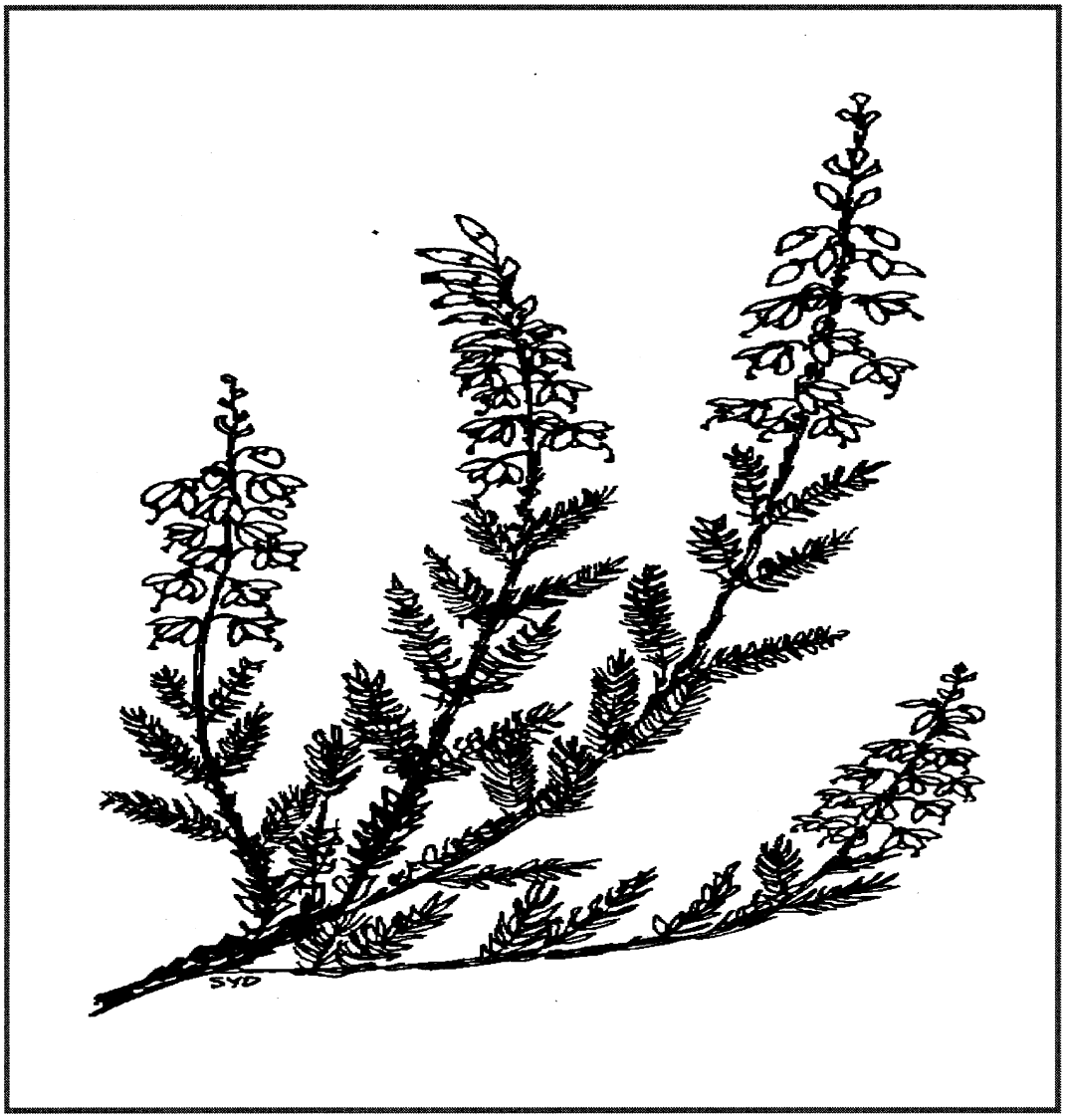
ENGLISH NATURE

North York Moors National Park upland vegetation survey

Summary Report

No. 245 - English Nature Research Reports



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for nature tomorrow

North York Moors National Park
Upland Vegetation Survey

Summary Report

by

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for

English Nature

and

North York Moors National Park Authority

7th May 1998

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This report is dedicated to Anya McCracken (1953 - 1998) who worked so hard to keep the North York Moors a beautiful and prosperous place for us all to enjoy

Summary

The North York Moors holds one of the largest continuous tracts of heather moor in England and Wales and is the most easterly area of moorland in Britain. A comprehensive survey of the upland vegetation communities of the North York Moors National Park has been undertaken by English Nature and the North York Moors National Park Authority to provide a database of vegetation information to a common standard and framework for all areas of moorland in the Park. This report summarises the results of this survey and provides an overview of moorland vegetation and management throughout the North York Moors National Park. It is hoped that wider circulation of the results of this survey will enable authorities and landowners, from this and other areas, to view their moors in context with the North York Moors.

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ACKNOWLEDGEMENTS

This survey could not have been carried out without the co-operation of the landowners, keepers, tenants and land agents and this is fully appreciated. Special thanks go to Nigel Underwood, who carried out much of the field survey in 1996 and to Sue Rees (North York Moors National Park Authority) and Dave Clayden (English Nature), who co-ordinated the survey.

The vegetation survey was funded by English Nature and the North York Moors National Park Authority. The heather condition survey was funded by the European Union's Objective 5b Programme for the Northern Uplands and the Ministry of Agriculture, Fisheries and Food (MAFF), English Nature, the North York Moors National Park Authority. Both surveys were carried out to further inform the Objective 5b Moorland Regeneration Programme.

1 INTRODUCTION

The North York Moors holds one of the largest continuous tracts of heather moor in England and Wales and is the most easterly area of moorland in Britain. This makes the North York Moors important, not only in Britain, but also internationally, as Great Britain holds over 70% of the heather moorland found in the world. At present less than 6% of the 490 square kilometres of moorland in the North York Moors National Park is designated as Sites of Special Scientific Interest. However the National Park holds seven internationally important National Vegetation Classification (NVC) communities (plant communities which are rare outside the British Isles) and six nationally important NVC communities (plant communities which are especially well developed within the British Isles but with restricted representation internationally). While all but two of these communities are represented in the existing SSSI's many of the areas scheduled are not extensive.

A comprehensive survey of the **upland vegetation communities** of the North York Moors National Park has been undertaken by English Nature and the North York Moors National Park Authority to provide a database of vegetation information to a common standard and framework for all areas of moorland in the Park. The baseline information on vegetation will be used to aid the targeting of resources by English Nature and the North York Moors National Park Authority (NYMNP) and will also assist in the development of management prescriptions through the Moorland Regeneration Programme started in 1995 as well as any future projects. The baseline information may also be used in the overall evaluation of the most important areas of moorland.

This report summarises the results of this survey and provides an overview of moorland vegetation and management throughout the North York Moors National Park.

In addition a survey of **heather condition** on moorland within the North York Moors National Park was carried out concurrently with this survey of vegetation communities. This Heather Condition Survey forms part of the Moorland Regeneration Programme funded under European Union Objective 5(b) to encourage retention of good quality heather moorland and better sheep and grouse management via improved sheep husbandry and bracken control. The Moorland Regeneration Programme is co-ordinated by the North York Moors National Park and is also funded by the Ministry of Agriculture, Fisheries and Food, the European Union and the private sector. As part of this programme, monitoring of vegetation and bird populations is being undertaken. Ninety two 1km × 1km squares have been surveyed for their breeding wading bird populations. Heather condition scoring and mapping was carried out on seventy five squares selected randomly from this sample. The information gained from these two surveys will provide, in combination with information from the vegetation community survey of the moors, baseline information to assist in identifying management prescriptions and the targeting of effort. While observations on moorland management taken from the Heather Condition Survey form part of the moorland management section of this report the main findings of the Heather Condition and Breeding Bird Surveys will be presented elsewhere.

2 METHODOLOGY

2.1 Vegetation Community Survey

The moors have been divided into a series of topographical units, blocks, which are further sub-divided into sites based on ownership, management and topography (Table 1 and Figure 1).

All areas of moorland were walked to establish vegetation stand boundaries and vegetation stands were mapped in the field onto colour photocopies of 1988 and 1995 colour aerial photographs (1:20,000 and 1:10,000 scale approx. respectively).

Stands were assigned to National Vegetation Classification communities and sub-communities using a combination of quadrat data recorded during field survey, community descriptions and constancy tables in Rodwell (1991a, b and 1993) and the experience of the field surveyor. Quadrats were 2m × 2m, unless stand size was smaller than this, and species ground cover was recorded using the domin scale:

Domin score	Percentage ground cover
10	91-100%
9	76-90
8	51-75
7	34-50
6	26-33
5	11-25
4	4-10
3	many individuals
2	<4 several individuals
1	few individuals

Constancy tables were constructed where more than one quadrat was recorded from a community. NVC communities and sub-communities are determined by how frequently individual plant species occur in quadrats recorded in homogeneous stands of vegetation. This frequency of occurrence of species is termed constancy. For example, where five quadrats have been recorded in a homogeneous stand and a plant species is found in all five quadrats, i.e. it has a frequency of occurrence of 100%, then it is deemed to have a constancy of V, whereas a species that only occurs in two of the five quadrats (a frequency of occurrence of 20%) will have a constancy value of II. The more constant a species is, that is the higher its constancy value, in a particular type of vegetation, the more important it is in determining which NVC community that vegetation belongs to.

NVC community boundaries were then transferred to 1:25,000 Ordnance Survey maps. and the areas of each community and sub-community were measured using a dot matrix.

In addition to community data notes were made on a number of other factors:

- areas of exposed rock, tors, crags and scree and whether it was siliceous or calcareous;
- quarries, tips and spoil heaps indicating past or present mining activity;
- standing or running water;
- access roads and tracks including public footpaths and bridleways;
- forestry plantations and shelterbelts;

- the grazing regime including type of stock (sheep, cattle or horses), and grazing intensity as assessed by the general condition of the vegetation (low, medium or high);
- supplementary feeding and whether the surrounding vegetation is damaged as a result of locally high grazing pressure;
- moorland management practice in relation to heather; is it burnt and if so are the burns large (c. > 30m wide) or small (c. < 30m wide);
- average height attained by *Calluna* within the ranges <15cm, 15-30cm, 30-45cm and >45cm;
- an estimation of the relative extent of ungrazed and lightly grazed heather, topiary and suppressed bushes, drumstick forms and dead heather in the ranges: none, local (1-25%), frequent (26-75%) and widespread (76-100%);
- artificial drainage either by grips or deep drains;
- bracken control, as evidenced by areas of dead bracken fronds present in the middle of the growing season, areas of bare ground or patchy vegetation cover with remains of dead bracken;
- fertiliser and lime application;
- the presence or absence of peat haggs or sheet erosion;
- the presence or absence of woodland or scattered trees;
- fauna seen, in particular raptors and waders, but also other animals.

Table 1 Survey Blocks

Block Number	Block Name
1	Lockton and Levisham Moors
2	Goathland Moor
3	Bransdale Moor
4	Danby Low Moor
5	Newton Mulgrave and Ugthorpe Moors
6	Hawnby and Snilesworth Moors
7	Spaunton Moors
8	Danby High Moor
9	Rievaulx Moor
10	Wheeldale Moor
11	Bridestones and Troutsdale Moors
12	Cawthorne and Appleton Moors
13	Fylingdales Moor
14	Westerdale Moor
15	Far Moor Plantation

2.2 Heather Condition Survey

Each square was walked between July and November 1996. The distribution of visually distinguishable vegetation types in each square was mapped at a scale of 1:10,000 with the aid of aerial photographs taken in August 1995.

The percentage ground cover of heather (*Calluna vulgaris*) plants in visually distinguishable stands was assessed and the following heather cover categories were mapped:

Heather Condition Category	Percentage Ground Cover
5	> 75% cover
4	51 - 75% cover
3	26 - 50% cover
2	10 - 25% cover
1	< 10% cover
	No heather

The following vegetation types were mapped as an overlay of the heather cover categories:

