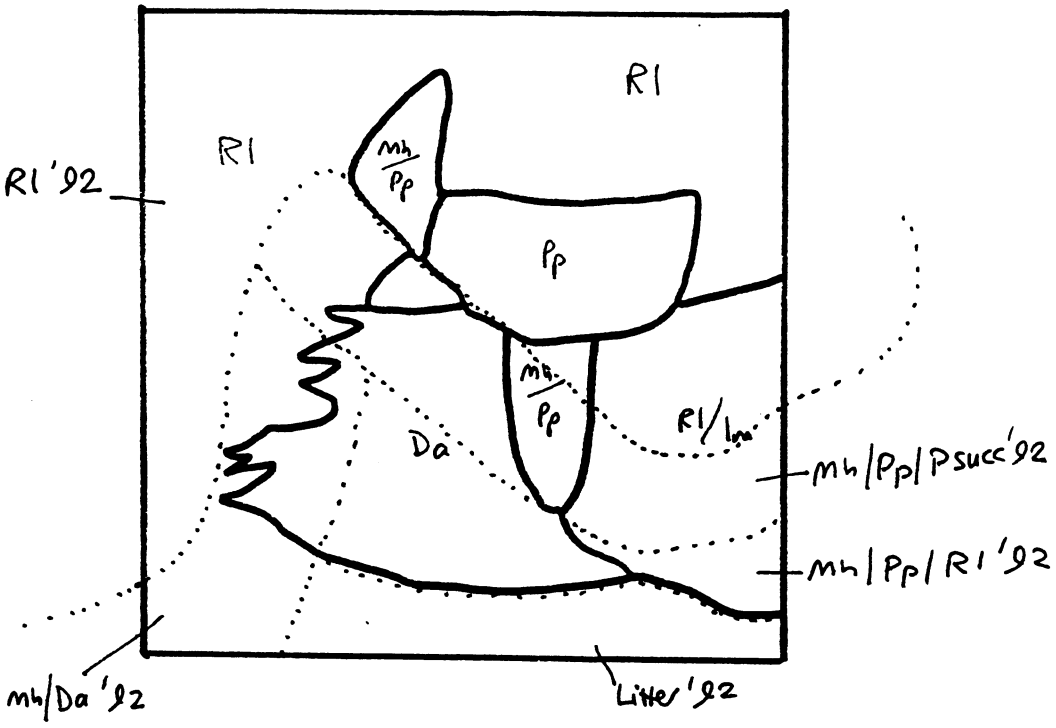
Plot 7, rock 5, quadrat a.

2m. E. of sycamore near rocks 3 & 4
(see drawing for rock 3).



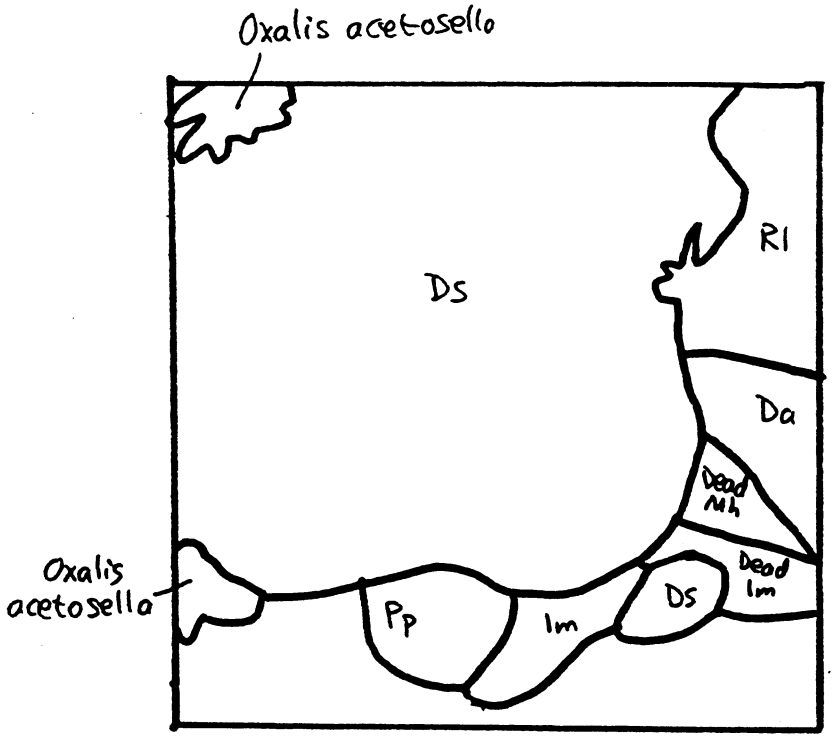
Plot 7, rock 5, quadrat b.

Quadrat b = immediately above quadrat a.



Plot 7, rock 5, quadrat c.

Quadrat C= immediately right of quadrat a.



Plot 7, rock 6, quadrat a.

Rock 6 = 1m. above rock 5. 2m. W + slightly up-slope from large sycamore.

Jan '92 - couldn't refind peg, so couldn't relocate quadrat.

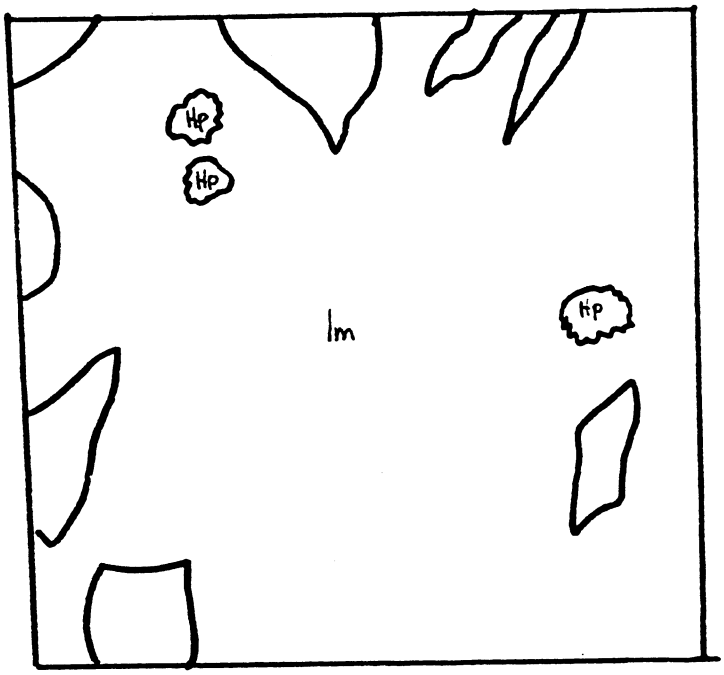
Plot 7, rock 6, quadrat b.

Quadrat b = immediately above quadrat a.

Jan.'12 - could not re-find quadrat.

APPENDIX 7

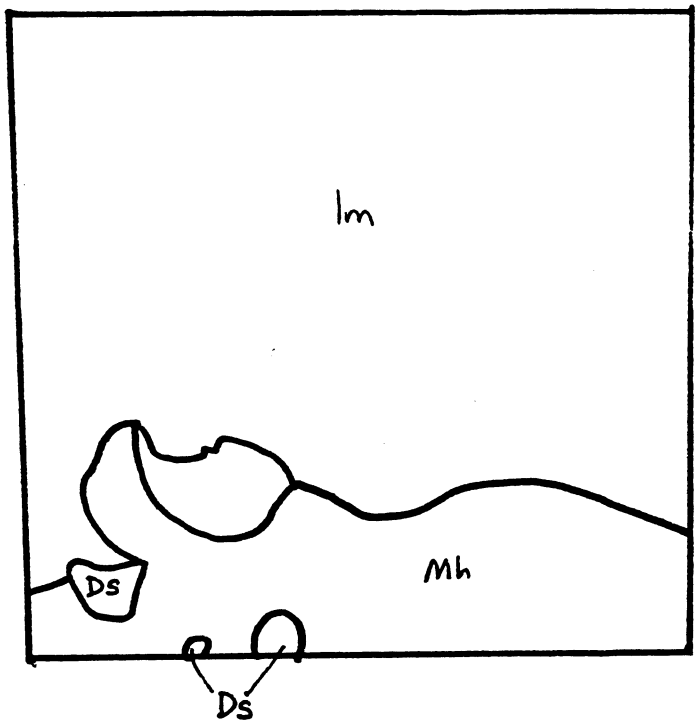
Tree quadrat drawings (1986 and 1992)



Plot 2, tree 1, quadrat a.

40cm. up up-slope side of large oak, 5m. up from bottom wall c. 1/2-way between plots 1 and 3.

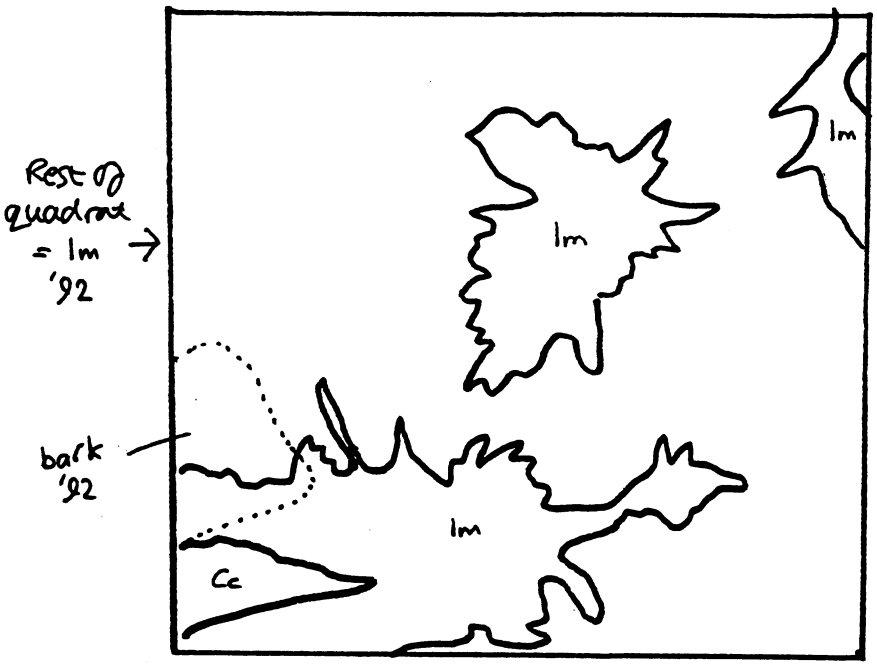
Jan '92 - Quadrat not refound. (peg gone).



Plot 2, tree 1, quadrat b.

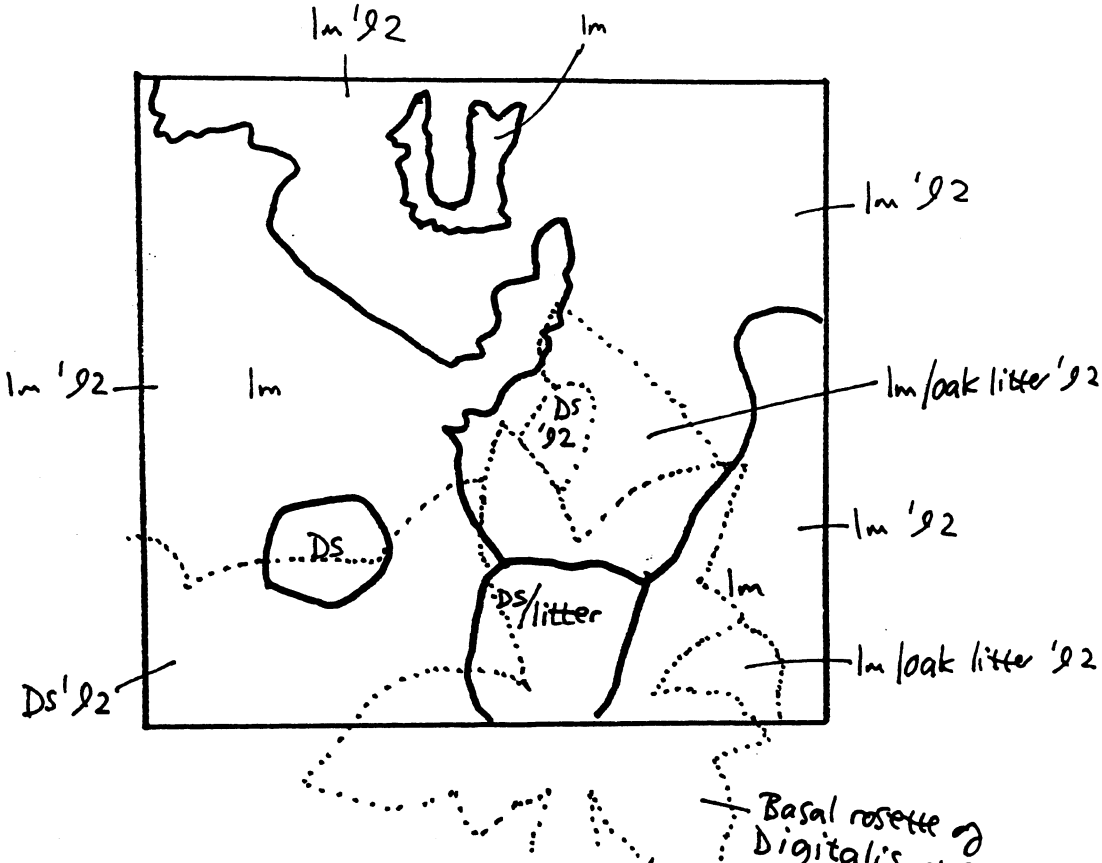
20 cm. up N. side of tree.

Jan '12. Quadrat not refound (peg gone)



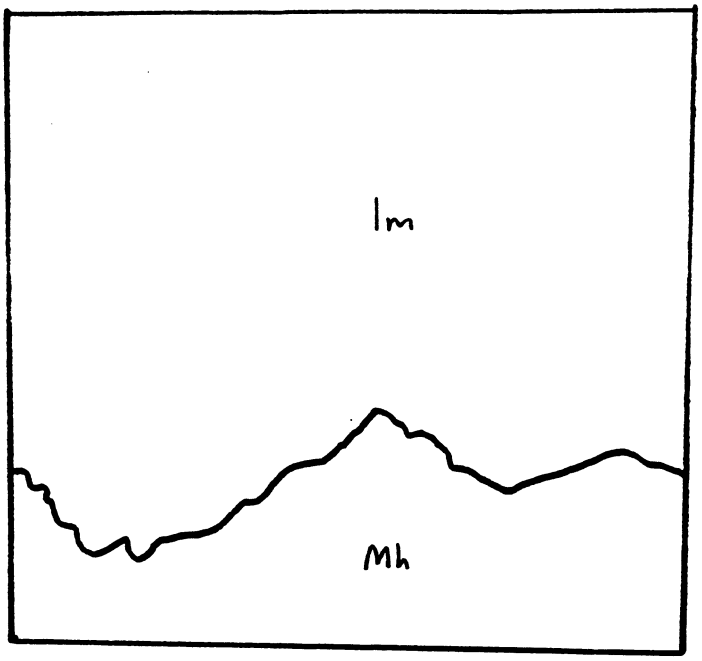
Plot 2, tree 1, quadrat c.

45 cm. up S. side of tree (opposite quadrat b).



Plot 2, tree 1, quadrat d.

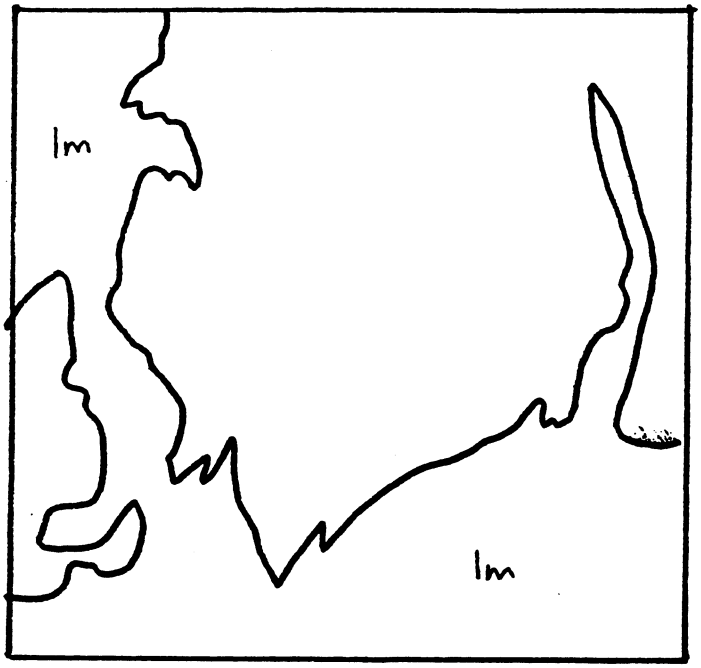
Immediately below quadrat c,
25cm. up trunk.