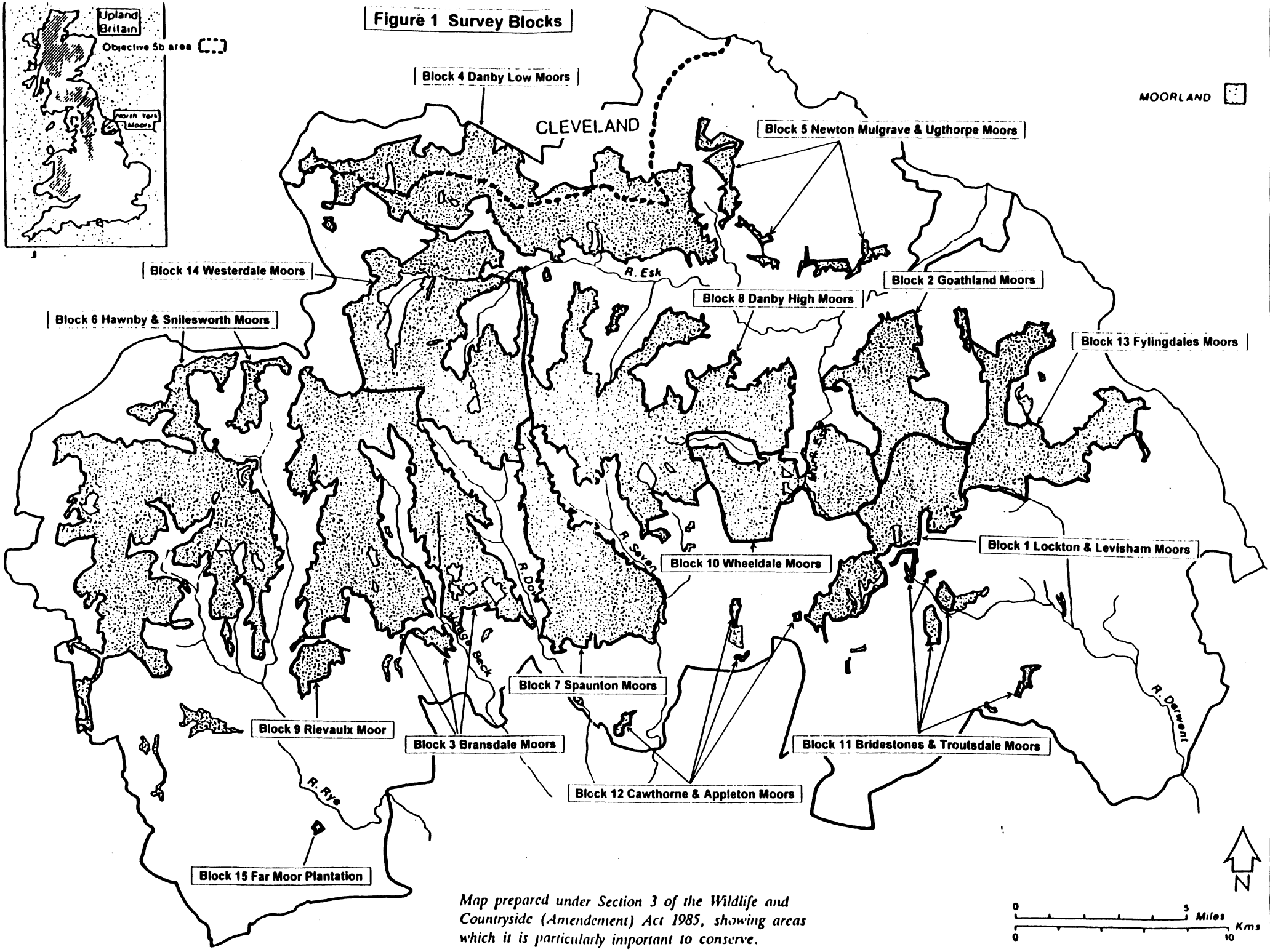
Heather types	Map Code	Definition
Newly burnt	NB	Less than 2 years since a burn
Pioneer	P	Less than 15cm tall
Building	B	15 - 30cm tall
Mature	M	30 - 40cm tall
Degenerate	D	Greater than 40cm tall
Suppressed	S	Heather on exposed sites kept short by climatic conditions or heavy grazing. Usually less than 10cm tall
Blanket bog	BB	Heather on deep peat normally waterlogged
Grassland types		
Agrostis / Festuca	A/F	Species rich grassland dominated by *Agrostis* spp and *Festuca* spp but with a higher proportion of *Agrostis* spp than *Festuca* spp. Will tend to occur on base rich soils
Festuca / Agrostis	F/A	Species rich grassland dominated by *Agrostis* spp and *Festuca* spp but with a higher proportion of *Festuca* spp than *Agrostis* spp. Will tend to occur on acid rich soils
Nardus	Na	Grassland with a greater proportion of *Nardus stricta* than any other grass species
burnt *Molinia*	bM	Grassland with a greater proportion of *Molinia caerulea* than any other grass species which has been burnt within the last year

unburnt *Molinia*	Mo	Grassland with a greater proportion of *Molinia caerulea* than any other grass species which has not been burnt within the last year
Reseeded grassland	Rg	Grassland reseeded with agricultural grass mixtures. Only included where stock have free access from the hill to these areas

Other vegetation

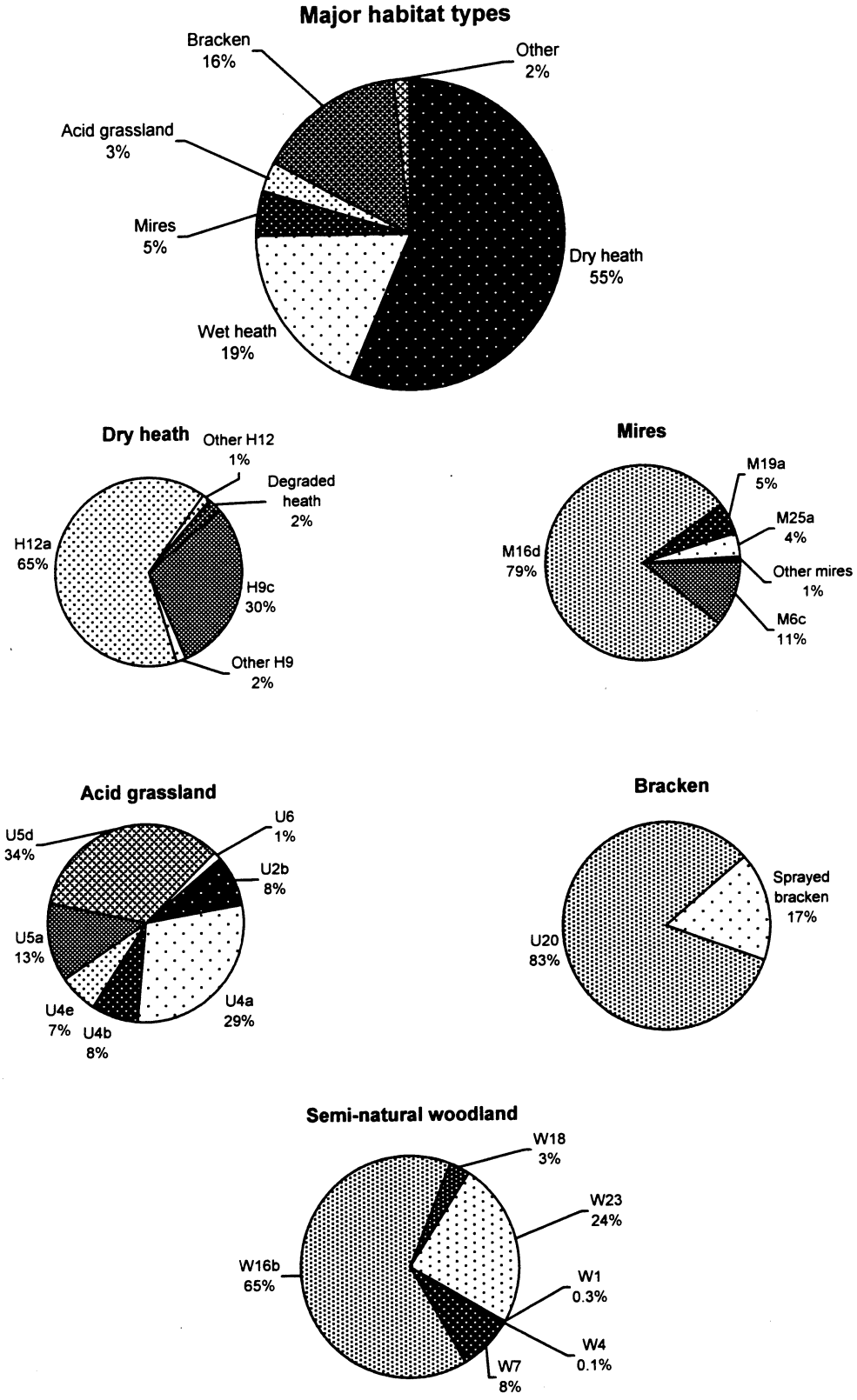
Woodland	W	Areas of woodland which are open to grazing by livestock on the moor
Bracken and *Juncus* spp	Pt, Ju	Areas dominated by these species where heather or the above grasses are absent from the vegetation. Presence of bracken and *Juncus* spp were also recorded where cover of heather was less than 25%

The area of each vegetation type present was measured in hectares using an Abbot Brown Beaminster 1:10,000 hectare (dot) grid.



Map prepared under Section 3 of the Wildlife and Countryside (Amendement) Act 1985, showing areas which it is particularly important to conserve.

Figure 2 Relative proportions of main upland habitat types and communities within the North York Moors



3 RESULTS

3.1 Principal vegetation communities present in the North York Moors

Figure 2 summarises the relative proportions of the main upland vegetation communities within the North York Moors. This shows that the greatest area of vegetation type is represented in descending order by: dry heath (55%), wet heath (19%), bracken (16%), mires (5%), acid grassland (3%) and other vegetation (2%). Figure 2 breaks these down further into NVC types. The details of these types are now discussed below and further area figures are given for each moor and habitat type in Table 2.

3.1.1 Dry Heath

Heaths are largely maintained by man-controlled activities such as by tree clearance, grazing stock, recurrent fires, etc. and this vegetation type is found in moist temperate climates, with mild winters with at least 4 months of the year where the mean temperature is above 10°C. They are generally formed on free-draining acid silaceous soils which develop a distinctive layered structure in the soil known as a *podsol*. At the surface there is a thin layer of peaty soil, below this there is a pale leached layer, where the minerals in the soil have been washed downwards by rainfall. The minerals accumulate at lower soil levels and may form an impervious 'iron-pan'. Heaths are usually covered by a closed canopy of dwarf shrubs from the heather family.

On the North York Moors dry heath accounts for 55% (26,500ha) of the total moorland area (Table 2 and Figure 2) and forms the main land cover on the western, southern and central moors and Lockton and Levisham Moors (Table 3). Two vegetation communities predominate: **H9c *Calluna vulgaris – Deschampsia flexuosa* heath, species-poor sub-community** (heather - wavy hair-grass heath, species-poor sub-community) and **H12a *Calluna vulgaris – Vaccinium myrtillus* heath, *Calluna vulgaris* sub-community** (heather - bilberry heath, heather sub-community). Both these communities tend to be very species-poor and are often virtually mono-cultures of heather *Calluna vulgaris*. In the H9 heather - wavy hair-grass heath almost no species other than heather are present, whilst in the H12 heather - bilberry heath, bilberry *Vaccinium myrtillus* is occasional to frequent in the sward, but other species tend to be scarce. A variant of the heather - bilberry heath is found where bracken has been eradicated by spraying, here bilberry predominates, sometimes with frequent cowberry *Vaccinium vitis-idaea*.

H12 heather - bilberry heath predominates on the western and central moors, where dry heath is the principal vegetation type present. The main vegetation type on the eastern and northern moors (Fylingdales Moor, Goathland Moor, Danby Low Moor and Newton Mulgrave and Ugthorpe Moors), however, is wet heath, and here H9 heather - wavy hair-grass heath is the dominant dry heath community. Rievaulx Moor is a notable exception to this trend. The H9 heather - wavy hair-grass heath community also tends to be found on the thinnest, fastest draining soils, often on the tops of ridges and hills, both within stands of H12 heather - bilberry dry heath and wet heath.

3.1.2 Wet Heath

Wet heath vegetation is similar to that of dry heath, in that it is dominated by dwarf shrubs of the heather family. However, this vegetation occurs on moister, somewhat impervious, soils, which favours cross-leaved heath *Erica tetralix* and other wetland plants over heather. Wet heath is a type of mire. Figure 3 shows the European distribution of cross-leaved heath, which is confined to the Atlantic seaboard, and reflects the similar restriction of wet and dry heath within Europe to this region.

Table 2 Areas of vegetation communities present on the North York Moors (ha)

NVC Community	Lockton & Levisham Moors	Goathland Moors	Bransdale Moors	Danby Low Moors	Newton Mulgrave Moors	Hawnby & Snilesworth Moors	Spaunton Moors	Danby High Moors	Reivaulx Moor	Wheeldale Moors	Bridestones & Troutsdale Moors	Cawthorne & Appleton Moors	Fylingdales Moors	Westerdale Moors	Far Moor Plantation	NVC Community	**Total Area (ha)**	Percentage of total area	Percentage of habitat
Dry Heath															**Dry Heath total**		**26,502.8**		
H9a									14.0							H9a	**14.0**	0.030	0.05
H9c	635.1	306.3	65.4	1,825.3	96.6	2,367.8	214.0	207.8	315.3	1,194.4	47.6		386.5	171.3		H9c	**7,833.3**	16.648	29.56
H9d				40.8		162.8				42.5			17.6	1.5		H9d	**265.2**	0.564	1.00
H9e				42.9		7.7										H9e	**50.6**	0.108	0.19
H10a	5.0	3.5	18.8							7.6						H10a	**34.9**	0.074	0.13
H12a	660.5	148.8	4,323.5	249.7	13.3	2,324.8	1,696.8	3,854.3	15.0	521.5	52.2		7.6	3,271.0	6.0	H12a	**17,145.0**	36.439	64.69
H12c			35.1	8.1	12.4	146.0		43.7		23.0	5.2			77.0		H12c	**350.5**	0.745	1.32
H9/M19						130.6										H9/M19	**130.6**	0.278	0.49
H12/M25												30.9				H12/M25	**30.9**	0.066	0.12
H12/U6						130.0										H12/U6	**130.0**	0.276	0.49
Eroded Heath			59.0			19.0		379.0		23.8			10.0	25.0		Eroded Heath	**515.8**	1.096	1.95
Peat extraction								2.0								Peat extraction	**2.0**	0.004	0.01
Wet Heath															**Wet Heath total**		**8,720.6**		
M16a	7.2															M16a	**7.2**	0.015	0.07
M16d	334.1	1,437.4	585.9	2,216.7	183.7	299.8	674.2	541.9		280.3	54.9		2,079.6	24.9		M16d	**8,713.4**	18.519	79.37
Other Mires															**Other Mires total**		**2,258**		
M4						1.4										M4	**1.4**	0.003	0.01
M6c	5.9	26.5	306.6	214.6	7.4	99.0	63.6	162.1		27.3			32.1	233.0		M6c	**1,178.0**	2.504	10.73
M6d				5.1												M6d	**5.1**	0.011	0.05
M10a	2.3		1.5							4.8						M10a	**8.6**	0.018	0.08
M18a	54.5															M18a	**54.5**	0.116	0.50
M19a	10.6	2.3	328.9	0.5		3.0	10.0	59.9		7.0	10.5			127.3		M19a	**559.9**	1.190	5.10
M21	2.3															M21	**2.3**	0.005	0.02
M23a	9.5					1.4										M23a	**10.9**	0.023	0.10
M25a	48.3	13.6	39.6	112.3	117.1	10.5	5.0	5.4		31.5		19.0	27.3	1.2		M25a	**430.7**	0.915	3.92
M25b		1.8		3.3												M25b	**5.0**	0.011	0.05
M25c	1.6															M25c	**1.6**	0.003	0.01
Acid Grassland															**Acid Grassland total**		**1,472.7**		
U2b			35.4	27.8	0.5	3.1	13.1	5.4			7.7	13.7		9.2	8.0	U2b	**123.9**	0.263	8.41
U4a	55.4	9.3	56.5	40.0	10.0	113.5	45.3	60.5	9.8		2.1			25.2		U4a	**427.6**	0.909	29.03
U4b	27.4	3.3	21.4	28.8	8.3	11.6				1.9		4.8	2.0	2.6	1.8	U4b	**113.7**	0.242	7.72
U4e	8.3		3.3	25.8		51.3		2.0		3.5	3.6					U4e	**97.7**	0.208	6.63
U5a	1.2	19.5	55.8	12.8	24.9	45.2	19.5	4.6						1.0		U5a	**184.4**	0.392	12.52
U5d		7.0	55.4	38.5	41.7	190.1	24.7	79.0		30.8	6.8		6.4	23.9		U5d	**504.2**	1.072	34.24
U6						17.6							3.6			U6	**21.2**	0.045	1.44