Plot 2, tree 2, quadrat a.

20cm. up SW side of oak, 30cm. up from bottom wall c.30 cm. SE of tree 1.

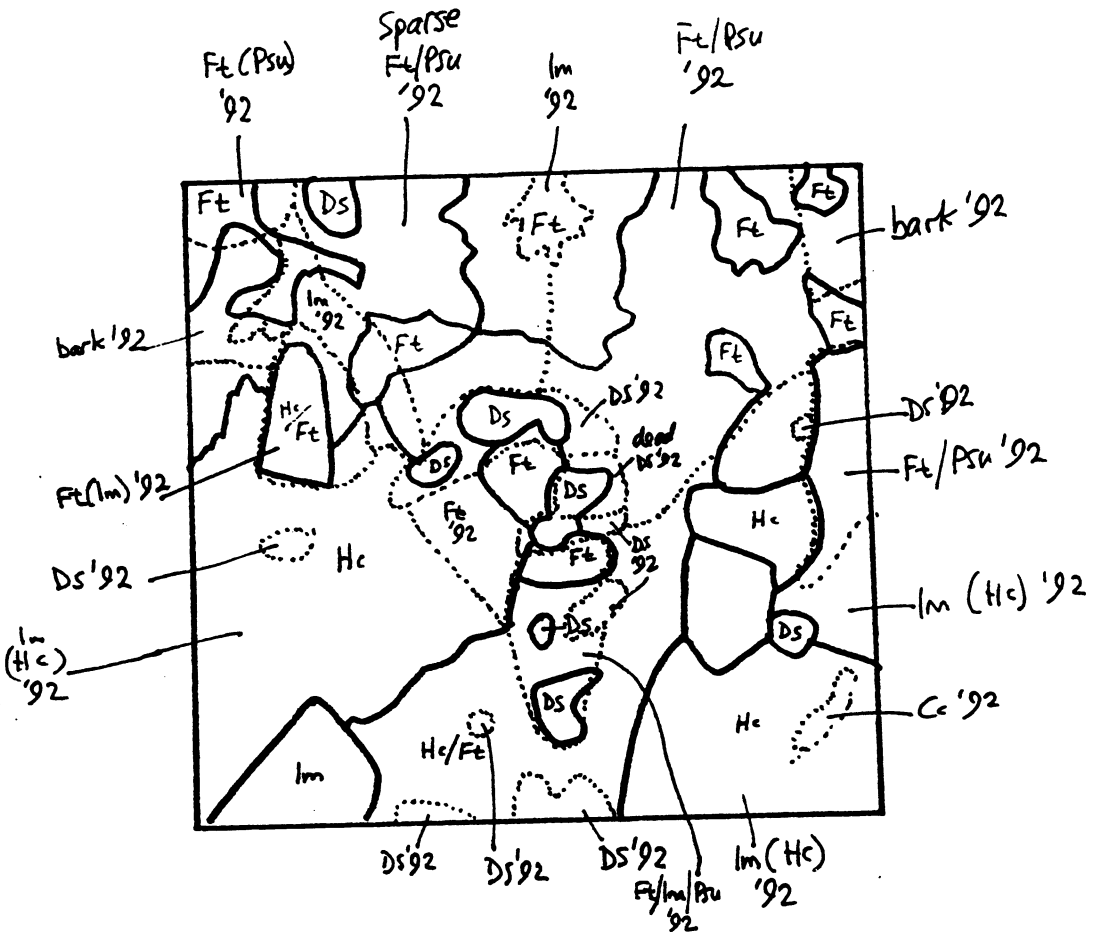
Jan '12 - Quadrat not refound (peg gone)



Plot 2, tree 2, quadrat b.

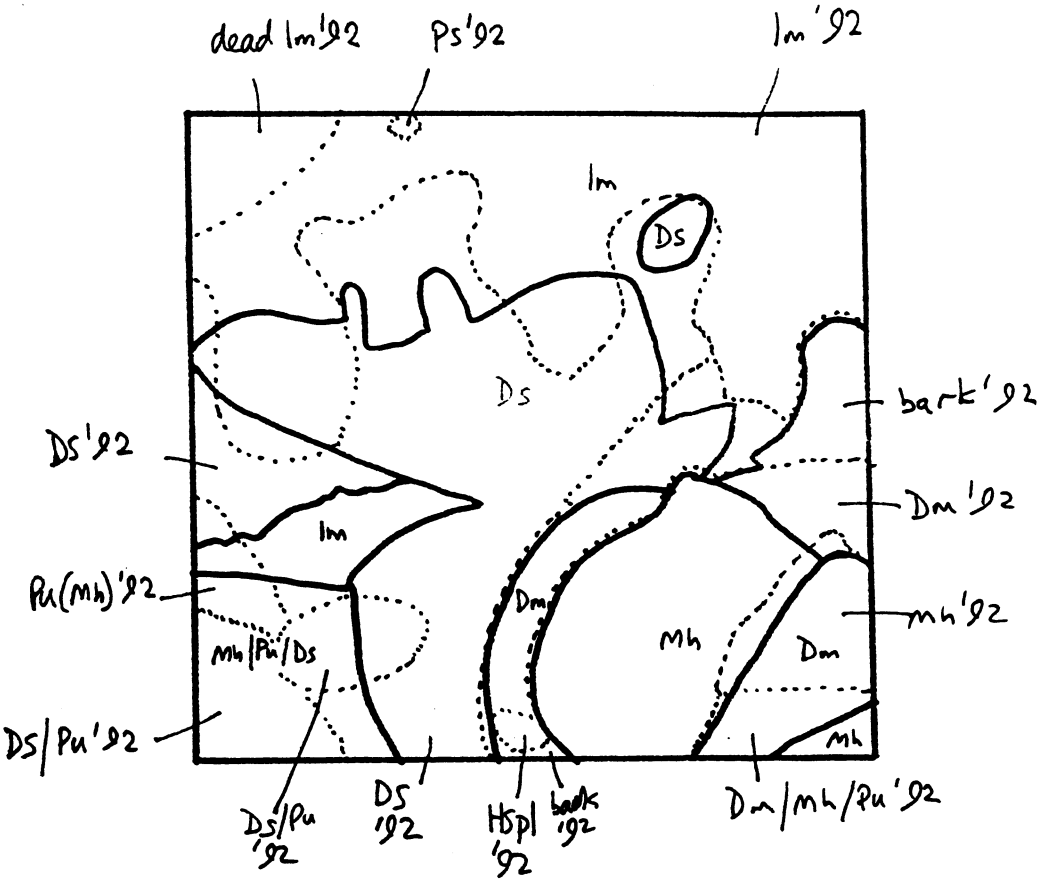
30cm. above quadrat a.

Jan '12 - Quadrat not refound (peg gone)



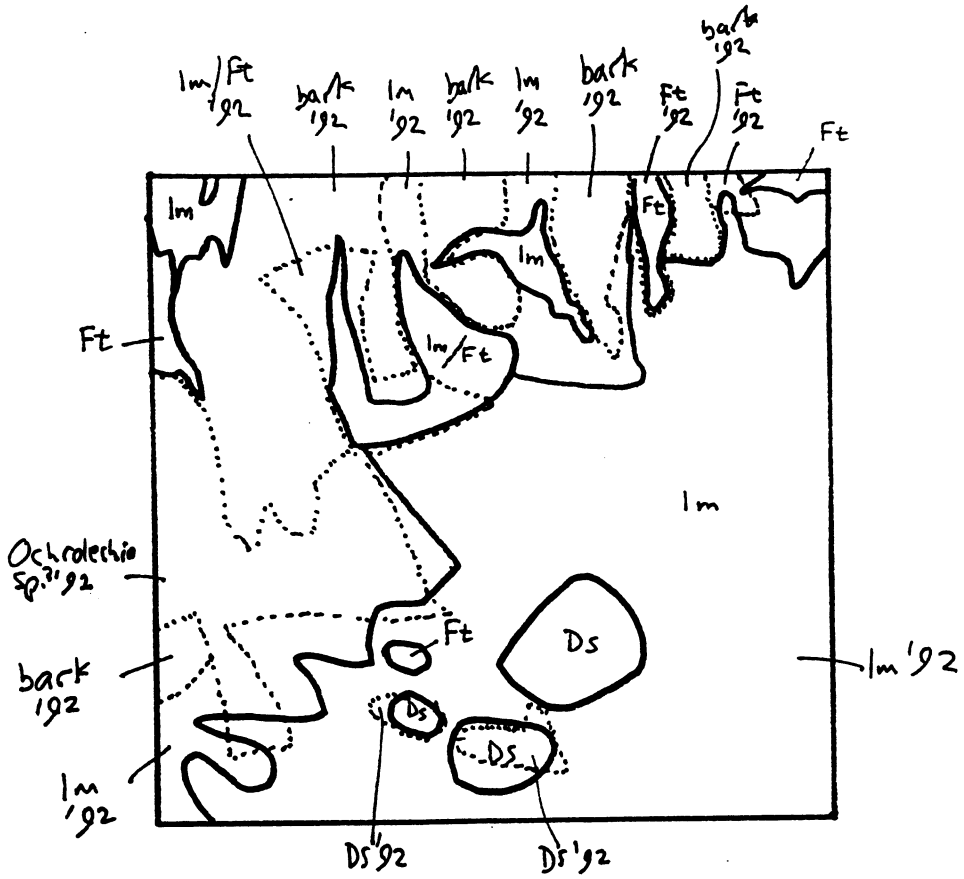
Plot 6, tree 1, quadrat a.

30cm. up S. side of oak, 30m. above road, midway between two lay-bys.



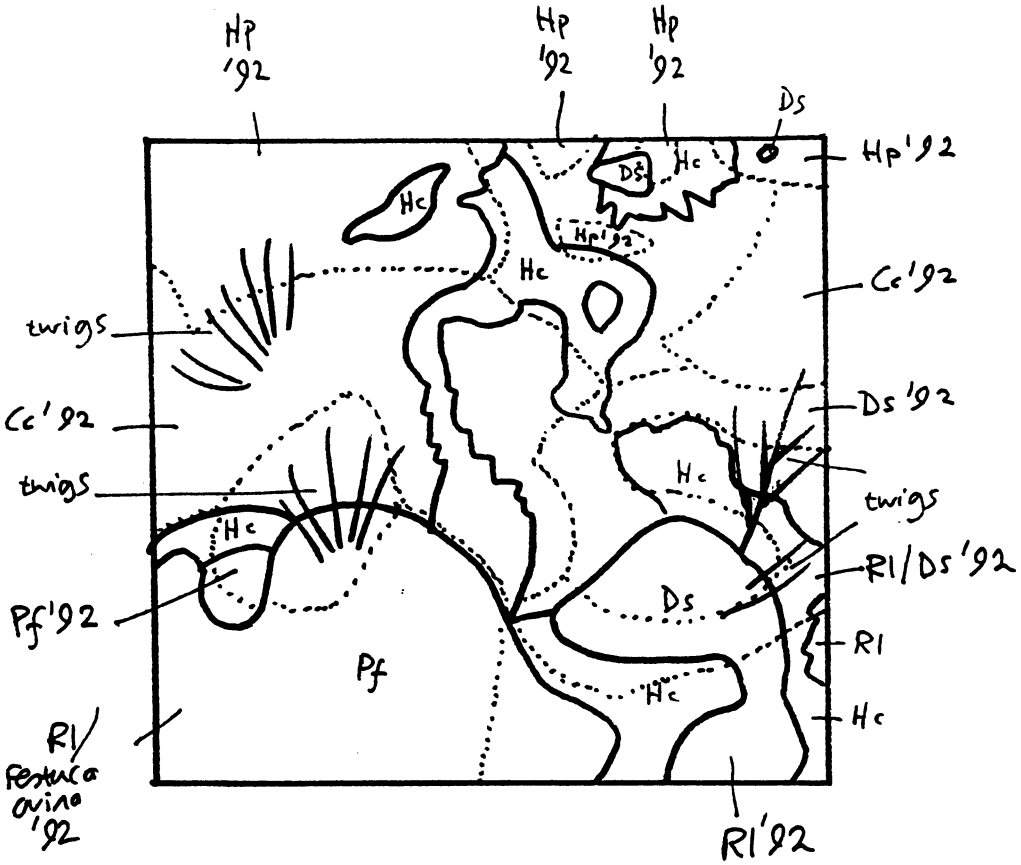
Plot 6, tree 1, quadrat b.

20cm. up E. side of trunk.



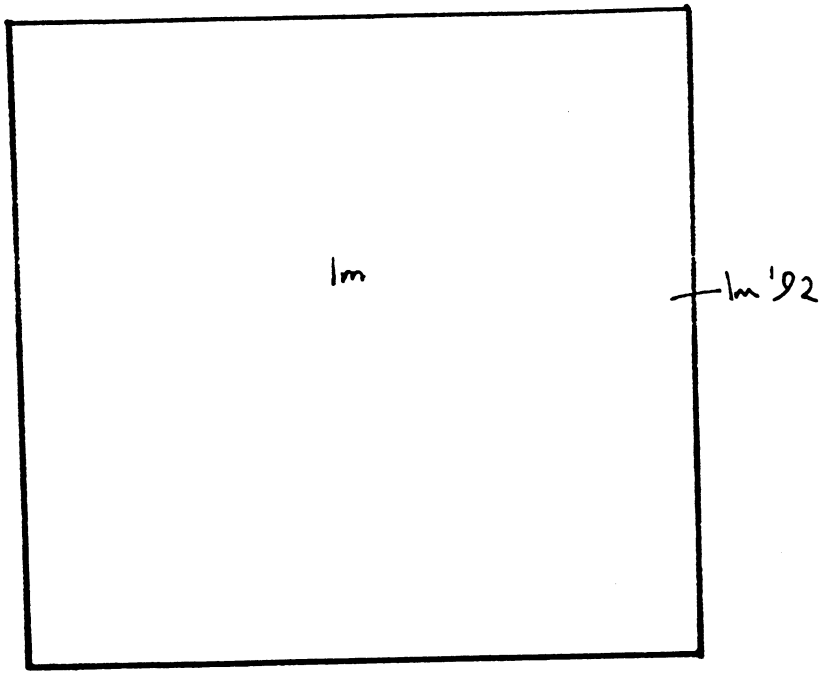
Plot 6, tree1, quadrat c.

40cm. up W. side of trunk.



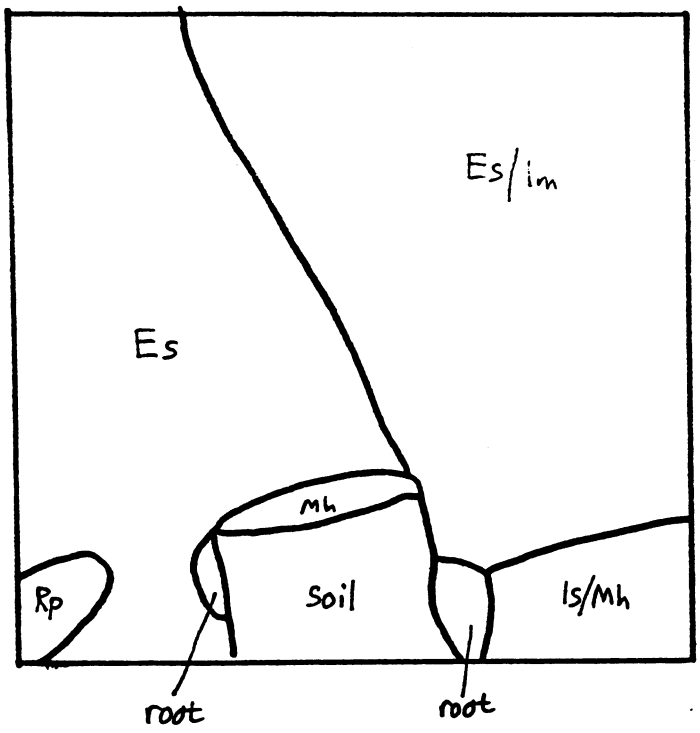
Plot 6, tree 2.