Table 2 Areas of vegetation communities present on the North York Moors (ha)

NVC Community	Lockton & Levisham Moors	Goathland Moors	Bransdale Moors	Danby Low Moors	Newton Mulgrave Moors	Hawnby & Snilesworth Moors	Spaunton Moors	Danby High Moors	Reivaulx Moor	Wheeldale Moors	Bridestones & Troutsdale Moors	Cawthorne & Appleton Moors	Fylingdales Moors	Westerdale Moors	Far Moor Plantation	NVC Community	Total Area (ha)	Percentage of total area	Percentage of habitat
Bracken															**Bracken total**		**7,293.9**		
U20	286.5	277.7	692.3	898.0	82.6	1,149.6	492.5	863.0	14.0	248.3	113.9	21.0	329.0	588.0	11.0	U20	**6,067.4**	12.895	83.18
Sprayed Bracken	37.1	4.0	130.1	90.8	1.3	373.8	115.5	205.5		10.1			39.2	219.1		PtS	**1,226.5**	2.607	16.82
Other Habitats																			
Woodland															**Woodland total**		**482.1**		
W1	1.4															W1	**1.4**	0.003	0.29
W4						0.6										W4	**0.6**	0.001	0.12
W7			12.0	6.8			3.0						16.5			W7	**38.3**	0.081	7.94
W16b	16.3	1.5	45.1	4.3	57.6	55.3		41.2		1.0	34.7	8.5	16.5	29.0		W16b	**311.0**	0.661	64.51
W18									14.0							W18	**14.0**	0.030	2.90
W23				3.0	34.7	2.2		4.1				27.0	44.3	1.5		W23	**116.8**	0.248	24.23
Neutral Grassland															**Neutral Grassland total**		**45.1**		
MG1					2.3								0.7			MG1	**3.0**	0.006	6.05
MG6b					1.3									9.3		MG6b	**10.5**	0.022	23.29
MG9												19.3				MG9	**19.3**	0.041	42.81
MG10	1.3		4.4	1.0	1.6							1.8		2.0	0.2	MG10	**12.3**	0.026	27.24
Calcareous grassland															**Calcareous grassland tot.**		**4.5**		
CG7	4.0					0.5										CG7	**4.5**	0.010	9.08
Swamp															**Swamp total**		**7.6**		
S4	1.1															S4	**1.1**	0.002	4.67
S7	1.6															S7	**1.6**	0.003	6.71
S11	1.9															S11	**1.9**	0.004	8.14
Open Water	0.3						0.5			0.3	1.0		1.0			OW	**3.0**	0.006	12.98
Open vegetation																			
OV24					1.4								0.7			OV24	**2.1**	0.004	9.09
OV27					1.5								0.7			OV27	**2.2**	0.005	9.52
Improved grassland	23.0	4.6	9.5			1.0		4.0		35.3						Improved grassland	**77.4**	0.164	72.58
Semi-improved grassland			27.5							1.8						Semi-improved grassland	**29.2**	0.062	27.42
Plantation	23.7		4.5	1.8	8.6	7.4	12.0	0.5				6.0	4.5			Plantation	**68.9**	0.146	81.15
Felled plantation												16.0				Felled plantation	**16.0**	0.034	18.85
Rhododendron						2.2										Rhodo-dendron	**2.2**	0.005	9.52
Arable						12.1										Arable	**12.1**	0.026	52.36
Bare ground	12.0		10.9	3.0		2.0										Bare ground	**27.9**	0.059	51.28
Quarry		1.5		3.1		21.9										Quarry	**26.5**	0.056	48.72
Totals	**2,279.0**	**2,268.5**	**6,928.2**	**5,904.5**	**708.5**	**7,764.8**	**3,389.7**	**6,525.9**	**382.0**	**2,496.5**	**340.2**	**168.0**	**3,025.8**	**4,842.8**	**27.0**	**Totals**	**47,051.4**	**100.000**	

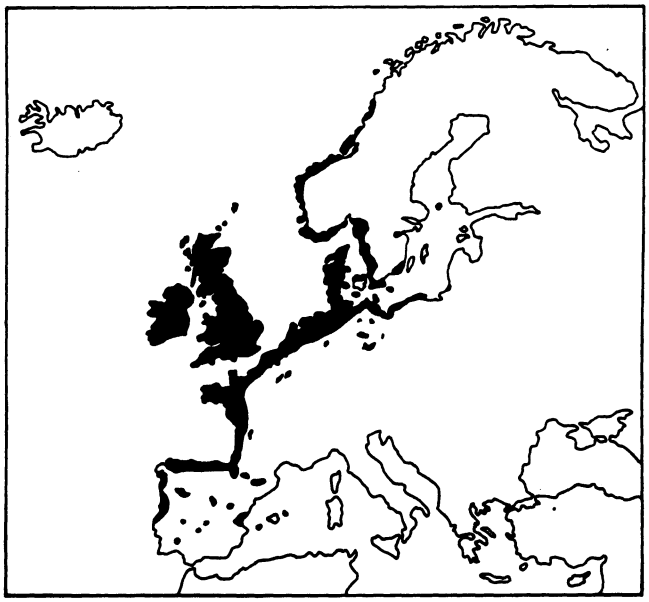


Figure 3 European distribution of cross-leaved heath *Erica tetralix*

From Polunin & Walters (1985), by permission of Oxford University Press

Wet heath is the second most extensive habitat type in the North York Moors, covering almost 20% (8,700ha) of the moorland (Table 2 and Figure 2). This habitat is found mainly on the eastern and northern moors (Fylingdales Moor, Goathland Moor, Danby Low Moor and Newton Mulgrave and Ugthorpe Moors; Table 3) where it forms extensive stands. On both Fylingdales Moor and Goathland Moors wet heath is the dominant habitat type, with dry heath being largely confined to the driest soils on hill tops and ridges.

The wet heath of the North York Moors belongs to the **M16d *Erica tetralix* – *Sphagnum compactum* wet heath, *Juncus squarrosus* – *Dicranum scoparium* sub-community** (cross-leaved heath - bog-moss wet heath, heath rush - *Dicranum* moss sub-community). Heather *Calluna vulgaris* tends to be dominant in this vegetation, with cross-leaved heath *Erica tetralix* varying in abundance from occasional to abundant. Both purple moor-grass *Molinia caerulea* and heath rush *Juncus squarrosus* can be occasional to abundant within stands of wet heath. Mosses, including the bog-moss *Sphagnum compactum* tend to be no more than occasional, except in the wettest stands.

In some areas on the Moors it has been noted that cross-leaved heath tends to be favoured following burning but tends to be replaced subsequently by heather. The reasons for this phenomenon are not clear. It is most likely due to the better regenerating abilities of cross-leaved heath (Rodwell 1991b) or it may be due to bitumisation of the peat following a fire leading to locally wetter conditions for a short period, which favour cross-leaved heath. Such changes emphasise the dynamic nature of certain of the vegetation communities as well as the difficulties in differentiating between wet and dry heath in some areas.

3.1.3 Mires

Mires are characterised by poor drainage and often by the accumulation of peat - plant material which fails to breakdown completely in oxygen starved, water-logged conditions. Mires may form where the surface is flushed by water, or in valleys, where drainage is impeded or along gently sloping watersheds on the highest moors. The latter are known as *blanket bogs*. Mires cover 5% (2,258ha) of the North York Moors (Table 2 and Figure 2). These areas are typically dominated by plants which can tolerate water-logged soil conditions, including bog mosses. Mires are usually rich in insect life and these insects form a vital component of the diet of moorland birds, including grouse.

Two mire types are commonly present on the North York Moors. Along the main watershed of the high moors areas of blanket bog are present (550ha, Table 2 and Figure 2). These bogs lie on deep peat, as shown by occasional abandoned and existing peat workings on Danby High Moor, where a depth of two to three metres of peat has been exposed. These blanket bogs tend to be dominated by heather *Calluna vulgaris*, with frequent hare's-tail cotton grass *Eriophorum vaginatum* and common cotton grass *E. angustifolium*. Bog-mosses *Sphagnum* species are only occasional and other mire species are scarce. By far the largest area of blanket bog in the North York Moors is to be found at the northern end of Bransdale Moor. This, and other areas of blanket bog in the North York Moors, belongs to the **M19a *Calluna vulgaris – Eriophorum vaginatum* blanket mire, *Erica tetralix* sub-community** (heather - hare's-tail cotton grass blanket mire, cross-leaved heath sub-community) community.

The other common mire type found on the moors is **M6c *Carex echinata – Sphagnum recurvum/auriculatum* mire, *Juncus effusus* sub-community** (star sedge - bog-moss mire, soft rush sub-community). This is the principal flush community on the moors, occurring along both seepage lines and stream courses. *Juncus effusus* (soft rush) dominates, over a field layer of *Sphagnum recurvum* (bog-moss) and *Polytrichum commune* (*Polytrichum* moss). These flushes tend to be species-poor.

Where there is some base enrichment of the water feeding flushes, more botanically diverse flushes may be found. These belong to the **M10a *Carex dioica – Pinguicula vulgaris* mire, *Carex viridula* ssp. *oedocarpa – Juncus bulbosus* sub-community** (dioecious sedge - common butterwort mire, common yellow-sedge - bulbous rush sub-community). They support a variety of short sedges, together with herbs and mosses. Base-rich flushes are uncommon on the moors, but were recorded on Lockton and Levisham Moors, Bransdale Moor, Wheeldale Moor, Goathland Moor and Fylingdales Moor, generally on steep valley sides where beds of limestone lie close to the surface.

M25a *Molinia caerulea – Potentilla erecta* mire, *Erica tetralix* sub-community (purple moor-grass mire, cross-leaved heath sub-community) is largely confined to small peripheral stands on most moors. On the low lying Newton Mulgrave and Ugthorpe Moors, however, it is one of the main vegetation communities present and also forms large stands on lower lying areas of Danby Low Moor, particularly on Liverton and Waupley Moors. This community is often dominated by purple moor-grass *Molinia caerulea* almost to the exclusion of other species, though both tormentil *Potentilla erecta* and cross-leaved heath *Erica tetralix* can be frequent.

3.1.4 Bracken

Bracken forms extensive stands on the steep valley sides that characterise the North York Moors and is the third most extensive habitat type present, covering 15% (7,200ha) of the moorland (Table 2 and Figure 2). These stands tend to be species-poor, with only bracken *Pteridium aquilinum* present, over a sparse field layer of grasses and, occasionally, bilberry *Vaccinium myrtillus*. These stands belong to the **U20 *Pteridium aquilinum - Galium saxatile* community** (bracken - heath bedstraw community). While they are generally species-poor these stands can in places support uncommon species such as dwarf cornel *Cornus suecica* and chickweed wintergreen *Trientalis europaea* as well as relict woodland species such as bluebell *Hyacinthoides non-scripta*.

3.1.5 Acid Grassland

These are grasslands which occur on acid soils (pH of less than 5.5). This type of grassland is generally species-poor and often grades into dry or wet heath. Stands of acid grassland are not extensive on the moors, being largely confined to peripheral areas, often where grazing

pressure either is or has been high. Acid grassland comprises only 3% of the total moorland area (1,500ha; Table 2 and Figure 2) and only exceeds 5% of the area of a Survey Block in two instances, on Newton Mulgrave and Ugthorpe Moors and on Cawthorne and Appleton Moors, both of which are low lying, fragmented Survey Blocks.

Two main types of acid grassland occur on the moors, **U4 *Festuca ovina - Agrostis capillaris - Galium saxatile* grassland** (sheep's fescue - common bent - heath bedstraw grassland) and **U5 *Nardus stricta - Galium saxatile* grassland** (mat-grass - heath bedstraw grassland). The former is characterised by abundant common bent *Agrostis capillaris* and sheep's fescue *Festuca ovina* and tends to be found on well drained soils, while the latter is dominated by mat-grass *Nardus stricta* and is found on less well drained gleyed soils. Where these communities are present on unenclosed moor they have generally been derived from heath communities via grazing.