20cm. up S. side of birch, 15m. up-slope from tree 1.



Plot 6, tree 3, quadrat a.

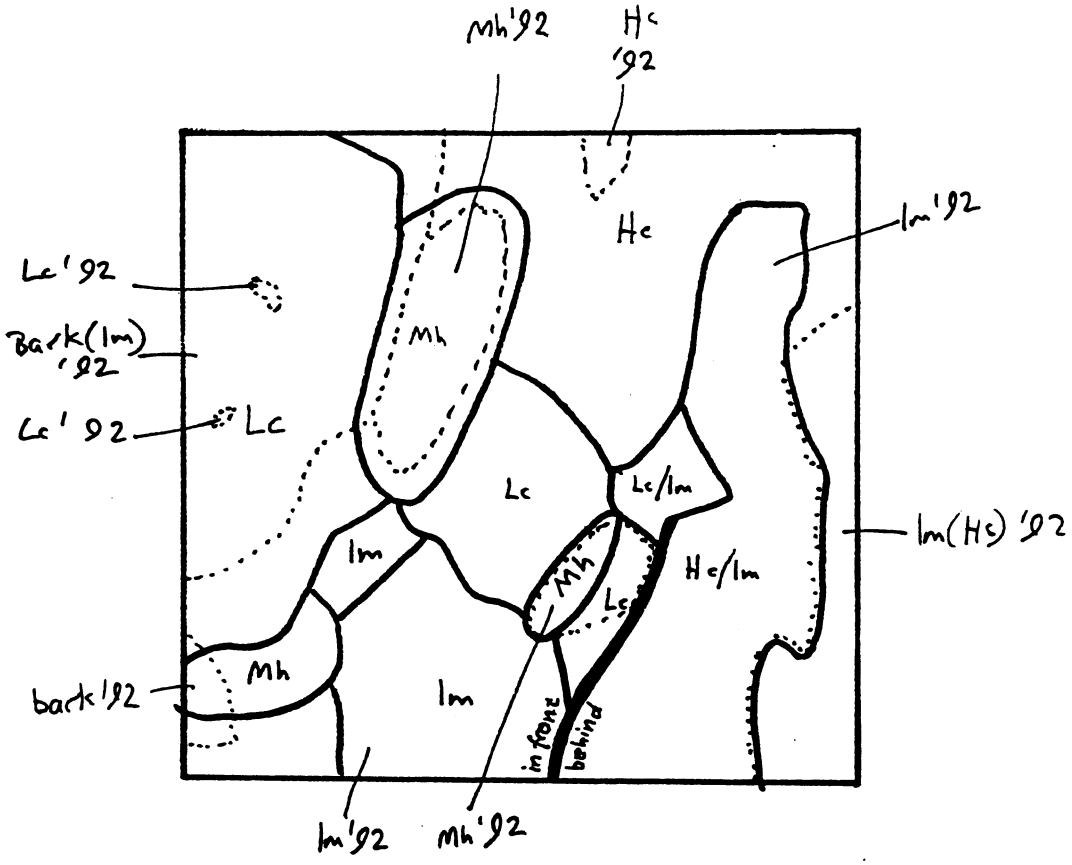
25cm. up SW side of ash, 4m. in from 9th post up E. fence.



Plot 6, tree 3, quadrat b.

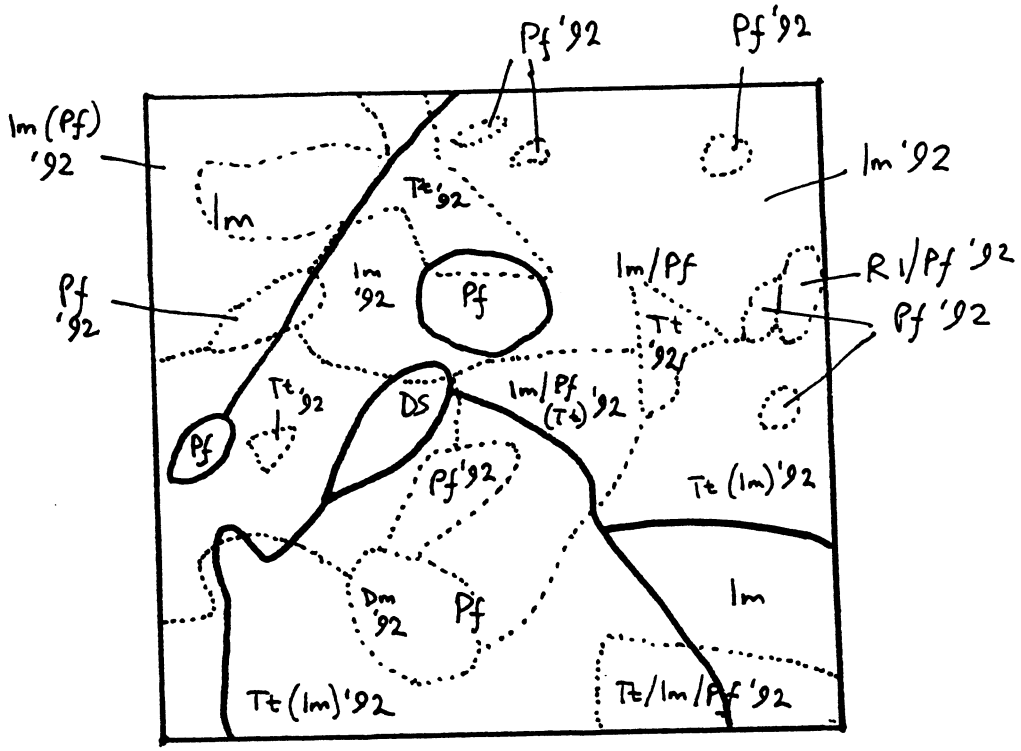
20cm. up N. side of trunk.

Jan'92 - couldn't refind quadrat (peg gone).



Plot 6, tree 4.

40cm. up S. side of birch, 6m. further into plot from tree 3.

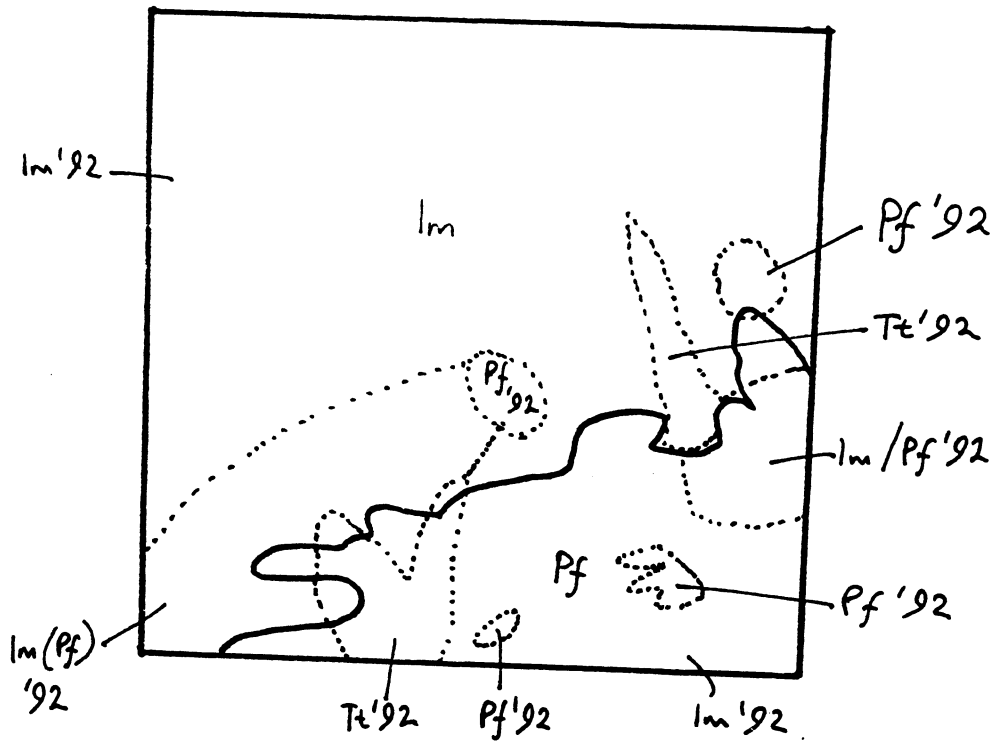


Plot 6, tree 5, quadrat a.

30cm. up W. side of ash, 25m. in from 14th post up E. fence.

Trunk of this ash tree is at a distinct angle.

Jan '92 – tree has fallen over. Quadrats are now on level surface of trunk, facing upwards.



Plot 6, tree 5, quadrat b.

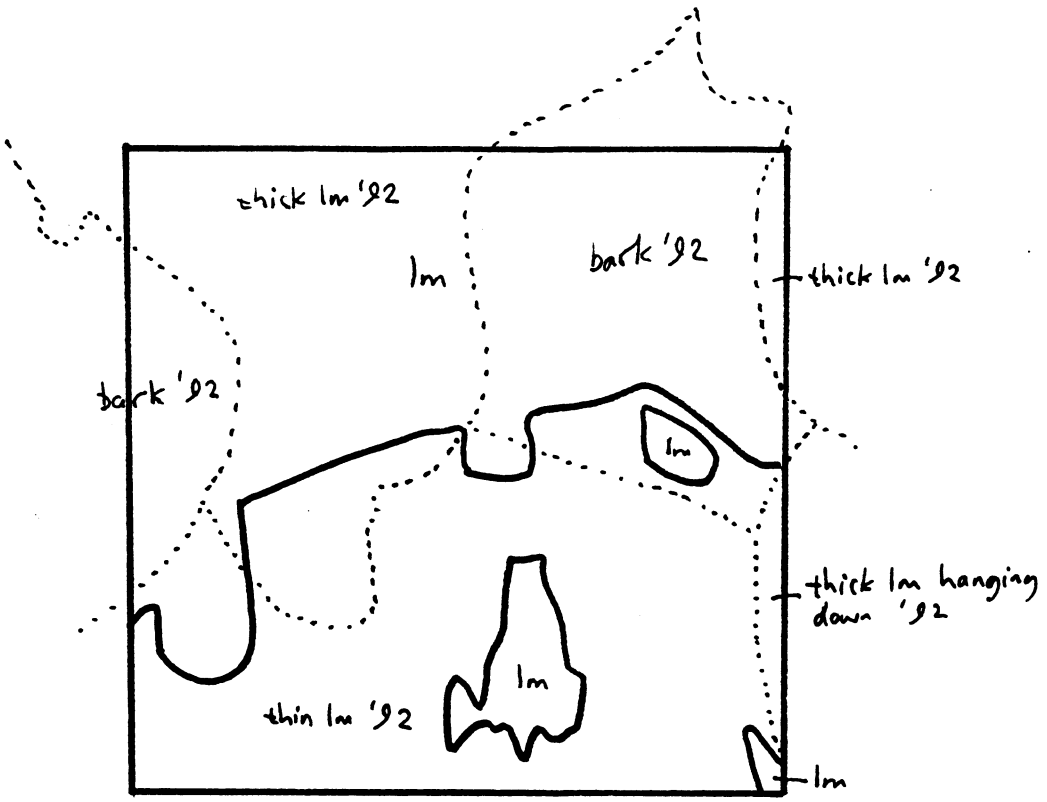
20 cm. above quadrat a.

Jan '92 – tree has fallen over (see quadrat 'a').

Plot 3, tree 1.

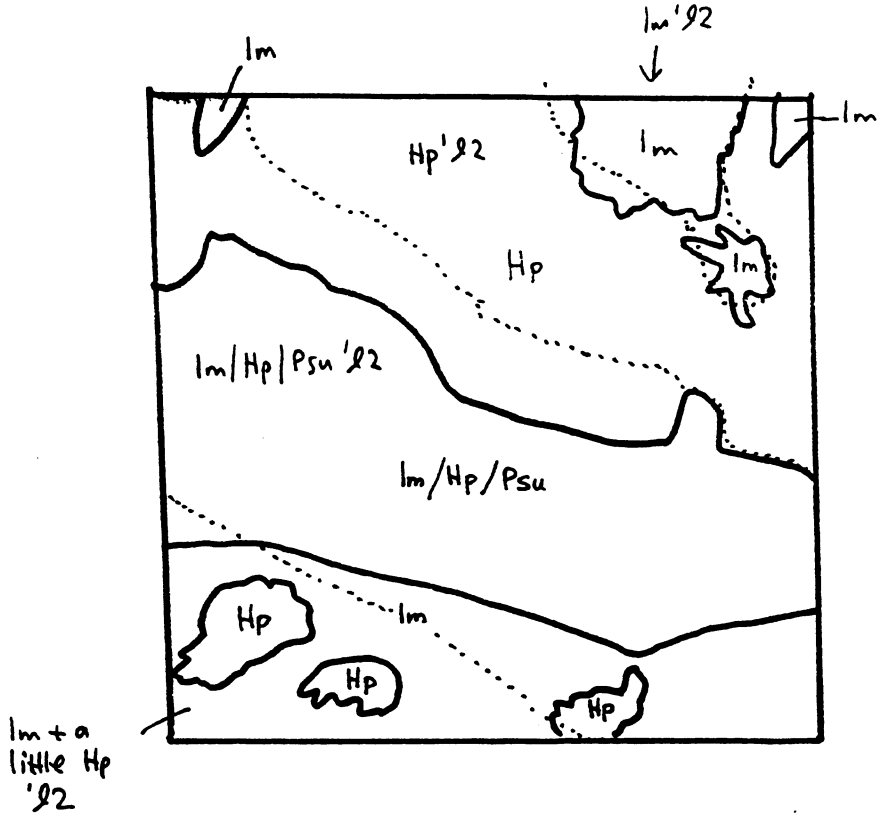
50cm up S. side of oak, 5m. up from 9th post E. along N. fence.

Jan '92 - couldn't refind quadrat exactly, because peg has come out (peg found resting on part of trunk c. 30cm. above ground). Still probably mostly Isothecium myosuroides, but some of this appears to have fallen off.



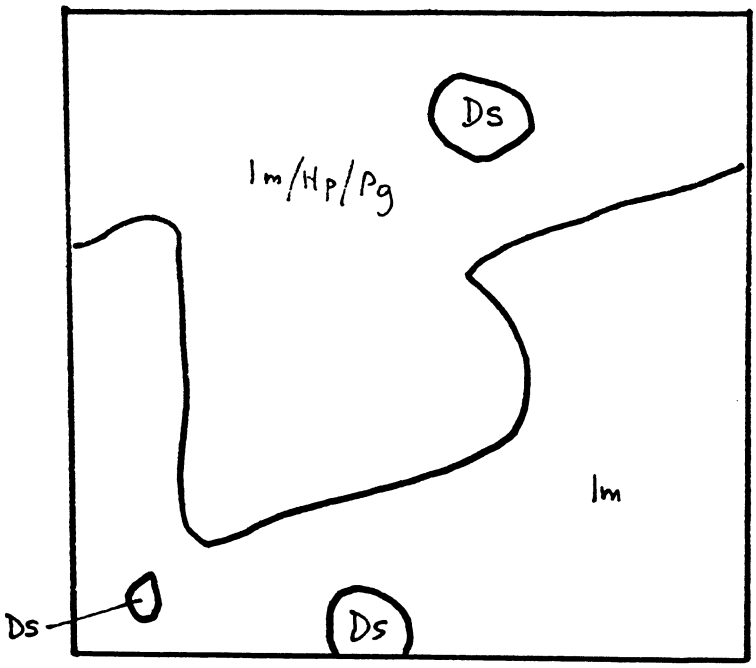
Plot 3, tree 2.

40cm up up-slope side of oak trunk,
12m. up from 13th post E. along N-fence.



Plot 3, tree 3.