The gradation between heath and grassland communities can be seen in the presence of grassy sub-communities of the two principal dry heath communities (**H9d *Calluna vulgaris - Deschampsia flexuosa heath, Galium saxatile* sub-community** [heather - wavy hair-grass heath, heath bedstraw sub-community] and **H12c *Calluna vulgaris - Vaccinium myrtillus* heath, *Galium saxatile - Festuca ovina* sub-community** [heather - bilberry heath, heath bedstraw - sheep's fescue sub-community]) and the heathy sub-communities of the grassland communities (**U4e *Festuca ovina – Agrostis capillaris – Galium saxatile* grassland, *Vaccinium myrtillus – Deschampsia flexuosa* sub-community** [sheep's fescue - common bent - heath bedstraw grassland, bilberry - wavy hair-grass sub-community] and **U5d *Nardus stricta – Galium saxatile* grassland, *Calluna vulgaris – Danthonia decumbens* sub-community** [mat-grass - heath bedstraw grassland, heather - heath grass sub-community]). This latter sub-community is the predominant type of mat-grass - heath bedstraw grassland found on the moors.

3.1.6 Other Grassland

Around the edges of the moors and in enclosures improved and semi-improved grasslands can be found, though generally these areas were excluded from the survey area. These grasslands tend to have abundant ryegrass *Lolium perenne* and crested dog's-tail *Cynosurus cristatus*, with frequent white clover *Trifolium repens* and sweet vernal-grass *Anthoxanthum odoratum*. They tend to belong either to the slightly acidic **MG6b *Anthoxanthum odoratum* sub-community** of the **MG6 *Lolium perenne – Cynosurus cristatus* grassland** (ryegrass - crested dog's-tail grassland, sweet vernal-grass sub-community) or the somewhat agriculturally improved **U4b *Holcus lanatus – Trifolium repens* sub-community** of the **U4 *Festuca ovina – Agrostis capillaris – Galium saxatile* grassland** (sheep's fescue - common bent - heath bedstraw grassland, Yorkshire fog - white clover sub-community). More agriculturally improved swards belong to the **MG6a *Lolium perenne – Cynosurus cristatus* grassland, typical sub-community** (ryegrass - crested dog's-tail grassland, typical sub-community).

Other neutral grasslands found on peripheral areas of moorland include the damp **MG9 *Holcus lanatus – Deschampsia cespitosa* grassland** (Yorkshire fog - tufted hair-grass grassland) and **MG10 *Holcus lanatus – Juncus effusus* rush pasture** (Yorkshire fog - soft rush rush pasture) and the **MG1 *Arrhenatherum elatius* coarse grassland** (false oat-grass coarse grassland) which tends to be found where there has been some disturbance.

Small areas of limestone grassland **CG7 *Festuca ovina – Hieracium pilosella – Thymus praecox* grassland** (sheep's fescue - mouse-eared hawkweed - thyme grassland) are present

on two moors, Hawnby and Snilesworth Moors and Lockton and Levisham Moors where limestone strata are exposed.

3.1.7 Woodland

Woodland covered 1% (482.1ha) of the moorland area surveyed (see Table 2) although these figures should be used with some caution since they consist largely of scattered small areas of gill-side woodland. Many of the larger woodland blocks (both conifer and broadleaved) adjacent to the main moorland areas were not included in the survey.

Stands of **W16 *Quercus* spp – *Betula* spp – *Deschampsia flexuosa* woodland** (oak - birch - wavy hair-grass woodland) are found on many of the steep sides of the valleys that dissect and delineate the moors. These woods tend to have groundfloras of bilberry *Vaccinium myrtillus* and wavy hair-grass *Deschampsia flexuosa.* Along streams narrow bands of **W7 *Alnus glutinosa – Fraxinus excelsior – Lysimachia nemorum* woodland** (alder - ash - yellow pimpernel woodland) alder woodland can also be present. Stands of **W23 *Ulex europaeus – Rubus fruticosus* scrub** (common gorse - bramble scrub) are present on the margins of low lying moors. Other woodland types are extremely scarce.

3.2 Trends across the North York Moors

There is no doubt that there are a number of complicating and confounding factors affecting the vegetation communities present across the moors. The greatest differences between the various moors appears to be determined by the degree of wetness on the moor, which in turn is determined by local geology, soil type and local weather conditions.

Table 3 attempts to gain a measure of these differences by listing the moors by the percentage of area dominated by either 'wet heath' and/or 'mire' and ranking them from the 'drier' to the 'wettest' moors. This ranking is further shown visually in Figure 4, with a further breakdown of habitat types.

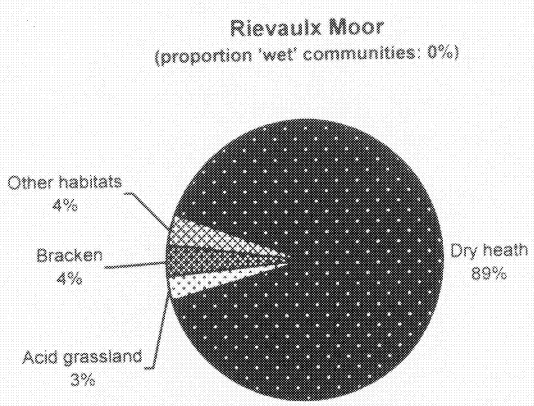
The results of this ranking on the wetter vegetation types does seem to reflect some of the broad differences traditionally said about the moors such as some of the northern moors (such as Newton Mulgrave and Ugthorpe, Danby Low Moors) and eastern moors (such as Goathland, Fylingdales and Bridestones/Troutsdale Moors) demonstrating wetter tendencies than the central moors (Westerdale, Danby High, Wheeldale Moors), southern moors (Rievaulx, Bransdale and Spaunton Moors) and western moors (Hawnby and Snilesworth Moors).

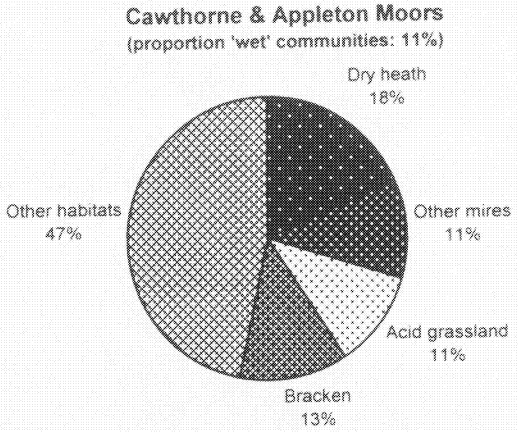
Figure 5, gives a more detailed breakdown of the types of dry heath found across the moors and is presented geographically running approximately west to east across the page.

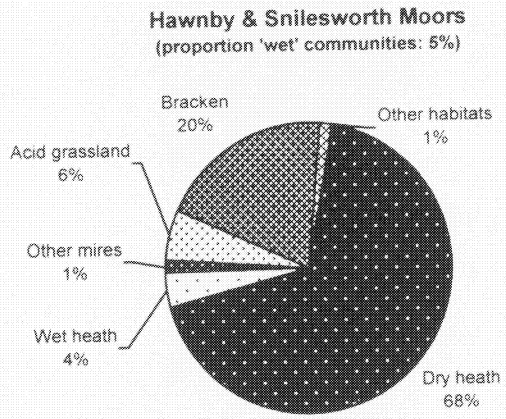
Figure 6 gives a more detailed breakdown of the types of mire communities found across the moors and again is presented geographically running west to east across the page.

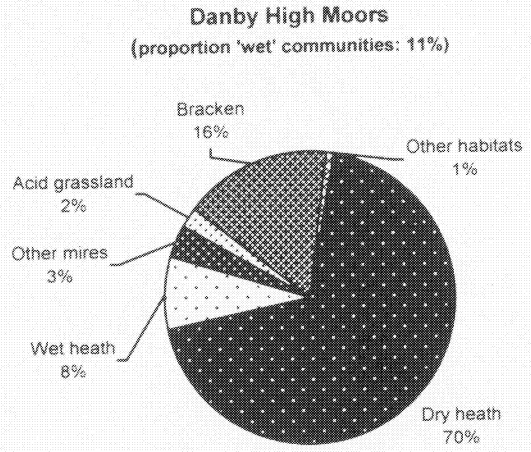
Figure 7 gives a more detailed breakdown of the proportion of bracken recorded as being sprayed within each main survey block and again is presented geographically running west to east across the page. These figures are given as accurate as is possible although in some cases where bracken spraying has been carried out some years ago and the vegetation has recovered to dwarf shrub heath (such as bilberry) it is not always easy to tell which areas are recently 'reclaimed' or old original dwarf shrub heath.

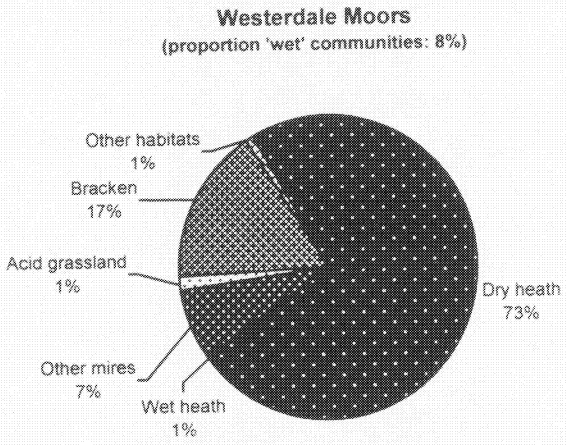
Figure 4 Relative proportions of main habitat types in Survey Blocks
(ordered by proportion of 'wet' communities present - see Table 3)

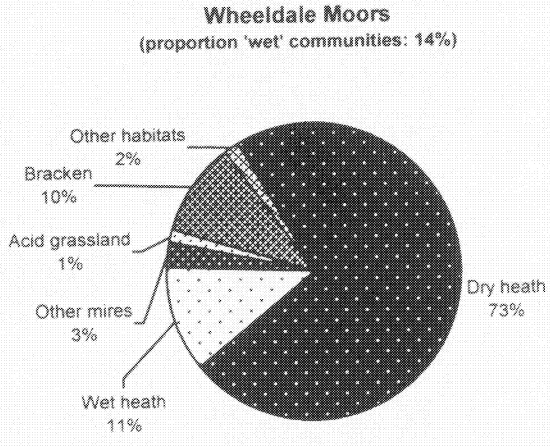




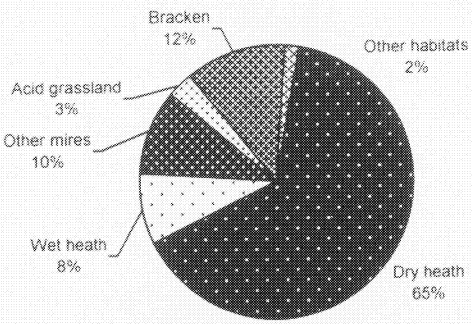




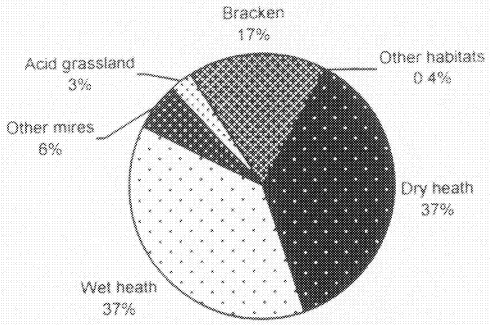




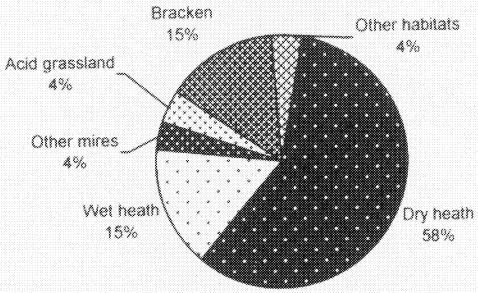
Bransdale Moors
(proportion 'wet' communities: 18%)



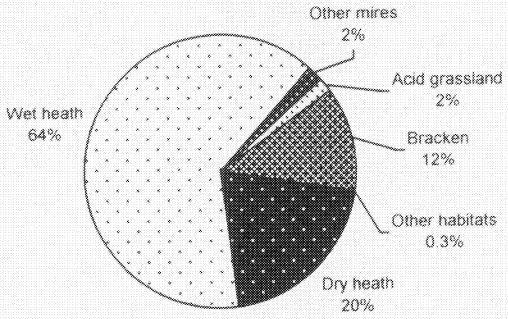
Danby Low Moors
(proportion 'wet' communities: 43%)



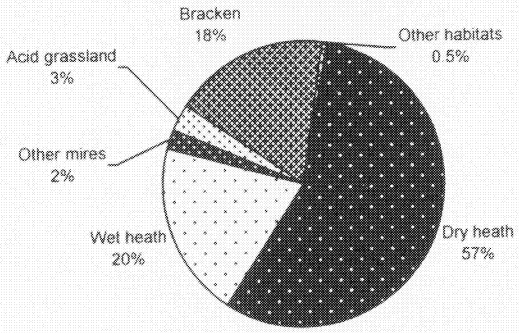
Lockton & Levisam Moors
(proportion 'wet' communities: 19%)



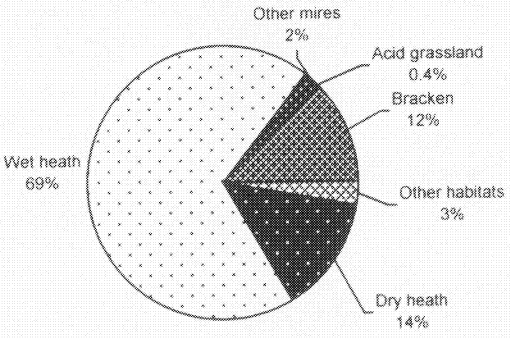
Goathland Moors
(proportion 'wet' communities: 66%)



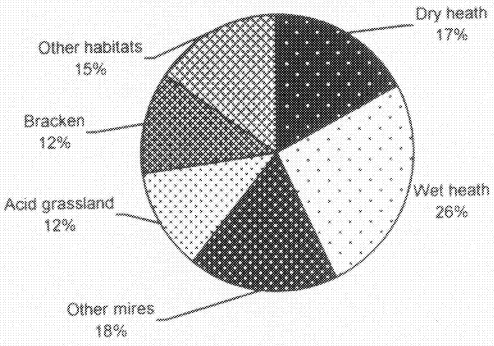
Spaunton Moors
(proportion 'wet' communities: 22%)



Fylingdales Moors
(proportion 'wet' communities: 71%)



Newton Mulgrave & Ugthorpe Moors
(proportion 'wet' communities: 43%)



Bridestones & Troutsdale Moors
(proportion 'wet' communities: 85%)

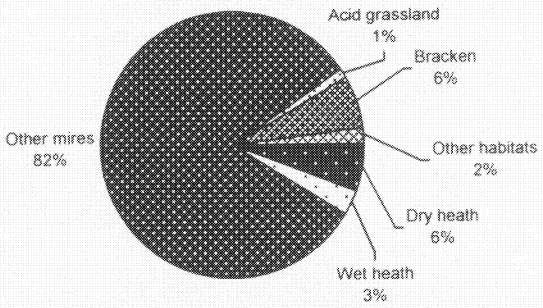
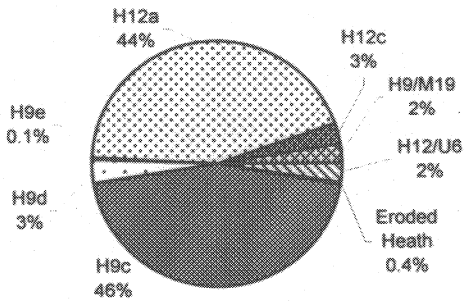
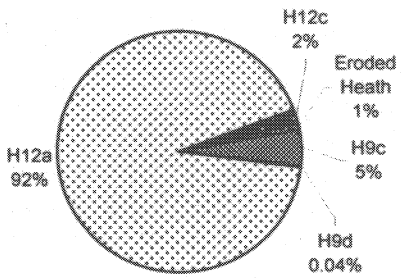


Figure 5 Relative proportions of dry heath communities in main Survey Blocks
(ordered from west to east)

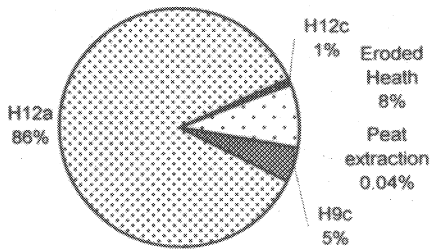
Hawnby & Snilesworth Moors Dry Heath



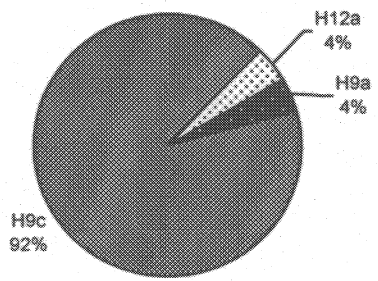
Westerdale Moors Dry Heath



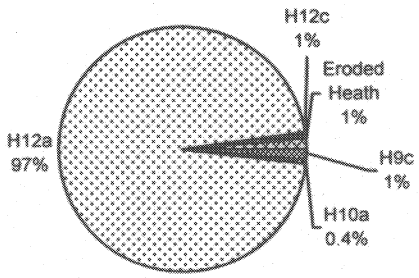
Danby High Moors Dry Heath



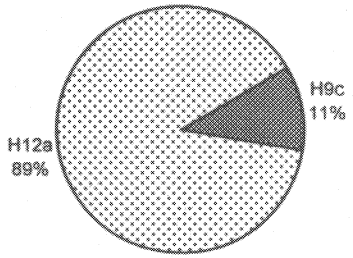
Rievaulx Moor Dry Heath



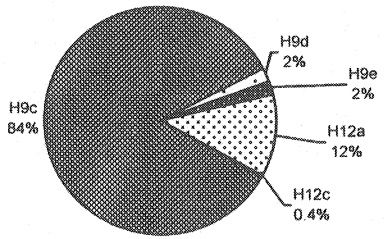
Bransdale Moors Dry Heath



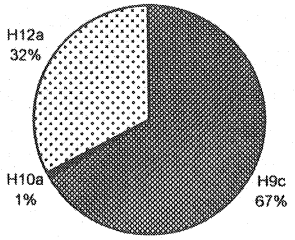
Spaunton Moors Dry Heath



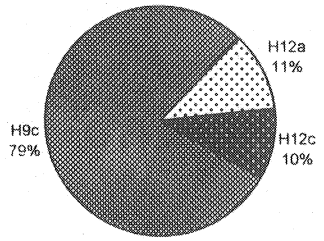
Danby Low Moors



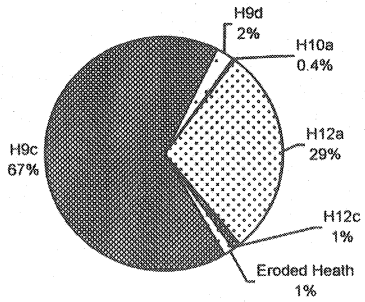
Goathland Moors Dry Heath



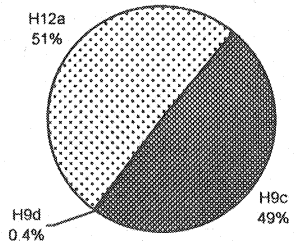
Newton Mulgrave & Ugthorpe Moors Dry Heath



Wheeldale Moors Dry Heath



Lockton & Levisham Moors Dry heath



Fylingdales Moor Dry Heath

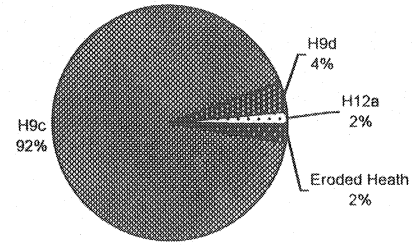
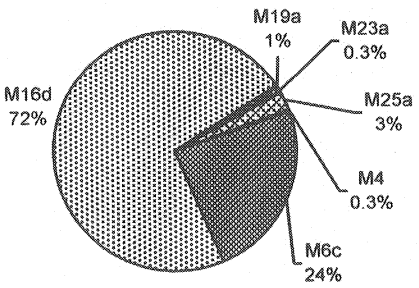
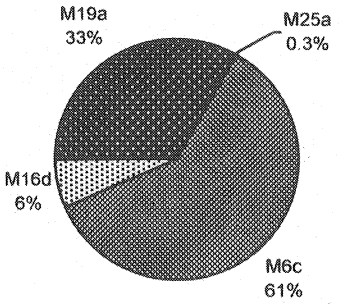


Figure 6 Relative proportions of mire communities in main Survey Blocks
(ordered from west to east)

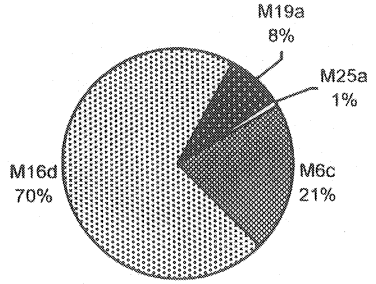
Hawnby & Snilesworth Moors Mires



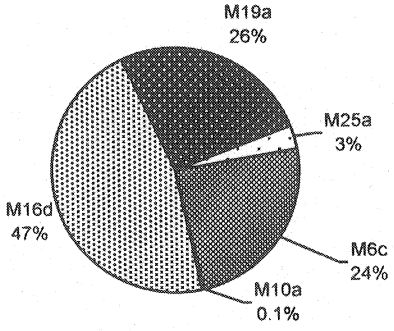
Westerdale Moors Mires



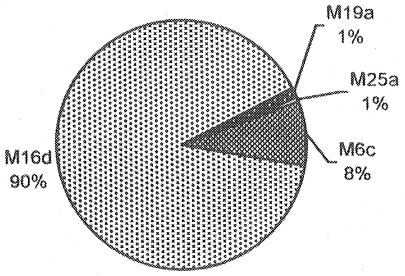
Danby High Moors Mires



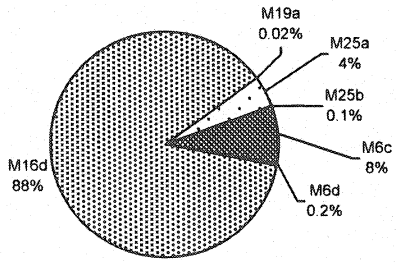
Bransdale Moors Mires



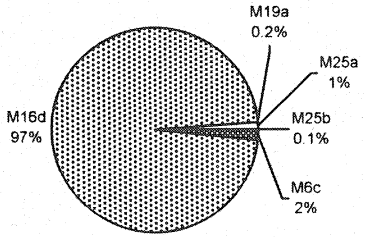
Spaunton Moors Mires



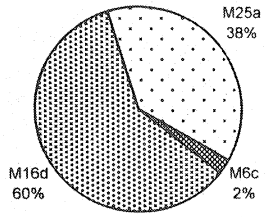
Danby Low Moors Mires



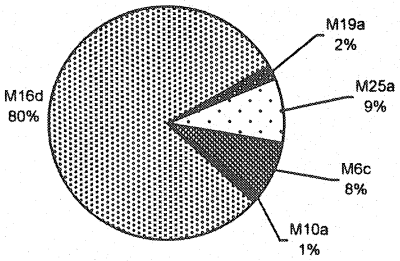
Goathland Moors Mires



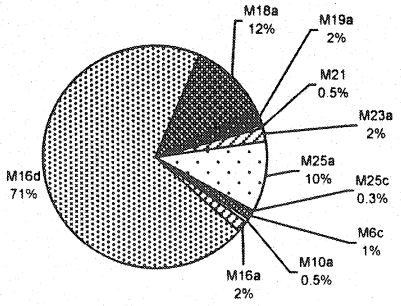
Newton Mulgrave & Ugthorpe Moors Mires



Wheeldale Moors Mires



Lockton & Levisham Moors Mires



Fylingdales Moors Mires

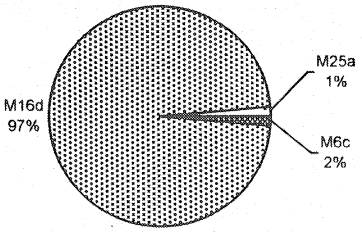
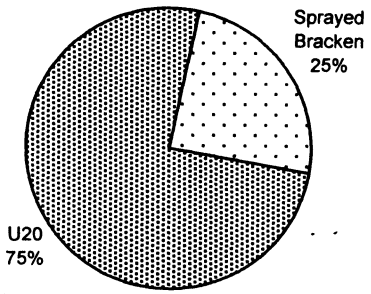
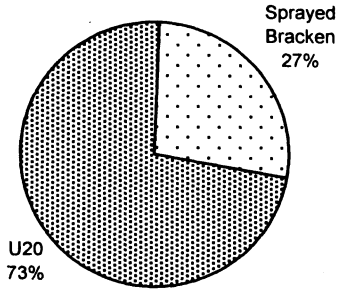


Figure 7 Proportion of bracken recorded as sprayed in main Survey Blocks

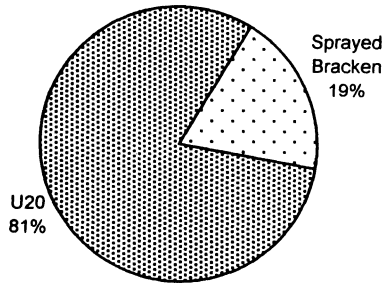
Hawnby & Snilesworth Moors Bracken



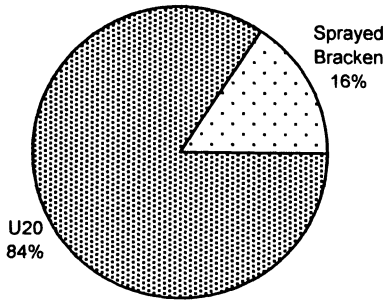
Westerdale Moors Bracken



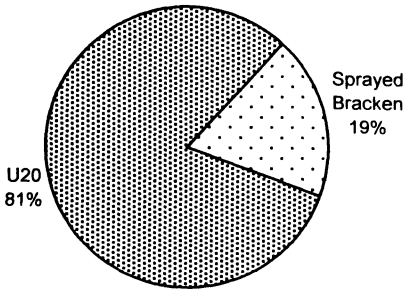
Danby High Moors Bracken



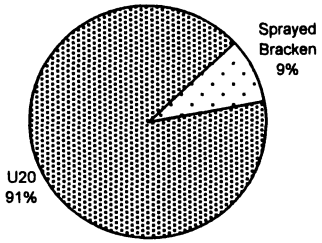
Bransdale Moors Bracken



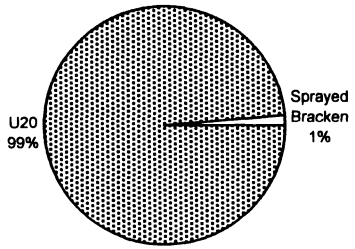
Spaunton Moors Bracken



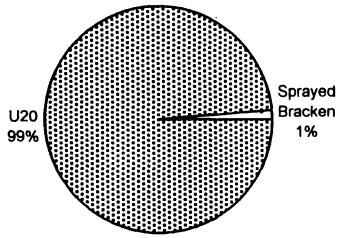
Danby Low Moors Bracken



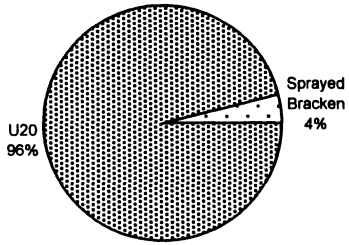
Goathland Moors Bracken



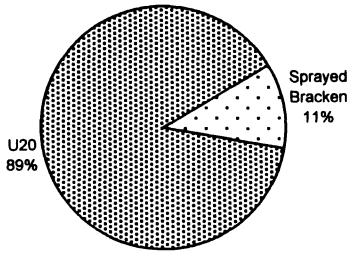
Newton Mulgrave & Ugthorpe Moors Bracken