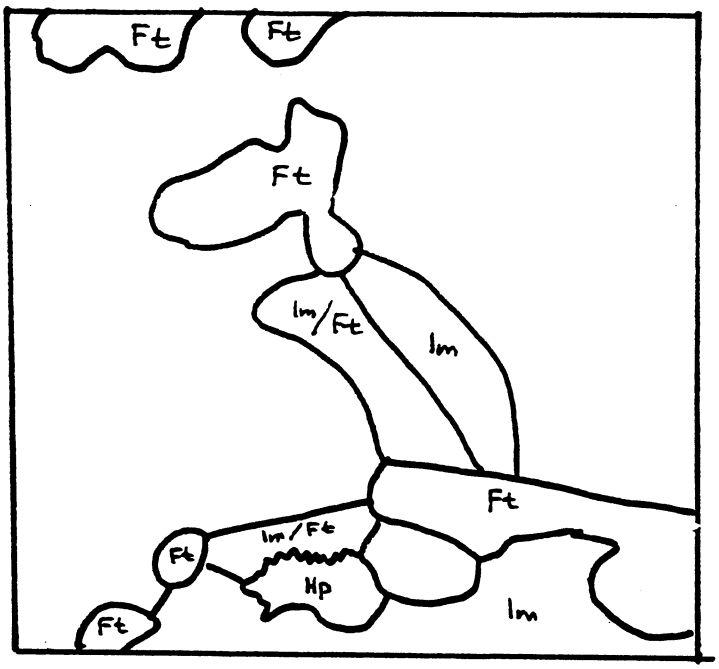
40 cm. up down-slope side of oak trunk, 16m. up from 15th post E. along N. fence. This is the westernmost trunk of a group of 4 trunks.



Plot 3, tree 4.

30cm. up up-slope side of oak trunk. This trunk is the down-slope trunk of a pair of trunks 1m. apart. Located 16m. up from 20th post E. along N. fence.

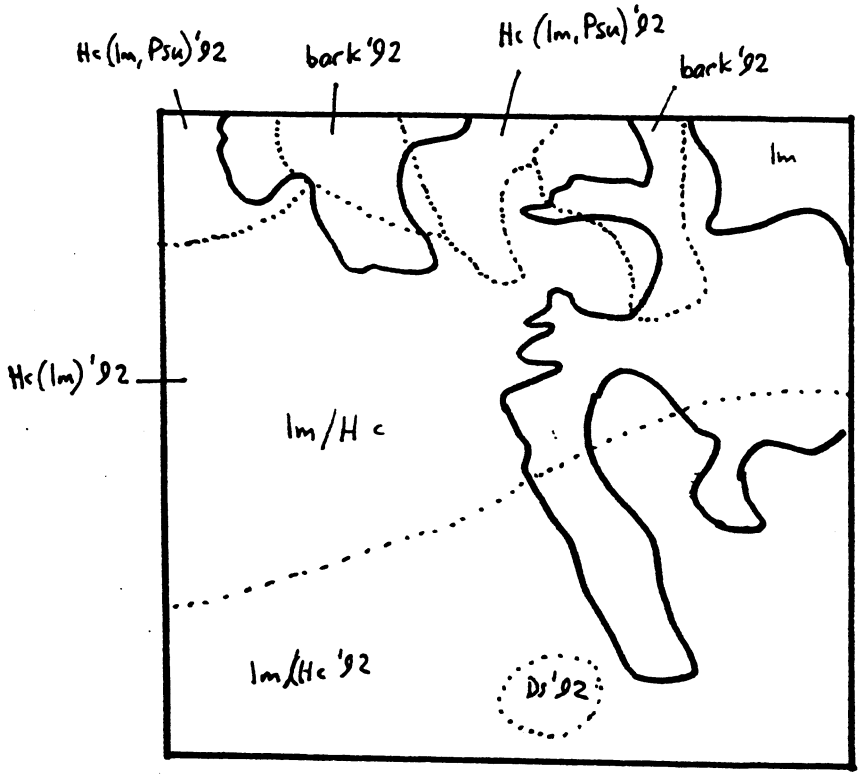
Jan.'92 - Quadrat not refound (peg gone).



Plot 3, tree 5, quadrat a.

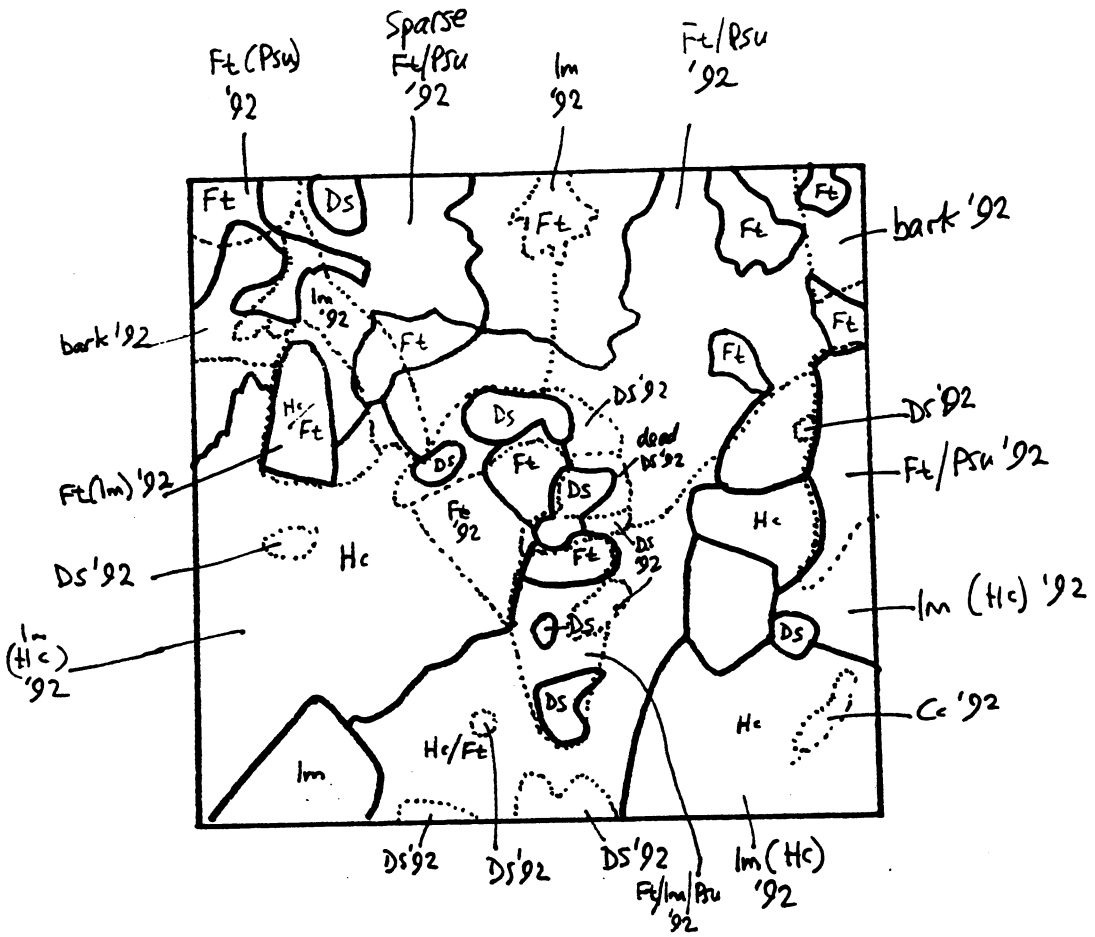
1m. up down-slope side of large oak,
6m. up from 24th past E. along N. fence.

Jan'92 - Quadrat not refound (peg gone).



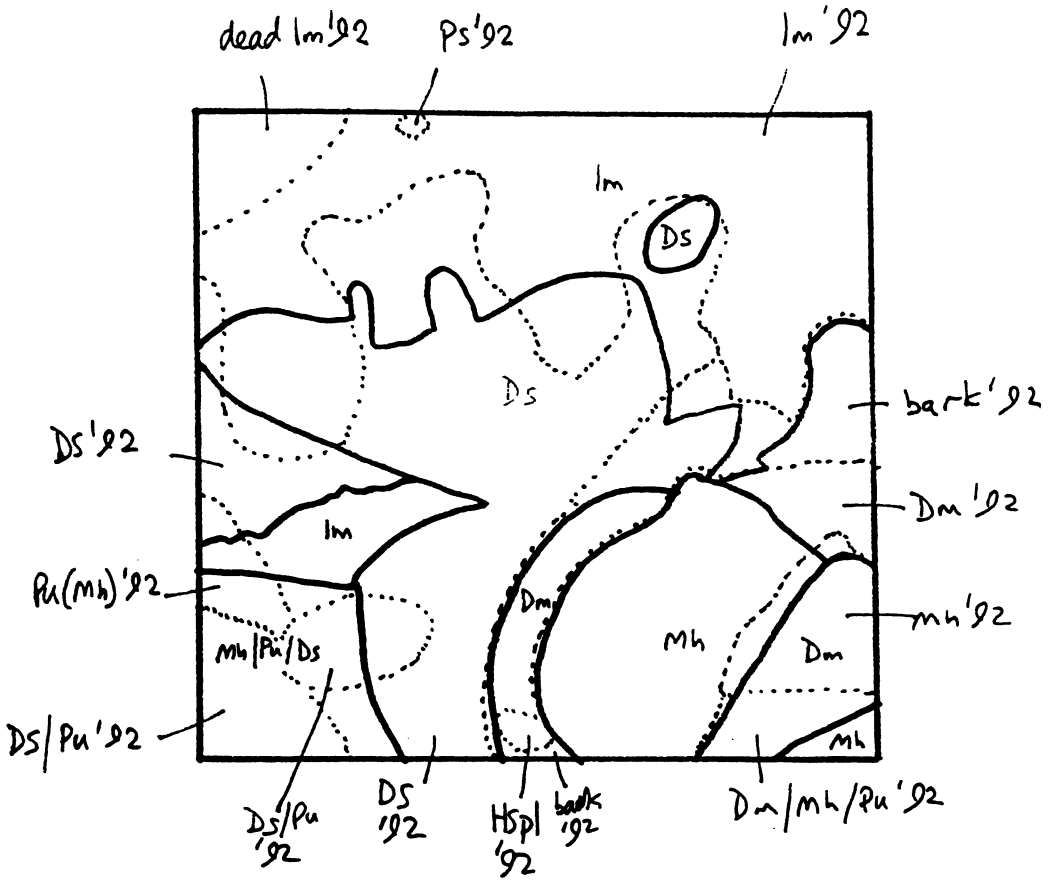
Plot 3, tree 5, quadrat b.

20cm. up SE side of oak trunk.



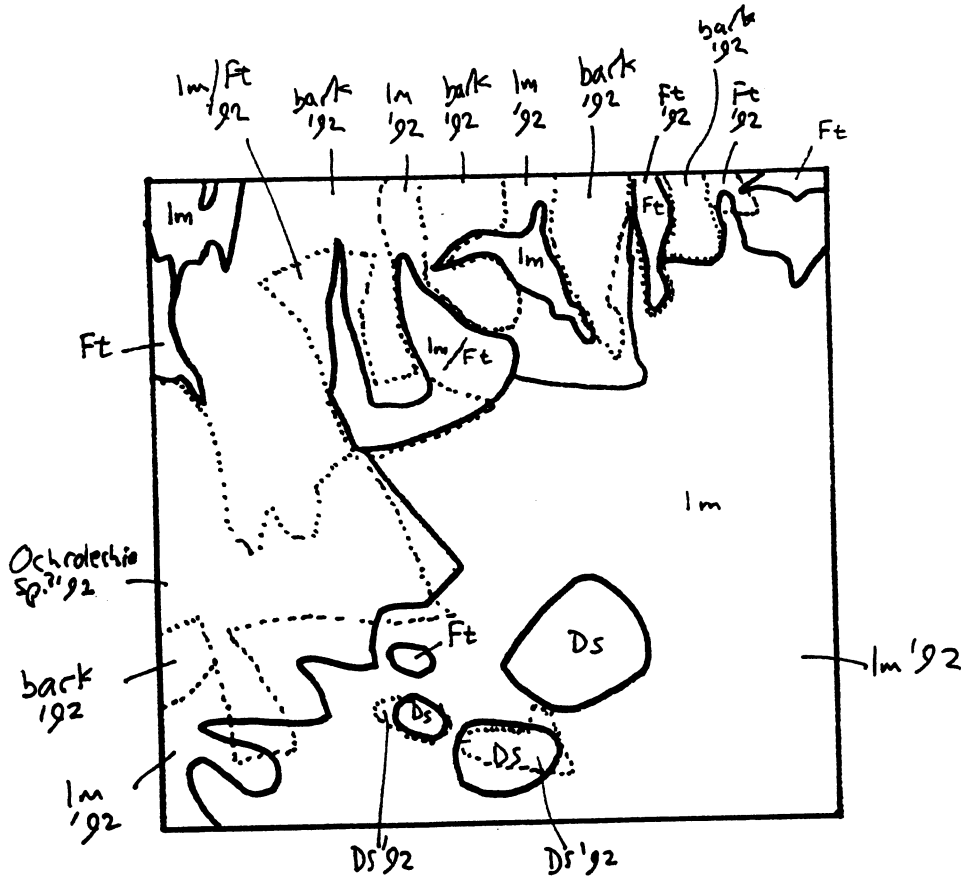
Plot 6, tree 1, quadrat a.

30cm. up S. side of oak, 30m. above road, midway between two lay-bys.



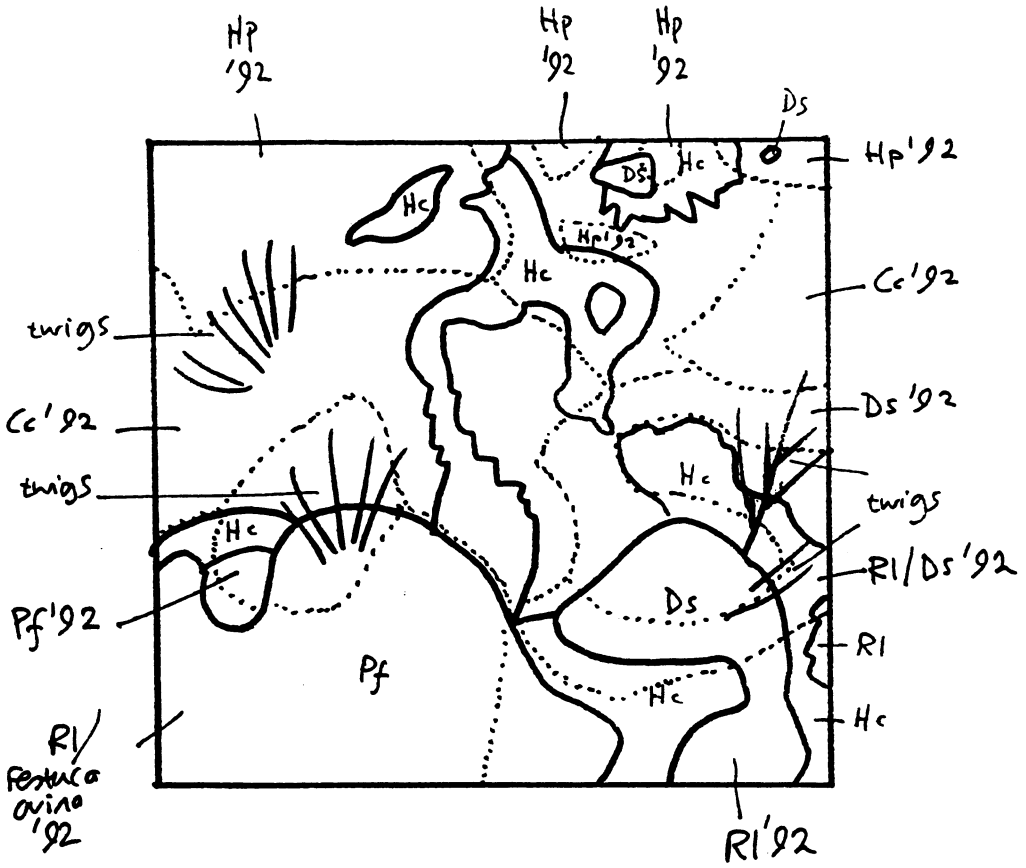
Plot 6, tree 1, quadrat b.

20cm. up E. side of trunk.