Wheeldale Moors Bracken



Lockton & Levisham Moors Bracken



Fylingdales Moors Bracken

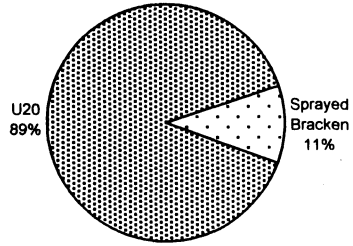


Table 3 Proportions of "wet" and "dry" habitats in Survey Blocks (& management practices) (arranged in order of increasing wetness)

Block	Upland Breeding Wader Survey Sector	% of moor composed of "wet" habitats (b+c)	Dry Heath (a)	Wet Heath (b)	Other Mires (c)	Keepered	Burnt	Grazed	Common Land
9 Rievaulx	South	0%	89%	0%	0%	✓	✓	x	x
6 Hawnby & Snilesworth	West	5%	68%	4%	1%	✓	✓	✓	small part
14 Westerdale	Central	8%	73%	1%	7%	✓	✓	✓	✓
8 Danby High	Central	11%	70%	8%	3%	✓	✓	✓	✓
12 Cawthorn & Appleton	Central	11%	18%	11%	0%	part	x	✓	x
10 Wheeldale	Central	14%	73%	11%	3%	✓	✓	✓	part
3 Bransdale	South	18%	65%	8%	10%	✓	✓	✓	part
1 Lockton & Levisham	East	19%	58%	15%	4%	part	✓+ cut	✓	✓
7 Spaunton	South	22%	57%	20%	2%	✓	✓	✓	✓
5 Newton Mulgrave & Ugthorpe	North	43%	17%	26%	18%	✓	x	✓	part
4 Danby Low	North	43%	37%	37%	6%	✓	✓	✓	part
2 Goathland	East	66%	20%	64%	2%	part	✓+ cut	✓	✓
13 Fylingdales	East	71%	14%	69%	2%	part	✓+ cut	✓	✓
11 Bridestones & Troutsdale	East	85%	6%	3%	82%	x	x	x	x

3.3 The international and national importance of the North York Moors vegetation communities

The North York Moors have been recognised as of international importance for their upland bird communities and have been proposed as a Special Protection Area (SPA) for this reason since the mid-1980s. However, until now there has never been any overall assessment of the importance of the vegetation communities in a international or national context.

Table 4 reviews the international and national important NVC vegetation types represented within the North York Moors. The table shows 2 sub-tables. The first sub-table (1a) shows those communities which are of *international* importance. The second sub-table shows those communities which are of *national* importance. For each community the total area on the moors is given, as well as the percentage of the moorland area, the area of each NVC type within existing Sites of Special Scientific Interest (SSSI) and the percentage of each NVC type found within the North York Moors which is currently found within existing SSSI.

Internationally important communities include some of the wet heaths (M16), some of the mires (M6, M23 and M25) the acid grassland (U6), and areas of more species-rich grassland found within some of the bracken communities (U20). Figure 3 reflects the limited distribution of heaths, particularly wet heath, in Northern Europe.

Nationally important communities include the dry heaths (H9, H10 and H12) and some of the mires (M10, M18 and M19)

Table 3 provides a more complete overview of all of the vegetation communities found in the survey.

Table 4 Internationally and nationally important NVC-types and their representation within current SSSIs in the North York Moors (after Drewitt and Manley 1997)

a) Internationally important NVC-types found only in the UK or rare elsewhere internationally (listed by habitat in descending order of occurrence)

NVC Type	International/ National Status*	Total Area (ha)	Percentage of Total Moorland Area	Area (ha) of each NVC type within existing SSSIs	Percentage of each NVC type within existing SSSIs
Wet Heaths					
M16	UK/EC	8,720	17.0%	c. 2,180	25.0%
Other Mires					
M6	-	1,183	2.5%	82	6.9%
M25	-	437	0.93%	33.5	7.7%
M23	-	11	0.02%	0	0
Acid Grasslands					
U20	-	6,067	13.0%	444	7.3%
U6	UK	21	0.05%	3.6	17.1%

b) Nationally important NVC-types especially well developed in the UK but found elsewhere (listed by habitat in descending order of occurrence)

NVC Type	International/ National Status*	Total Area (ha)	Percentage of Total Moorland Area	Area (ha) of each NVC type within existing SSSIs	Percentage of each NVC type within existing SSSIs
Dry Heaths					
H12	I/EC	c. 17,496	37.0%	735	4.2%
H9	I/EC	8,163	17.4%	413	5.1%
H10	I/EC	35	0.05%	3	8.6%
Other Mires					
M19	I/EC	560	1.2%	55	9.8%
M18	I/EC	54.5	0.1%	0	0
M10	-	8.6	0.02%	0.25	2.9%

* after Thompson *et al.* (1995)

I = communities which are localised internationally, but especially well developed in the UK

EC = communities which are listed under EC Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Fauna and Flora

UK = communities which have no or rare close affinities outside the UK and Ireland

See Table 2 for key to NVC-types

Table 5 Summary of vegetation communities present on the North York Moors and their regional importance

NVC Community		Total Area (ha)	Importance*		
			International	National	Regional
Dry Heath					
H9	Calluna vulgaris – Deschampsia flexuosa heath	8,163.1		✓	
H10	Calluna vulgaris – Erica cinerea heath	34.9		✓	
H12	Calluna vulgaris – Vaccinium myrtillus heath	17,495.5		✓	
Wet Heath					
M16	Erica tetralix – Sphagnum compactum wet heath	8,720.6	✓		
Other Mres					
M4	Carex rostrata – Sphagnum recurvum mire	1.4			✓
M6	Carex echinata – Sphagnum recurvum/auriculatum mire	1183.1	✓		
M10	Carex dioica – Pinguicula vulgaris mire	8.6		✓	
M18	Erica tetralix – Sphagnum papillosum raised mire	54.5		✓	
M19	Calluna vulgaris – Eriophorum vaginatum blanket mire	559.9		✓	
M21	Narthecium ossffragum – Sphagnum papillosum mire	2.3			✓
M23	Juncus effusus/acutiflorus – Galium palustre rush pasture	10.9	✓		
M25	Molinia caerulea – Potentilla erecta mire	437.3	✓		
Acid Grassland					
U2	Deschampsia flexuosa grassland	123.9			
U4	Festuca ovina – Agrostis capillaris – Galium saxatile grassland	639			
U5	Nardus stricta – Galium saxatile grassland	688.6			
U6	Juncus squarrosus – Festuca ovina grassland	21.2	✓		
Bracken					
U20	Pteridium aquilinum – Galium saxatile community	6,067.4	✓		
Woodland					
W1	Salix cinerea – Galium palustre woodland	1.4			✓
W4	Betula pubescens – Molinia caerulea woodland	0.6			✓
W7	Alnus glutinosa – Fraxinus excelsior – Lysimachia nemorum woodland	38.3			✓
W16	Quercus spp – Betula spp – Deschampsia flexuosa woodland	311.0			✓
W18	Pinus sylvestris – Hylocomnium splendens woodland	14.0			✓
W23	Ulex europaeus – Rubus fruticosus agg. scrub	116.8			
Neutral Grassland					
MG1	Arrhenatherum elatius grassland	3.0			
MG6	Lolium perenne – Cynosurus cristatus grassland	10.5			
MG9	Holcus lanatus – Deschampsia cespitosa grassland	19.3			✓
MG10	Juncus effusus – Holcus lanatus rush pasture	12.3			✓
Calcareous grassland					
CG7	Festuca ovina – Hieracium pilosella – Thymus praecox grassand	4.5			✓
Swamp					
S4	Phragmites australis swamp	1.1			✓
S7	Carex acutiformis swamp	1.6			✓
S11	Carex vesicaria swamp	1.9			✓
Open vegetation					
OV24	Urtica dioica – Galium aparine community	2.1			
OV27	Chamerion angustifolium community	2.2			

* International: communities with no, or rare, equivalents outside the British Isles

National: communities which are especially well developed in the British Isles and which are very local internationally

Regional: communities which are uncommon in the North York Moors

3.4 Results of Heather Condition Survey

3.4.1 Overview

There have been recent attempts to try to define the favourable and unfavourable status of vegetation, in nature conservation terms, within the British uplands by looking at sward composition and structure (Jerram and Drewitt 1998, Macdonald *et al.* 1998). Some of this work has included the North York Moors National Park (Fylingdales Moor). Much of this work is very detailed and examines the general habitat categories of each 1 kilometre square (dry heath, wet heath and blanket bog, etc) and then assesses the optimum condition in relation to a range of criteria which include the degree of grazing and burning. Such a technique would be too time consuming to cover the complete moorland area of the North York Moors.

Whether a moorland is considered as in 'optimum' condition depends very much on the aims of the current management. Management for **sheep grazing** is likely to lead to a decline in heather condition and favour larger burn patterns with very little retention of mature or degenerate heather, so that stock can penetrate the area to graze. Management for **grouse** is likely to favour a mosaic of smaller, regular burns, with some mature and degenerate heather remaining over from delays in the burning rotation. Management for **nature conservation** is likely to favour the mosaic of burns favoured by the grouse moor manager but with more retention of longer-rotation heather (mature and degenerate phases) to favour birds such as merlin, as well as allowing the development of some of the slower growing mosses and lichens on the peat below the heather, and also allowing more structural diversity within the heather to favour some insects. The retention of wetter flushes and avoidance of overgrazed areas and suppressed heather would also be favoured. However, the nature conservationist can have problems with competing interests as well. For example more regular burning may favour wading birds which prefer shorter heather but which may work against birds preferring taller heather, as well as mosses and lichens which prefer the longer rotation heather. Clearly some compromise has to be reached in many areas to cater for all of these competing interests.

Jerram and Drewitt (1998) looking at optimal conditions in pure nature conservation terms, and looking also purely from the vegetation point of view, suggest that all age classes of heather should be present with 33% of any management unit excluded from a burning rotation for dry heath, 50 % of the management unit excluded from burning rotation for wet heath and a no burning policy to be favoured on blanket and raised bogs (the deeper peat areas). Applying these and the other optimal habitat condition requirements set by Jerram and Drewitt to the North York Moors very little of the moorland would be considered to be in optimal condition from a nature conservation and vegetation viewpoint due to the low frequencies and abundance of bryophytes and the lack of dwarf-shrub species, other than heather *Calluna*, over large tracts of moor, together with low proportions of moorland management units excluded from the burning rotation. The only extensive area that would meet the criteria is the MOD 'Radhaz' area (now controlled by Forest Enterprise). Thus, despite the fact that grazing on most of the moors would be considered to be optimal it is the burning frequency on some moors which would be considered to be sub-optimal. It is possible that some fine-tuning may be needed to the criteria to cater for local effects since the North York Moors are very dry and may not favour extensive bryophyte communities even where grazing and burning levels are optimal.

The results from the present heather condition survey under discussion here do not allow a direct comparison of the percentage of unburnt or longer rotation areas into habitat types (eg- dry heath, etc) as required by the Jerram and Drewitt (1998) method, without quite a lot more

analysis since figures of heather management are given for a whole 1 kilometre square containing all habitat types.

Much data was gathered by this survey. To make some sense of this data the results have been summarised into two different graphs for each of the sectors of the Park.(North, East, West, South and Central sectors as in RSPB survey).

Firstly a more detailed examination of the data revealed that each square differed in the amount of **'non-heather vegetation'** (grasses and rushes, bracken and other habitats) present. These differences are shown in the first graph for each sector and the survey squares are ranked on the amount of this 'non-heather vegetation' from the least per square to the left-hand side of each graph to those with the most, on the right-hand side of each graph. It is instructive to examine which of the moorland squares have greater than or equal to 50% of the area as non-heather vegetation.

Secondly, there was substantial variation between each survey square when **heather age structure (heather condition)** was examined. The second graph for each sector examines the heather component only of the first graphs and details the structure/ condition of that heather within each square. For each square the percentage of heather cover is given for the categories of 'newly burnt', 'pioneer', 'building', 'mature', 'degenerate', or 'suppressed'. It is useful to look at the number of moors with greater than or equal to 33% of the heather which has 'not recently been burnt' (i.e. the heather present in the mature, degenerate or suppressed categories). It is also instructive to look at the opposite ends of the scale - at squares which have much active burning management of the heather (i.e. those with the most newly burnt, pioneer and building heather), and particularly where these categories make up greater than or equal to 50% of the heather within a square.

Therefore, with the two above graphs it is now possible, for the first time on the North York Moors for a moorland owner to compare a given moorland square with other squares within and between the different moorland sectors, looking at the percentage of non-heather vegetation (or a component of this such as bracken), as well as the age structure of the heather (heather condition):

3.4.1.1 North Sector

Figure 8a shows the sum of 'non-heather vegetation' within this sector. No squares have just heather alone. All squares have some degree of ' non-heather vegetation'. Square 7 has the least non-heather vegetation running down to the most in square 1. Square 1 is the only square to have greater than 50% of the moor as non-heather vegetation.

Figure 8b examines the structure of the heather with square 1 showing the greatest amount of heather in the older classes and square 3 the least amount. Squares 1,8,4, and 7 all have greater than or equal to 33% of the heather 'not recently burnt'. Square 3 is the most actively managed of the squares within this sector. Square 7 could be considered close to some sort of nature conservation 'ideal' with a mosaic of different heather ages although with a significant amount of suppressed heather which is less ideal.

3.4.1.2 East Sector

Figure 9a shows that squares 91,92 and 93 all consist of heather alone with no non-heather areas. Squares 87, 96 and 83 have the most non-heather habitat with all of these squares having greater than or equal to 50% of the area as non-heather habitat.

Figure 9b clearly demonstrates the less managed nature of the eastern moors with squares 99,83,81,100,84,94,96,98,93,85,97,95,90 and 88 all showing greater than or equal to 33% of the moor 'not recently burnt'. Squares 87,86 and 91 are the most actively burnt. Square 88

could be considered to have the closest to an nature conservation 'ideal' mosaic of heather ages.

3.4.1.3 Central Sector

Figure 10a shows that no squares in this sector have heather alone. Square 19 comes the closest to this state. Squares 13,16,14 and 21 all have greater than or equal to 50% of the moorland area as 'non-heather' habitat.

Figure 10b clearly shows the greater degree of active heather burning on the central moors with squares11,10,38,21,29,31,39,24,35,13,32,16, and 17 all showing greater than or equal to 50% of the heather showing recent management. However, there are quite a few squares showing little recent management with squares 14,27,26 and 20 with greater than or equal to 33% of the heather 'not recently burnt'(i.e. - with mature, degenerate or suppressed heather). Square 19 probably has the best range of different aged heather.

3.4.1.4 West Sector

Figure 11a demonstrates that no squares have heather alone - all have some amount of non-heather habitat present. Squares 44,48 and 55 all have greater than 50% of 'non-heather' habitat.

Figure 11b shows a mixture of under-managed to very actively managed heather squares. Squares 55,48, 53 and 42 all show greater than or equal to 33% of the moor 'not recently burnt' whilst squares 49,47,50,44,52 and 54 all have greater than or equal to 50% of the heather recently burnt. Square 42 appears to show the best combination of heather ages.

3.4.1.5 South Sector

Figure 12a shows that no squares have heather alone - all have some non-heather habitat with squares 73 and 70 with the least non-heather habitat. Squares 62,61,60,80 and 65 all show greater than or equal to 50% of the area as non-heather habitat.

Figure 12b demonstrates a mix of unmanaged and managed heather squares. Squares 65,61 and 78 all have greater than or equal to 33% of the moor 'not recently burnt'. Squares 72,70,74,60,66,67 and 56 all have greater than or equal to 50% of the heather as recently burnt. Square 76 probably has the best range of heather structure.

3.4.2 Summary

From these initial observations it can be seen that the sample squares in all sectors show a range of both heather and non-heather habitats with the northern and western sectors showing the most non-heather habitat. The latter however is more likely to be an artefact of sampling than a genuine trend in the distribution of moorland vegetation types.

The eastern sector has the least recently-managed heather followed by the northern sector. The central and southern sectors have the greater amounts of more recently burnt heather. We can rank the degree of burning on the moorland sectors as follows: eastern (least) < north < west < south < central (most).

Figure 8a: North York Moors Heather Condition Survey: Survey Sector North (sorted by sum of non-heather habitats)

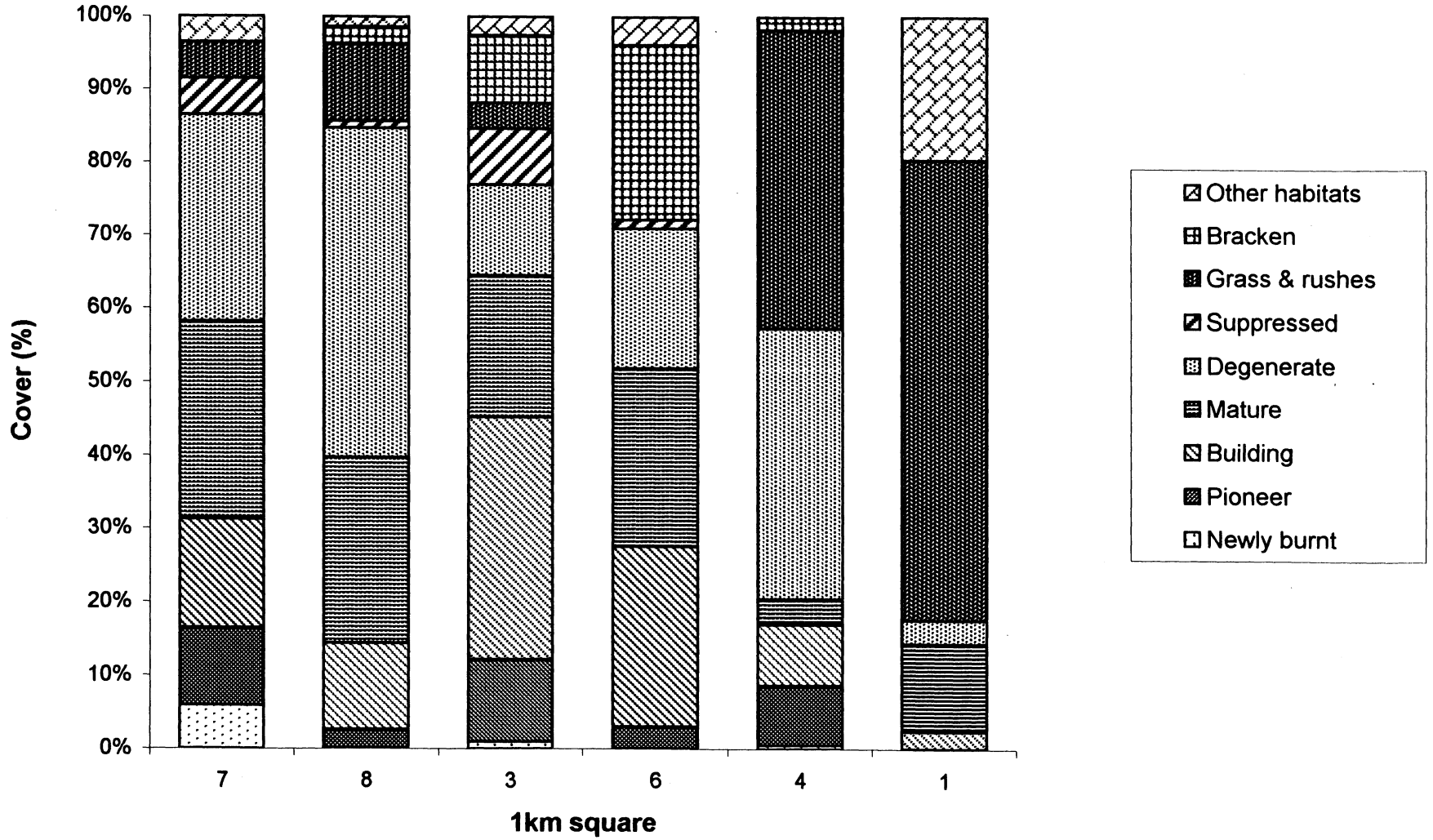


Figure 8b: North York Moors Heather Condition Survey: Survey Sector North
(heather classes sorted by sum of % cover mature, degenerate and suppressed heather)

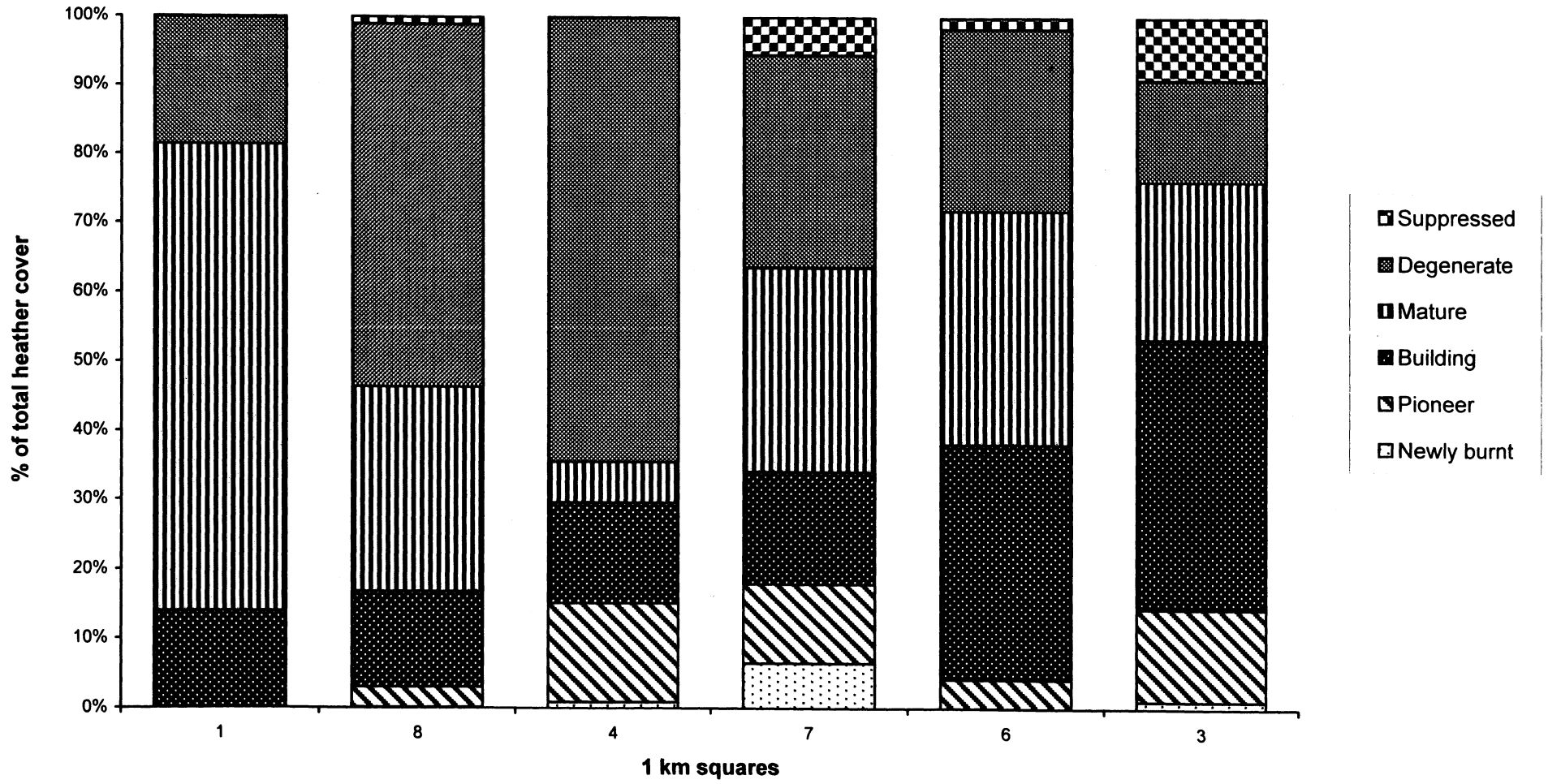


Figure 9a: North York Moors Heather Condition Survey: Survey Sector East (sorted by sum of non-heather habitats)

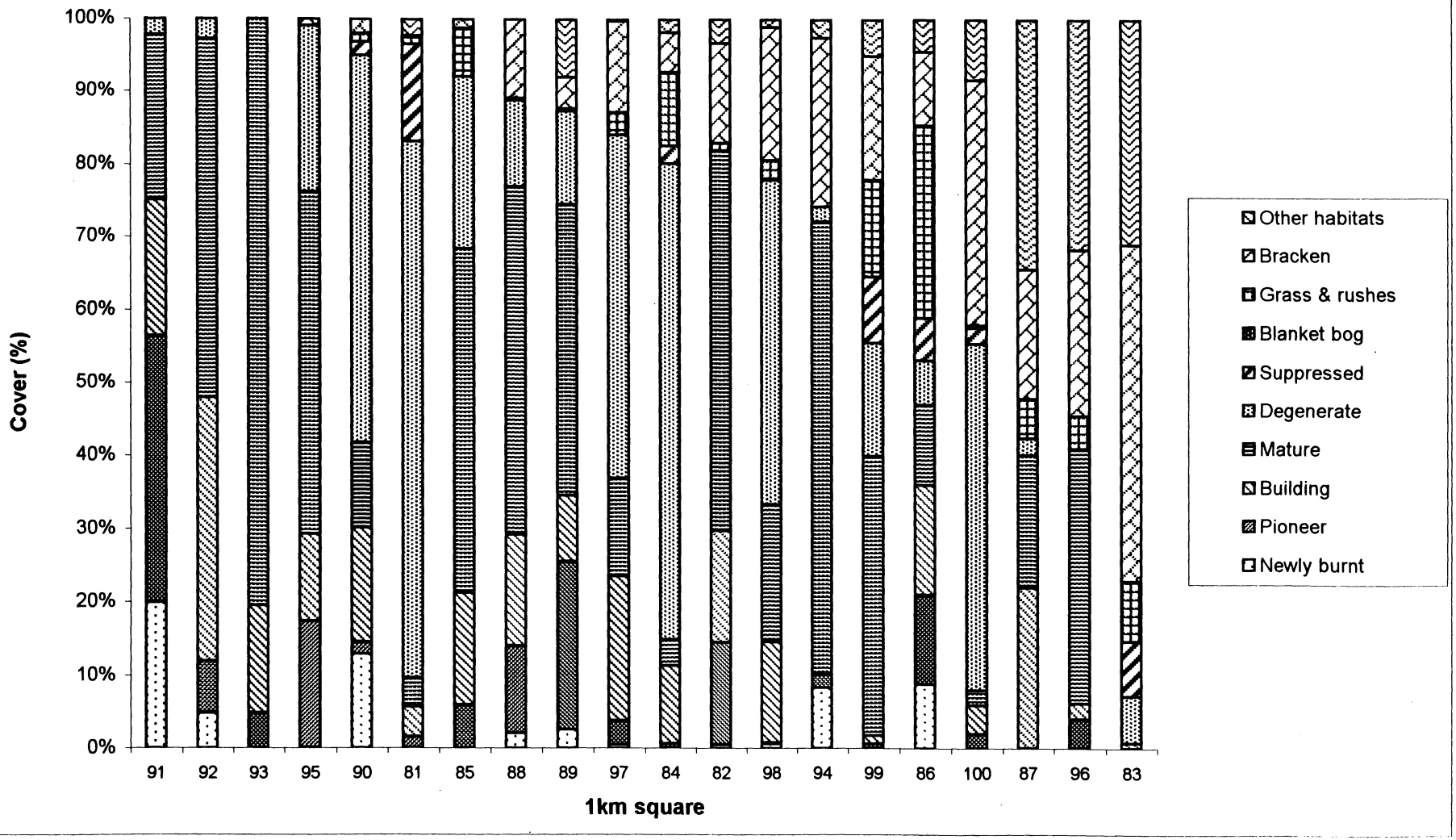


Figure 9b: North York Moors Heather Condition Survey: Survey Sector East
(heather classes sorted by sum of % cover mature, degenerate and suppressed heather)