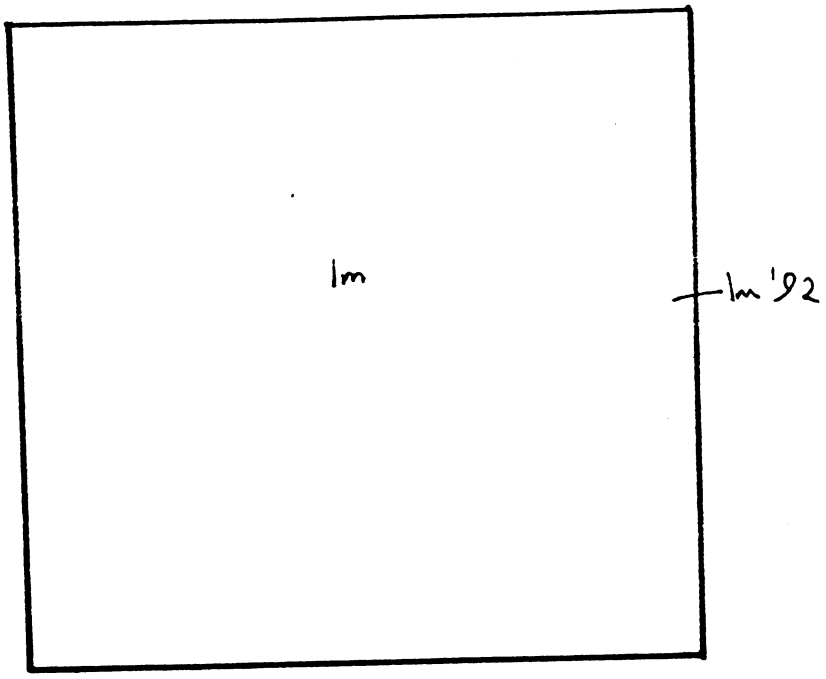
Plot 6, tree1, quadrat c.

40cm. up W. side of trunk.



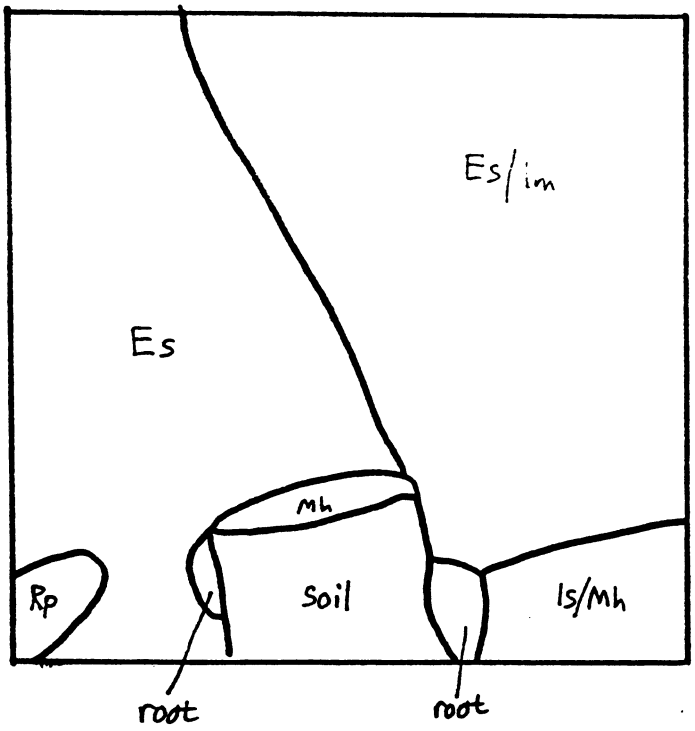
Plot 6, tree 2.

20cm. up S. side of birch, 15m. up-slope from tree 1.



Plot 6, tree 3, quadrat a.

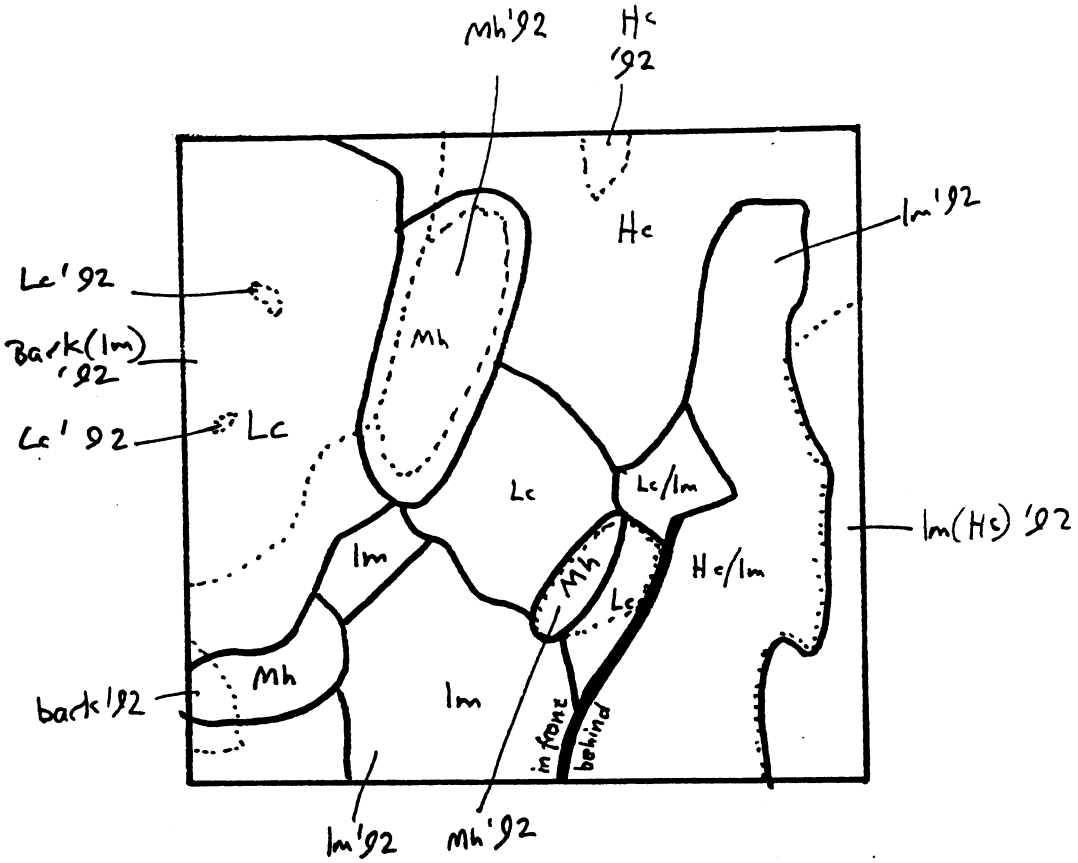
25cm. up SW side of ash, 4m. in from 9th post up E. fence.



Plot 6, tree 3, quadrat b.

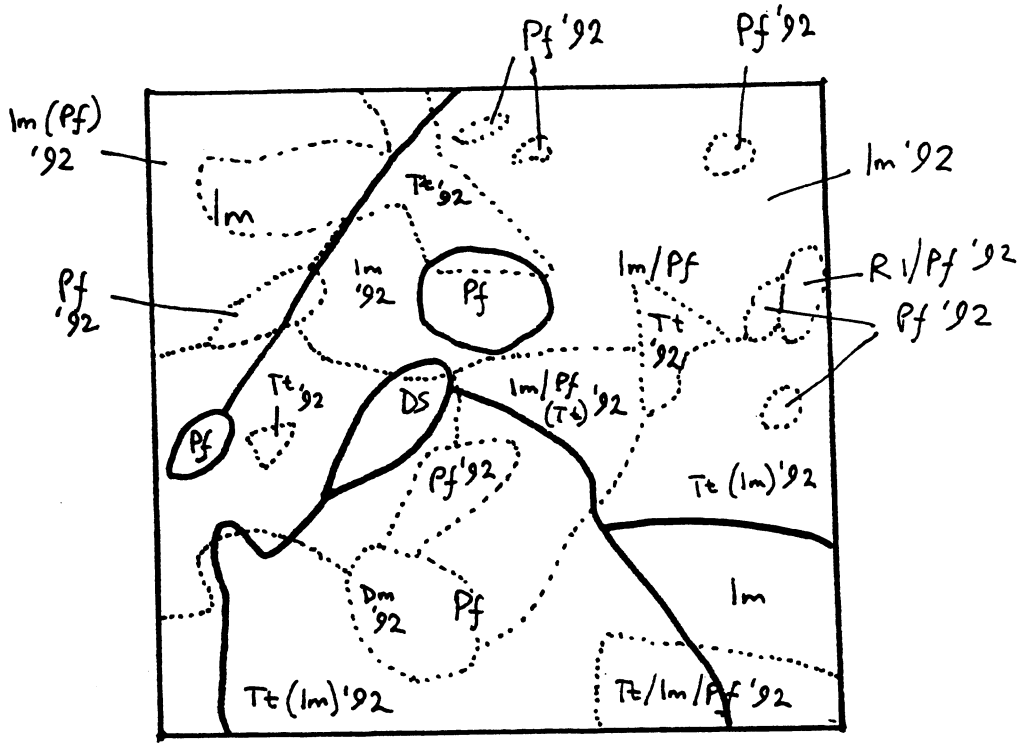
20cm. up N. side of trunk.

Jan'92 - couldn't refind quadrat (peg gone).



Plot 6, tree 4.

40cm. up S. side of birch, 6m. further into plot from tree 3.

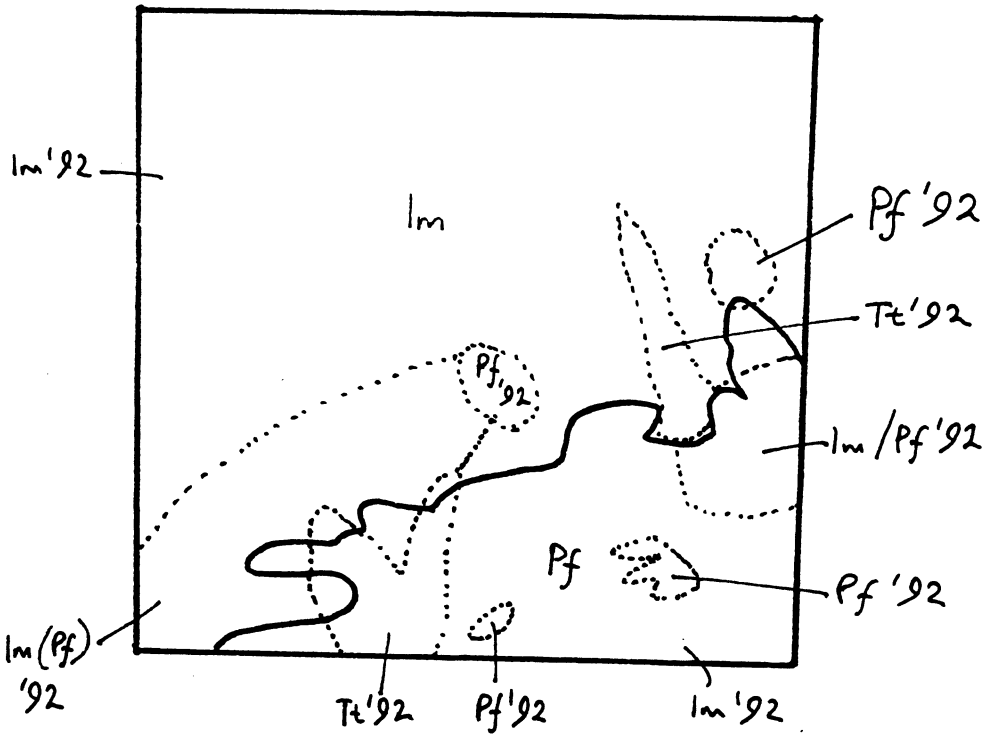


Plot 6, tree 5, quadrat a.

30cm. up W. side of ash, 25m. in from 14th post up E. fence.

Trunk of this ash tree is at a distinct angle.

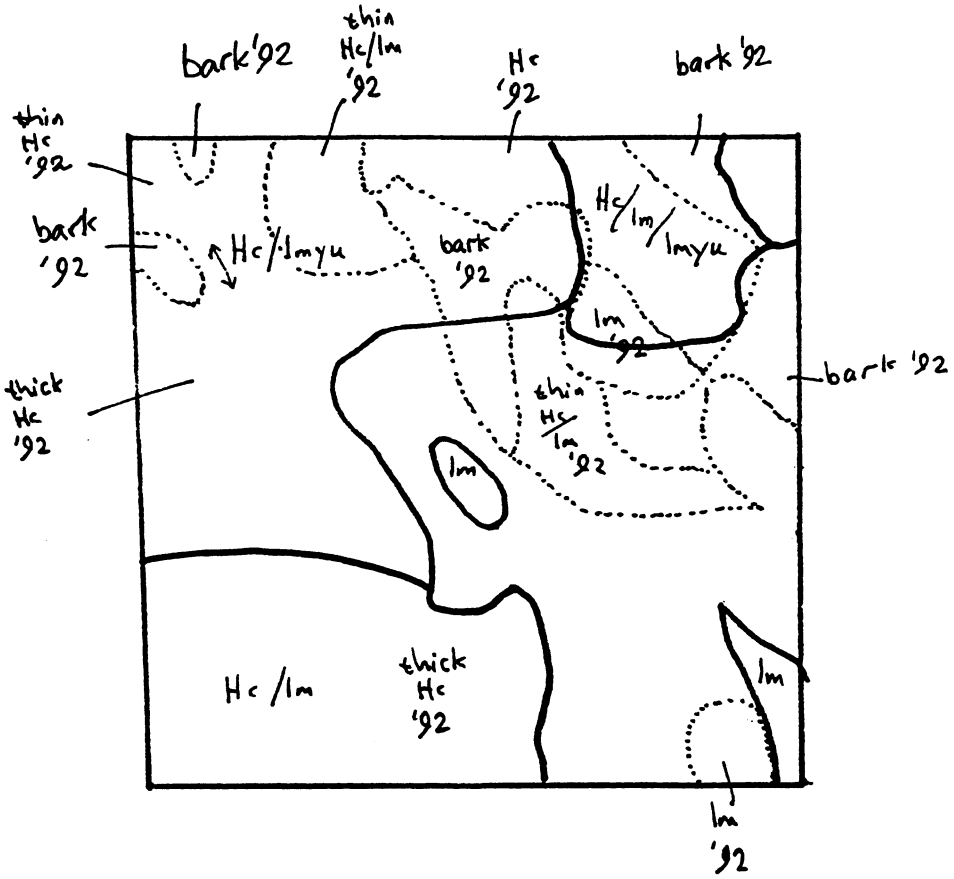
Jan '92 – tree has fallen over. Quadrats are now on level surface of trunk, facing upwards.



Plot 6, tree 5, quadrat b.

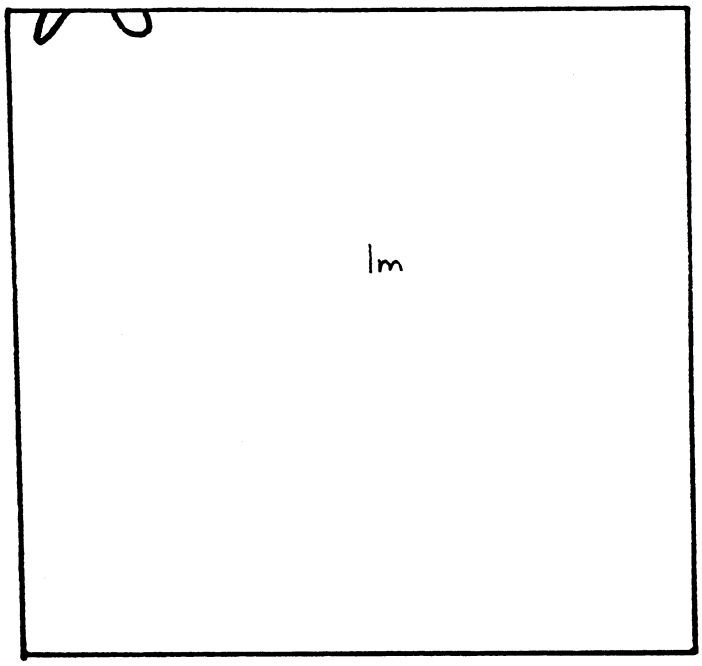
20 cm. above quadrat a.

Jan '92 – tree has fallen over (see quadrat 'a').



Plot 6, tree 6.

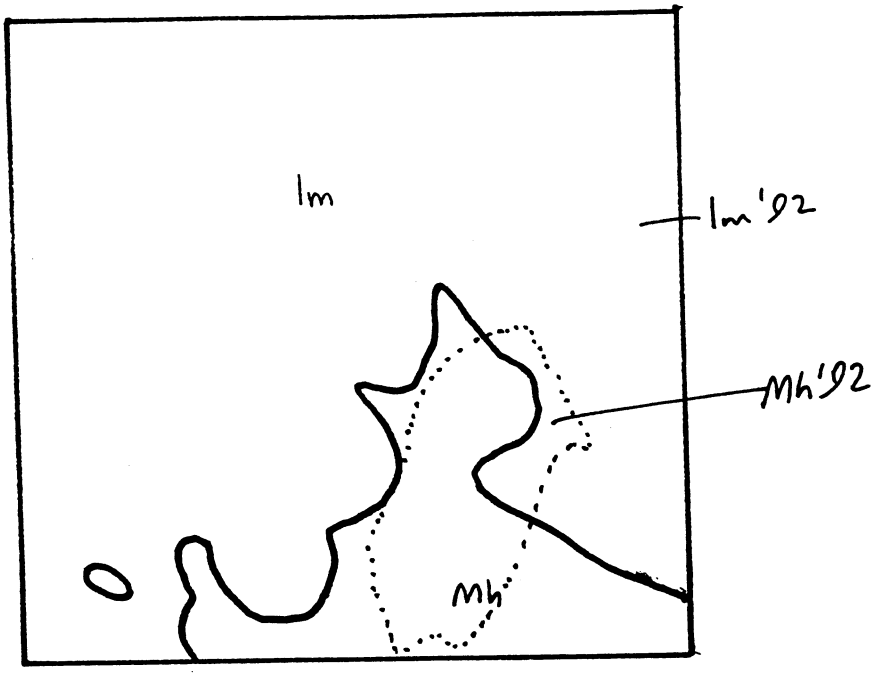
30 cm. up W. side of large oak, 1m. in from 18th post up E. fence.



Plot 7, tree1.

60cm. up ash, 2m. up-slope from 6th post W. along bottom (N.) fence.

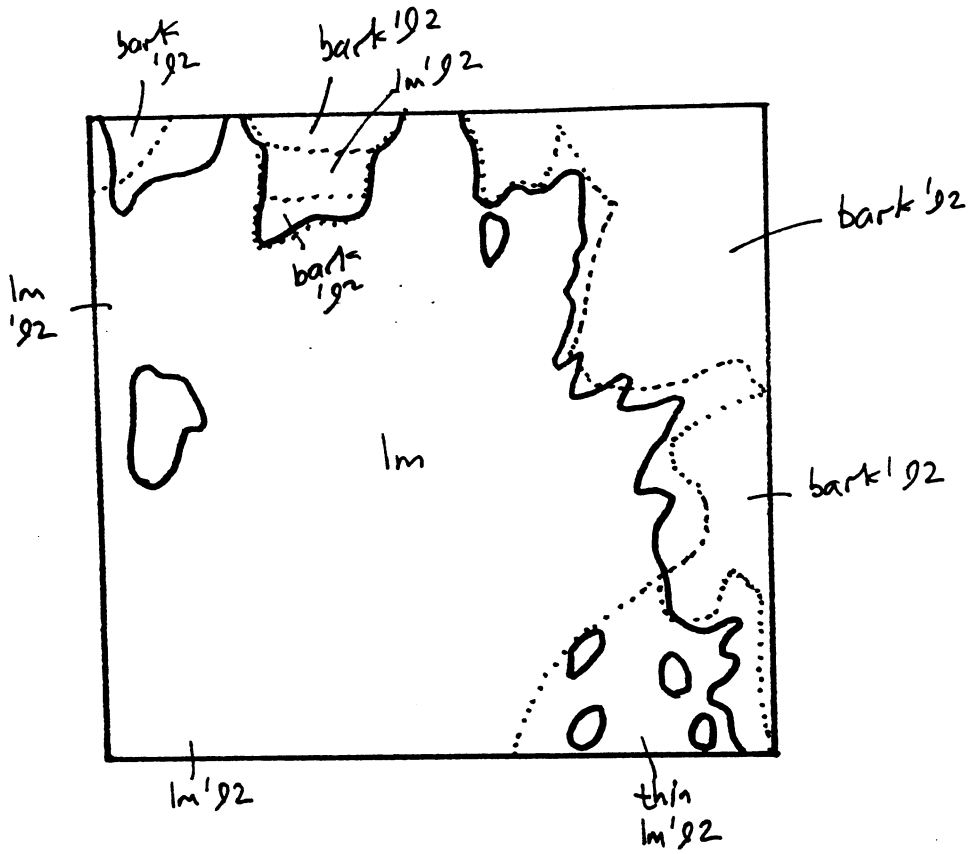
Tree felled by Oct. 1988, so can't re-do quadrat.



Plot 7, tree 2.

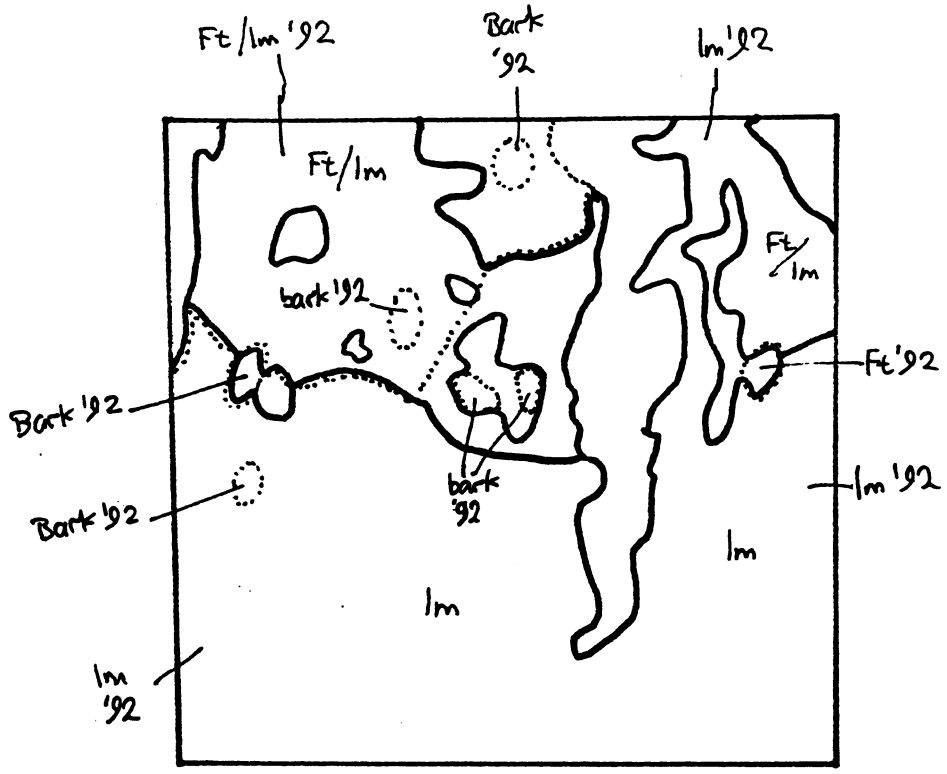
32 cm. up ssideof ash, 10m. up-slope from 15th post W. along N. fence.

Jan'92 - peg broken, so probably won't be able to refind quadrat in future.



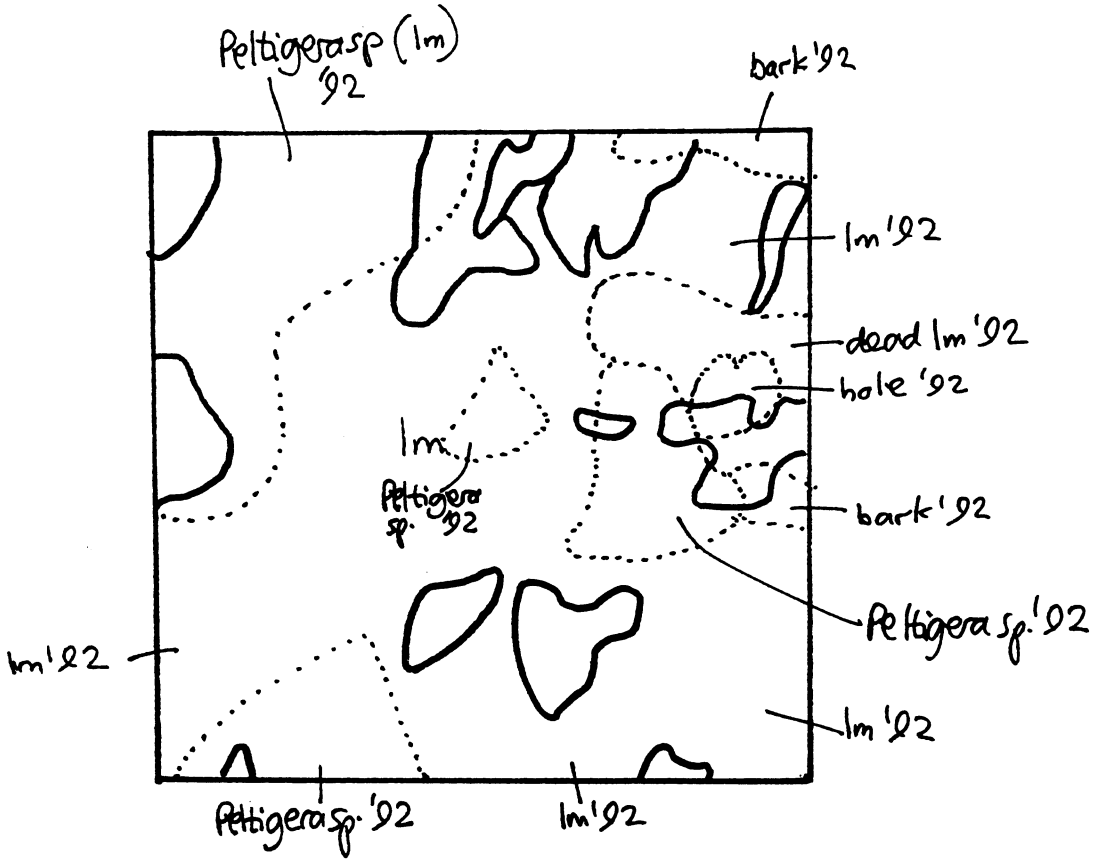
Plot 7, tree 3.

35 cm. up ash, 12m. up-slope from 17th post W. along N. fence.



Plot 7, tree 4.

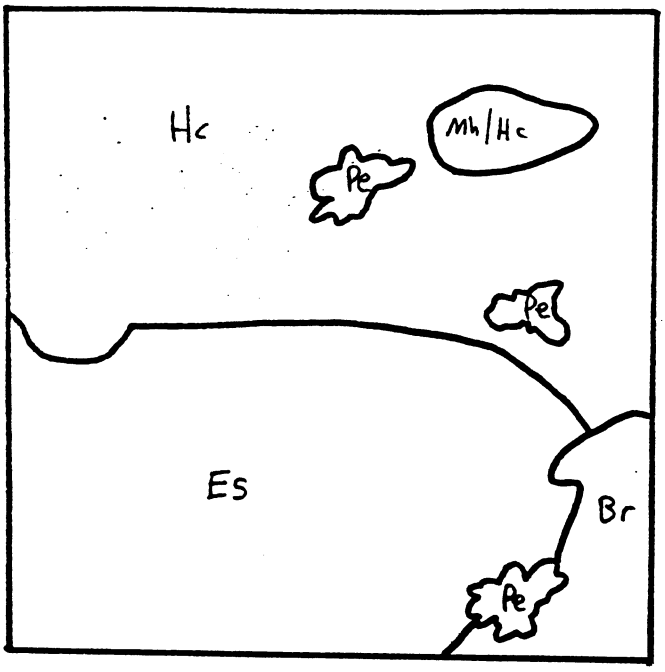
75cm. up ash, 20m. up-slope from 17th post W. along N. fence.



Plot 7, tree 5, quadrat a.

150cm. up SW side of ash, 6m. in from 9th post up E. fence.

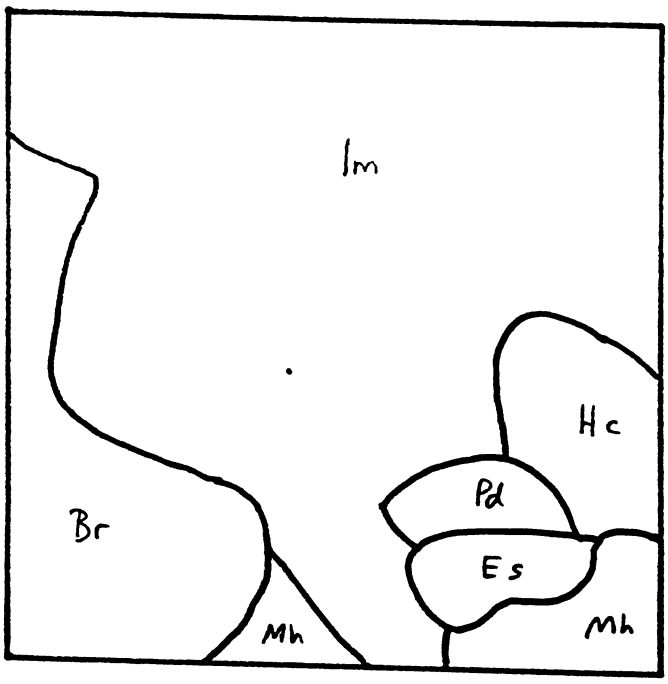
Tree has fallen (trunk at c. 40°, pointing ENE) by Jan '92, & is dead.



Plot 7, tree 5, quadrat b.

50cm. up trunk.

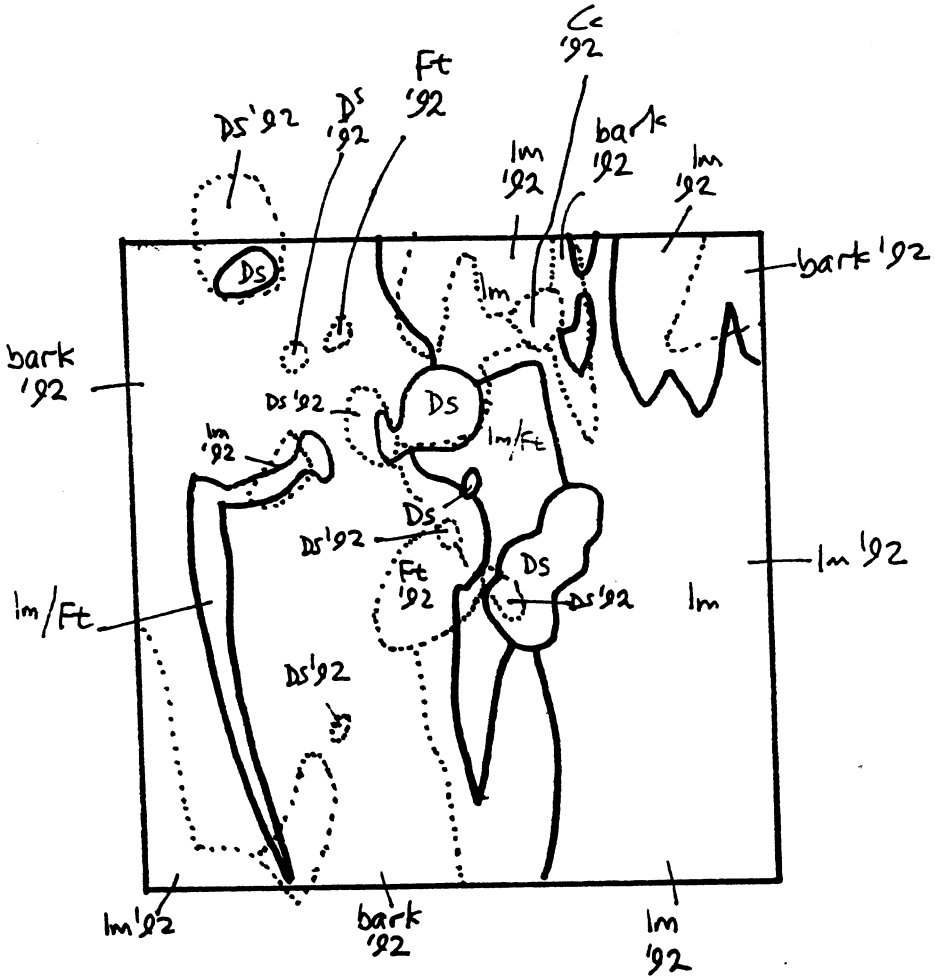
Jan '92 – couldn't refind quadrat (peg gone).



Plot 7, tree 5, quadrat c.

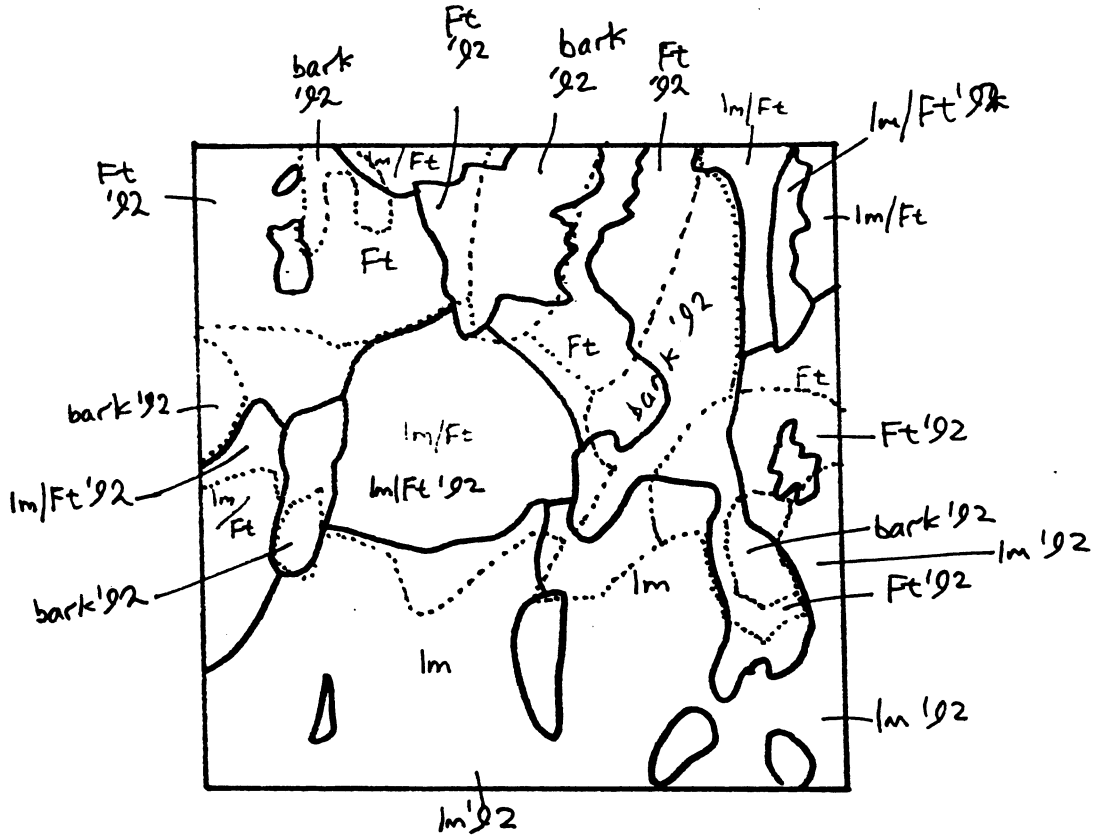
35 cm. up trunk.

Jan '92 - couldn't refind quadrat (no peg).



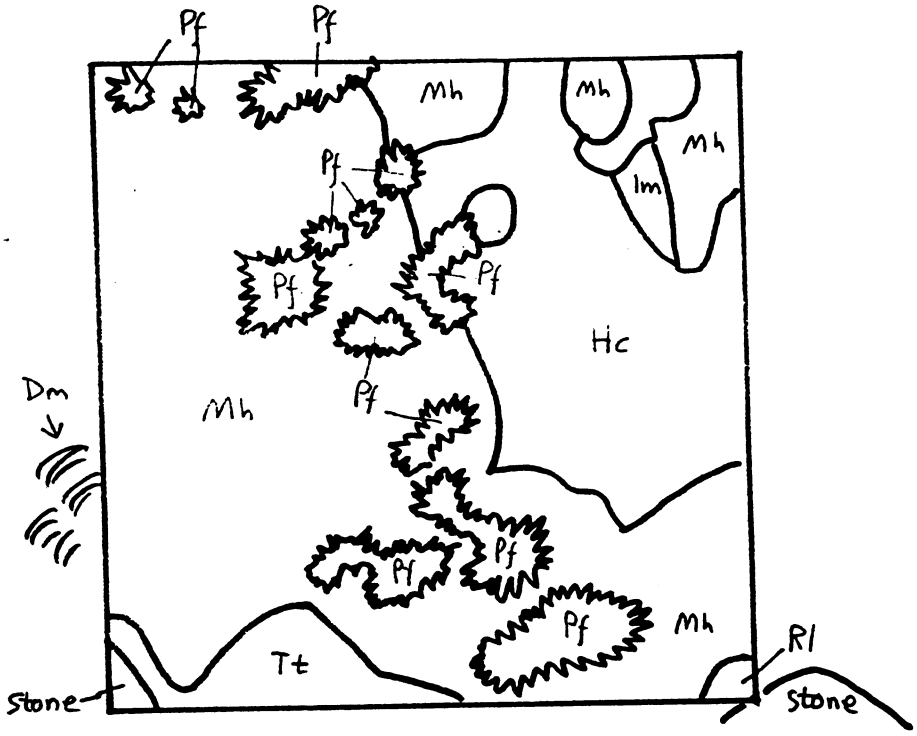
Plot 7, tree 6.

80cm. up W. side of ash, 1m. in from 18th post up E. fence.



Plot 7, tree 7.

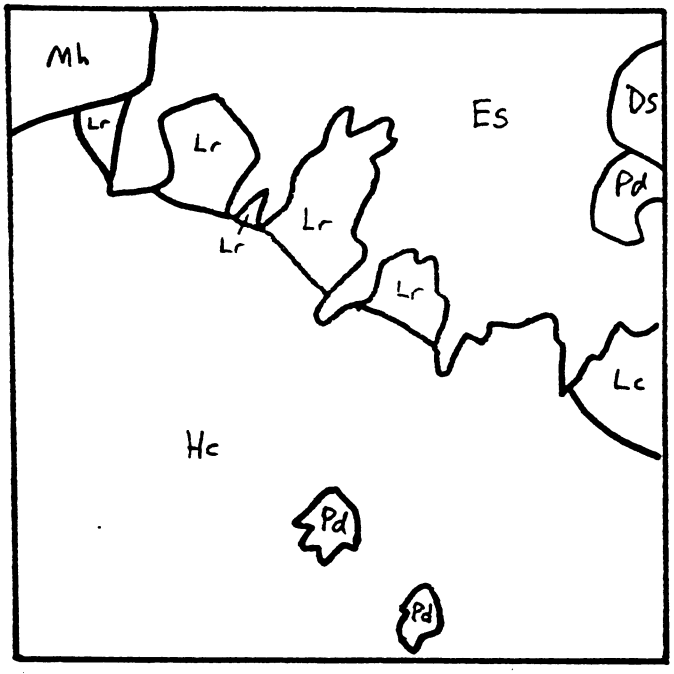
150 cm. up S. side of ash, 2m. in from 17th post up E. fence.



Plot 7, tree 8.

20 cm. up SE side of hazel, 2m. in from 10th post up E. fence.

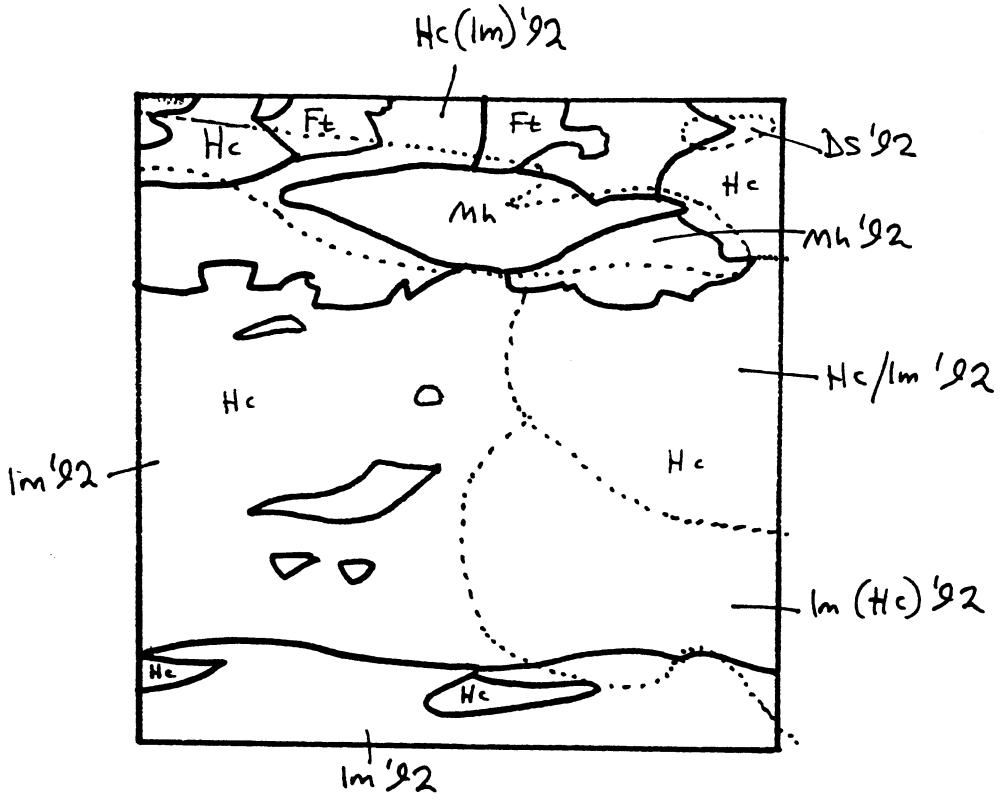
Jan '12 - couldn't re-find quadrat exactly (no peg).



Plot 7, tree 9, quadrat a.

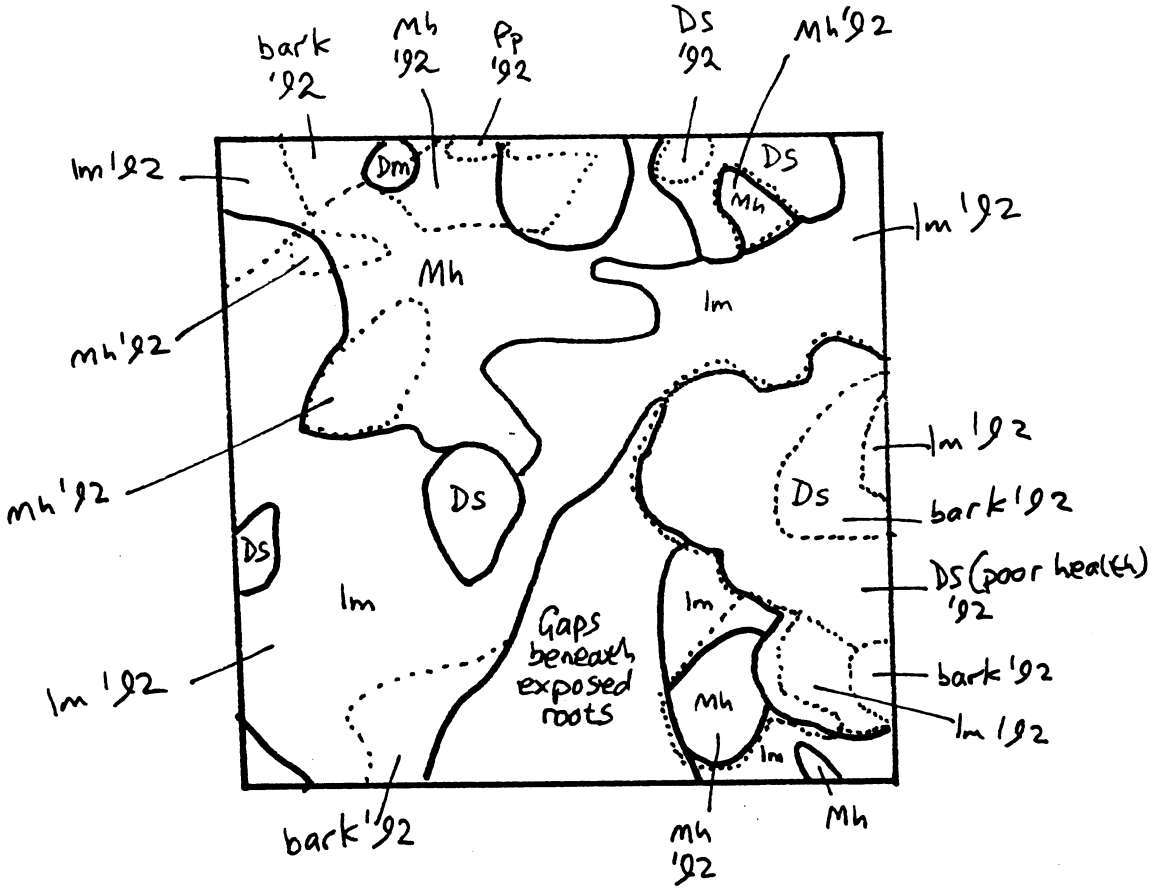
30 cm. up (above ground) S. side of fallen ash trunk
4m. in from 5th post up E. fence.
Quadrat = 50 cm. W. of two large branches.

Jan '22 - couldn't refind quadrat (no peg)



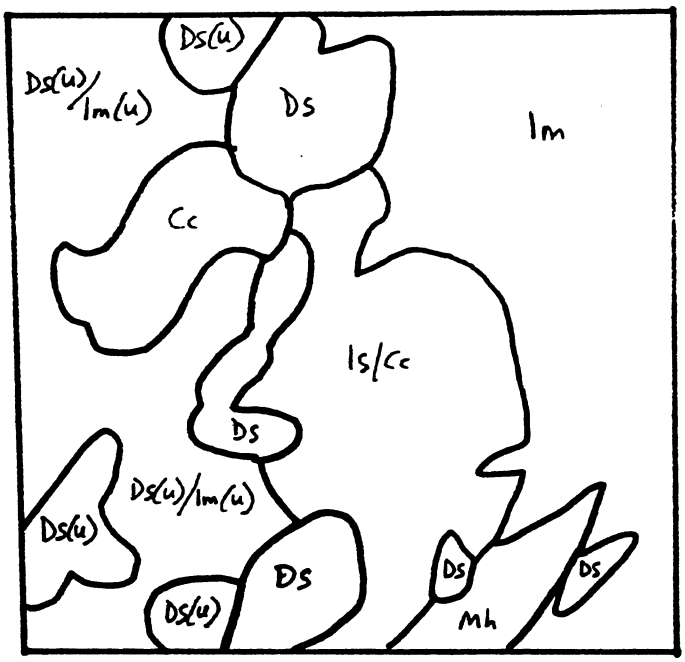
Plot 7, tree 2, quadrat b.

4m. W. along trunk from quadrat a.



Plot 7, tree 10.

30cm. above ground, on base of S. side of birch, with exposed roots, and trunk at an angle of c. 45°.
Tree = 25m. up-slope from 7th post E. along N. fence.

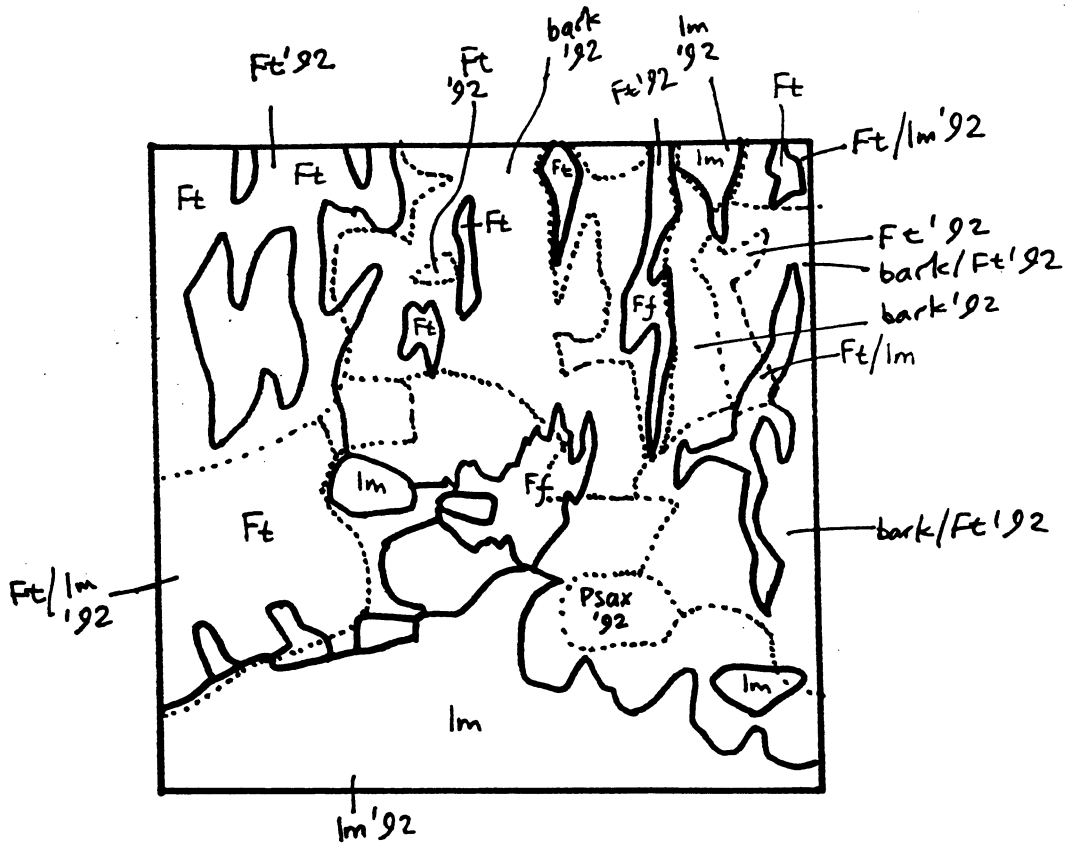


Plot 7, tree 11.

25cm. up S. side of birch, 4m. in from 17th post up W. fence.

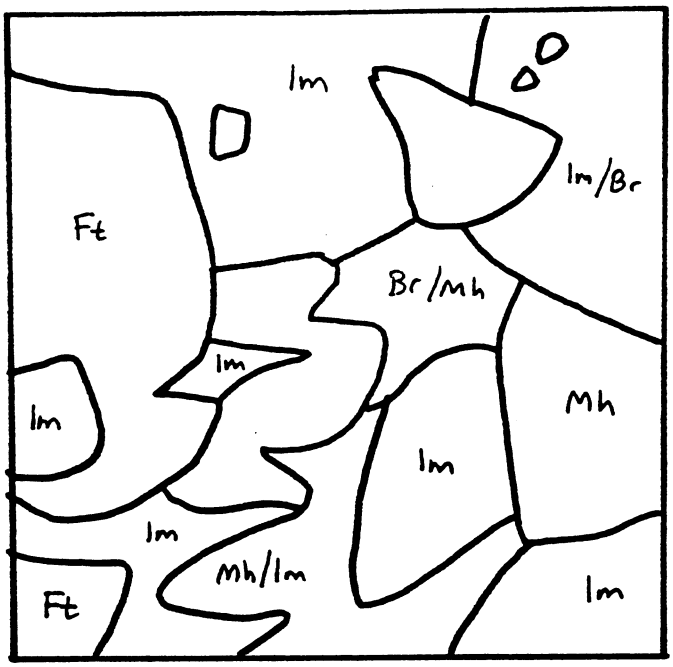
(u) = unhealthy.

Jan'92 - couldn't refind quadrat (peg gone).



Plot 7, tree 12.

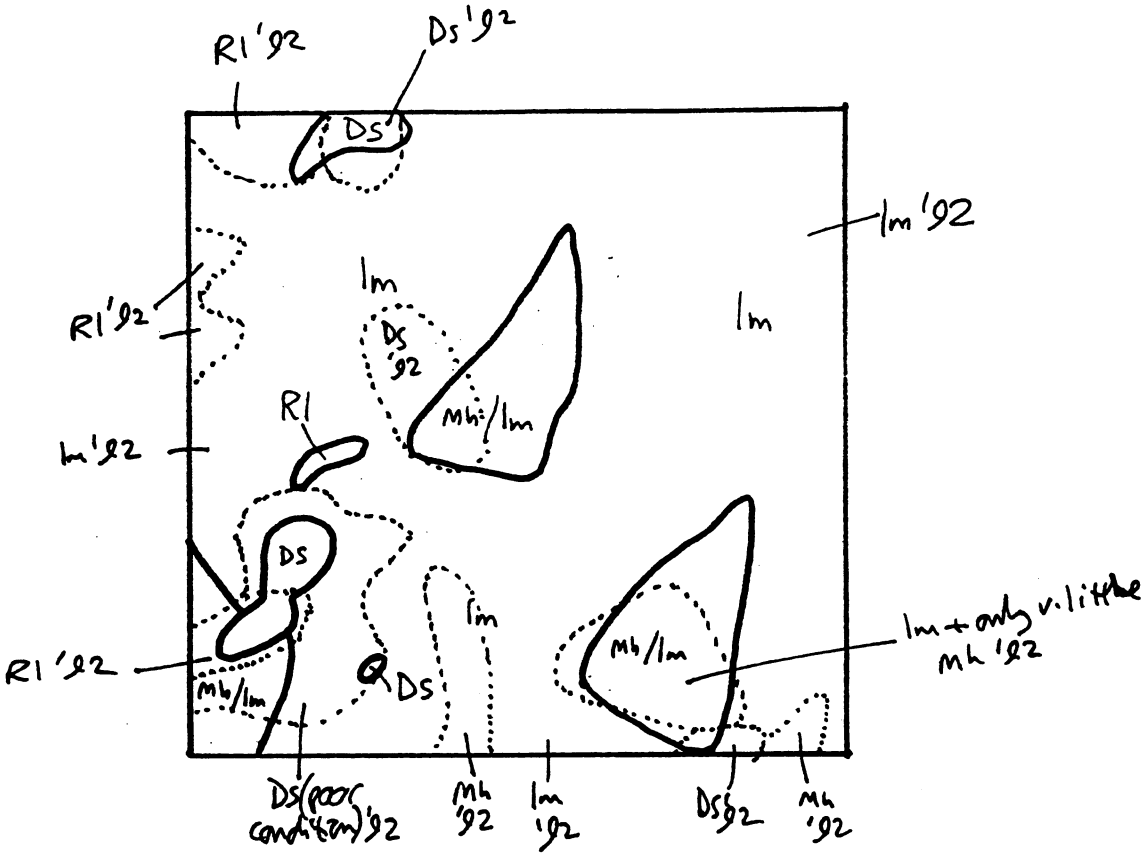
50cm. up S. side of ash, 5m. in from 26th post up W. fence.



Plot 8, tree 1.

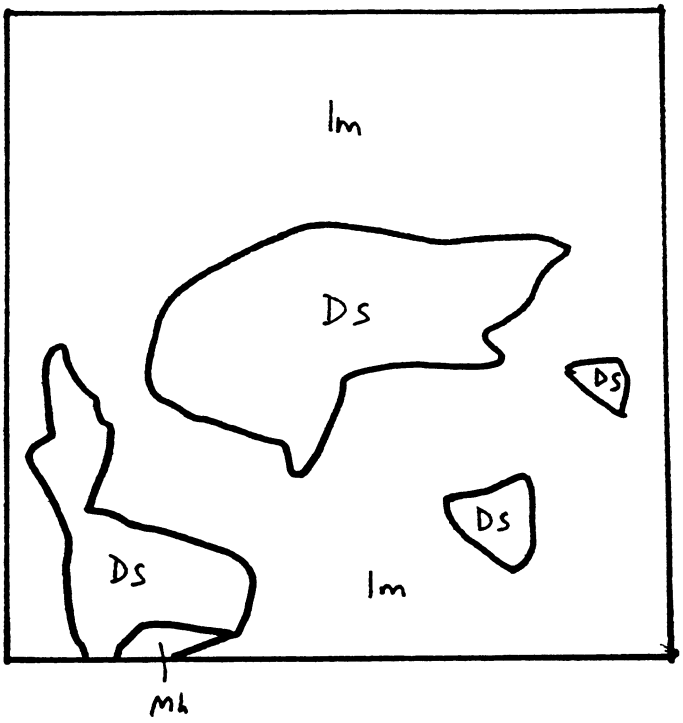
50cm. above ground, on N. side of v. large, fallen ash trunk 6m. in from E. fence, c. 50m. up from bottom of wood. (2+ posts)

Jan '92 - could not refind quadrat.



Plot 8, tree 2.

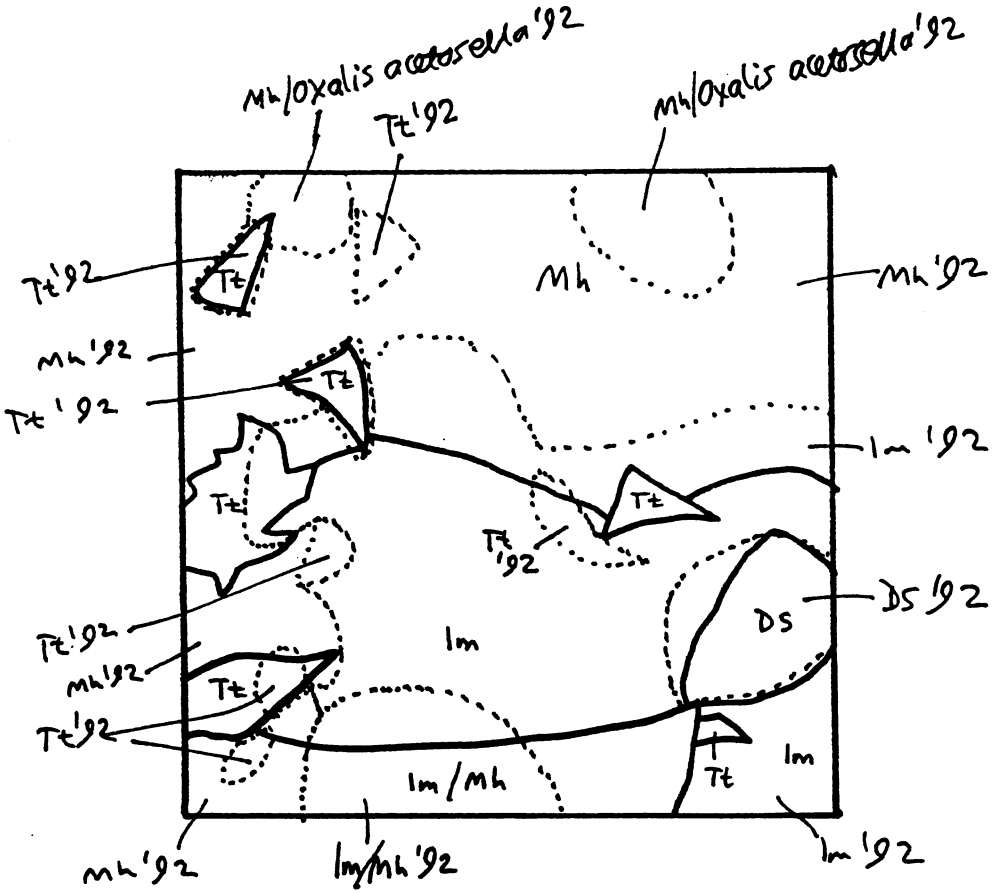
30cm. up ash on S. side of, 20m. up-slope from 15th post W. along N. fence.



Plot 8, tree 3.

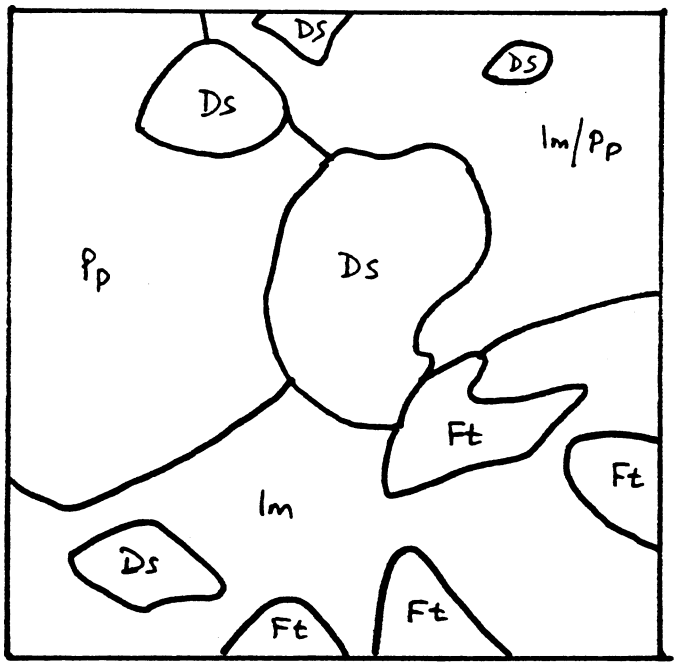
25cm. up SW. side of ash, 20m. up-slope from 17th post along N. fence.

Jan. 1992 - couldn't refind quadrat (tree had fallen over by Oct. 1988).



Plot 8, tree 4, quadrat a.

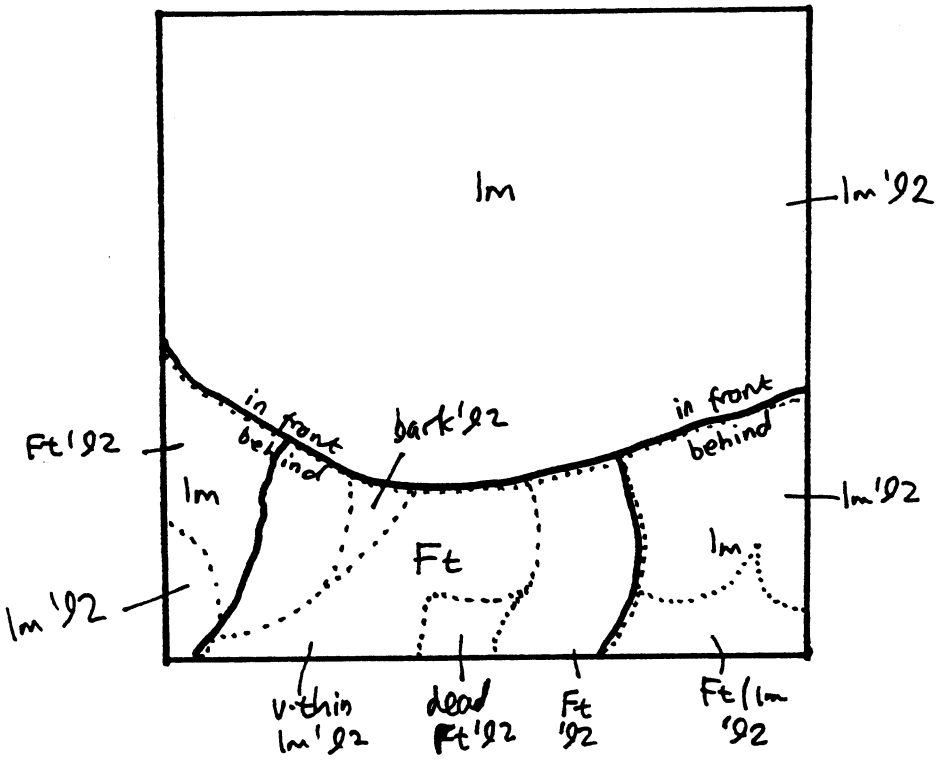
35cm. up S. side of partly-dead ash, 4m. up-slope from 26th. post W. along N. fence.



Plot 8, tree 4, quadrat b.

45 cm. up NW. side of trunk.

Jan'12. Couldn't refind quadrat exactly, but Dicranum scoparium still probably about as extensive, & Plagiochila porelloides probably decreased in left half of quadrat.



Plot 8, tree 4, quadrat c.

25cm. above quadrat b.