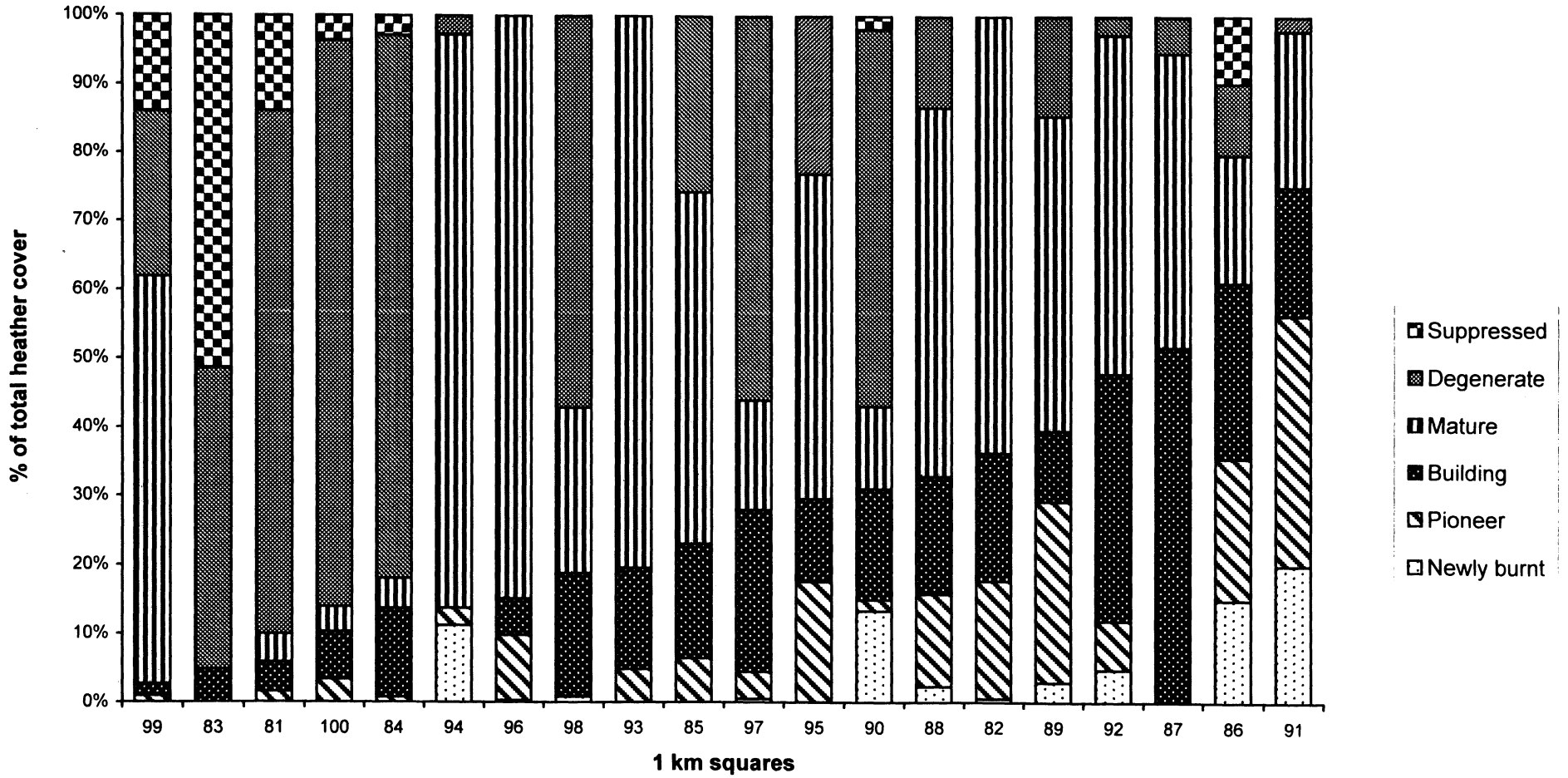


Figure 10a: North York Moors Heather Condition Survey: Survey Sector Central (sorted by sum of non-heather habitats)

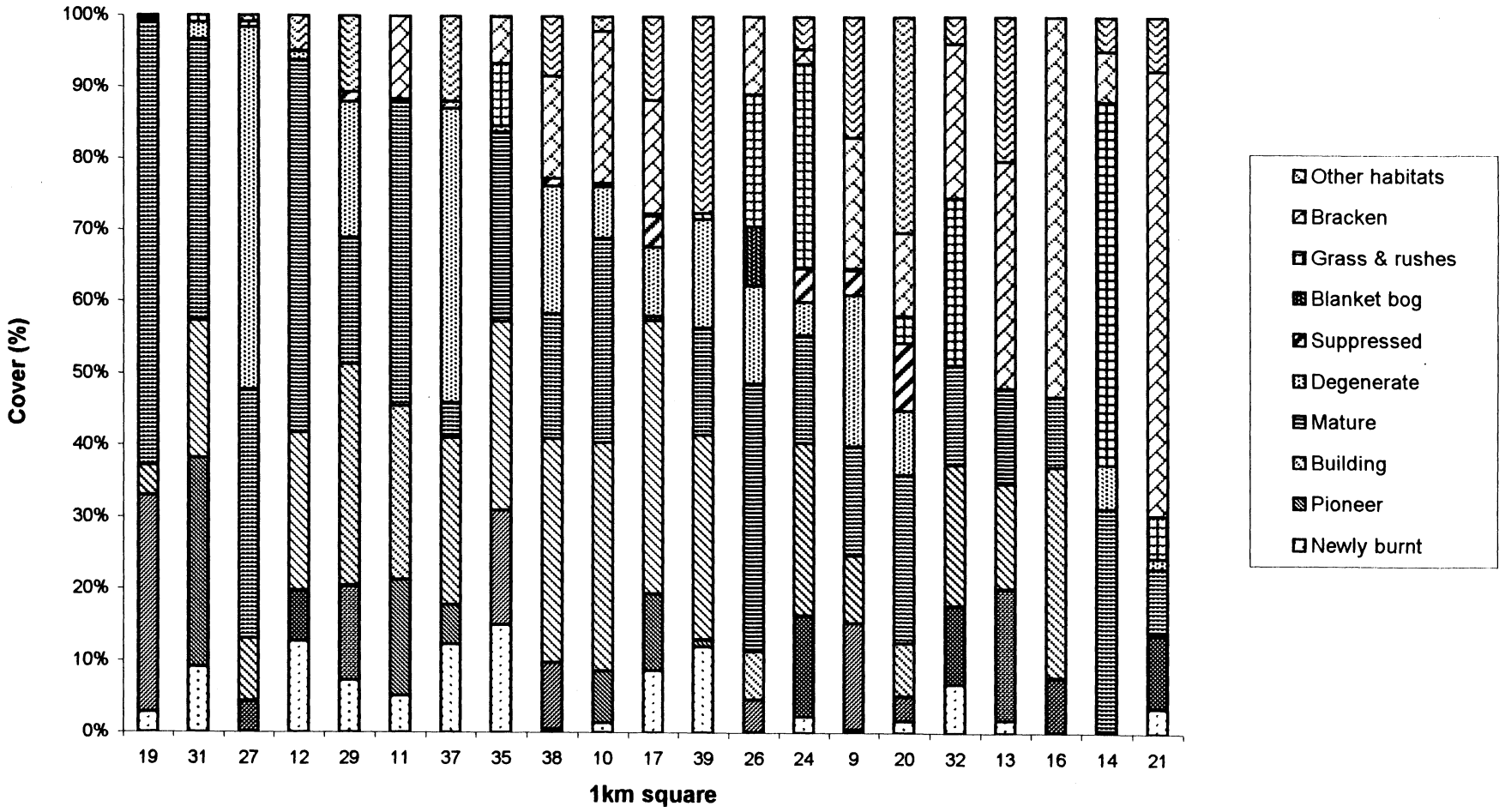


Figure 10b: North York Moors Heather Condition Survey: Survey Sector Central
(heather classes sorted by sum of % cover mature, degenerate and suppressed heather)

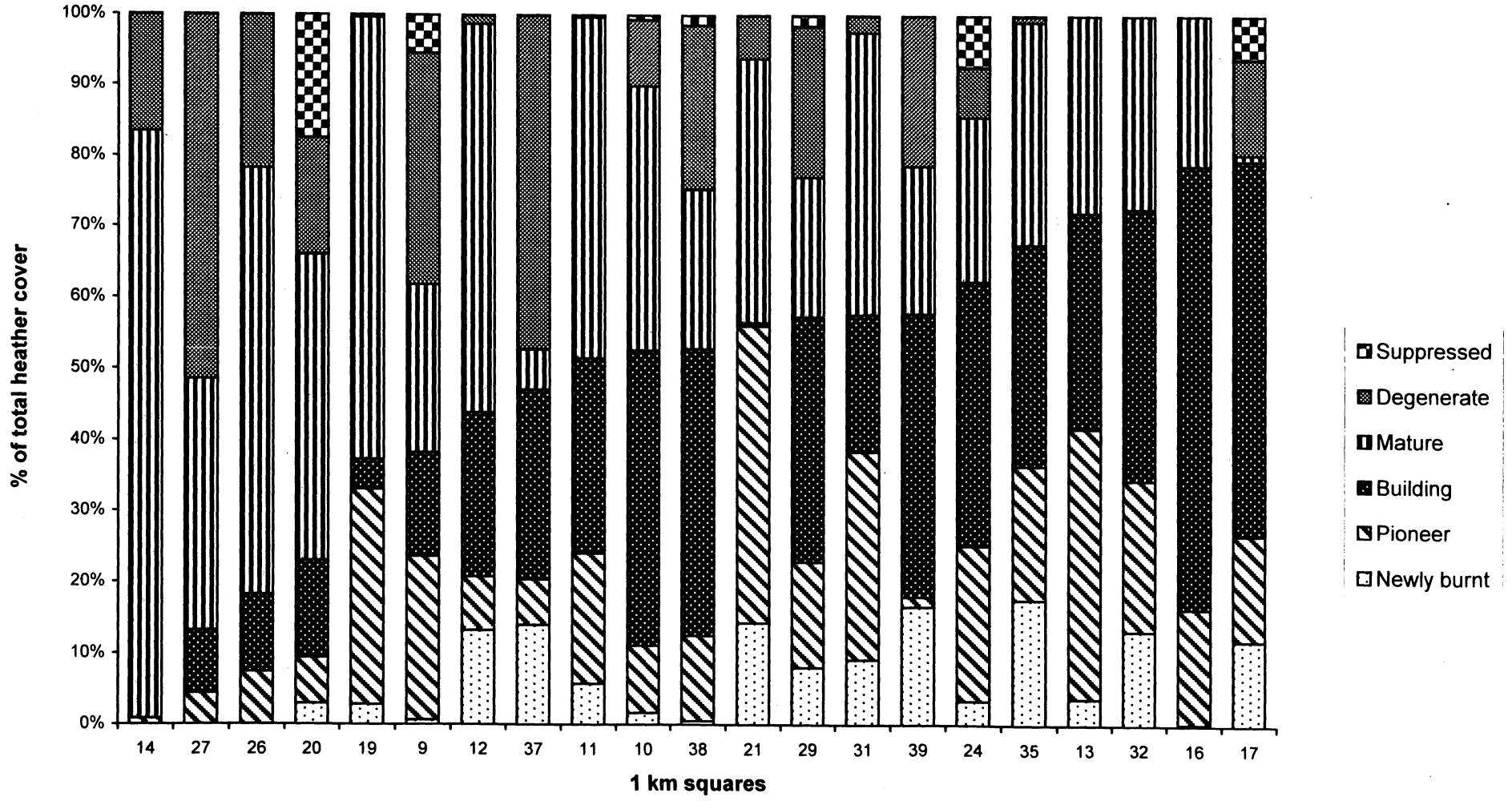


Figure 11a: North York Moors Heather Condition Survey: Survey Sector West (sorted by sum of non-heather habitats)

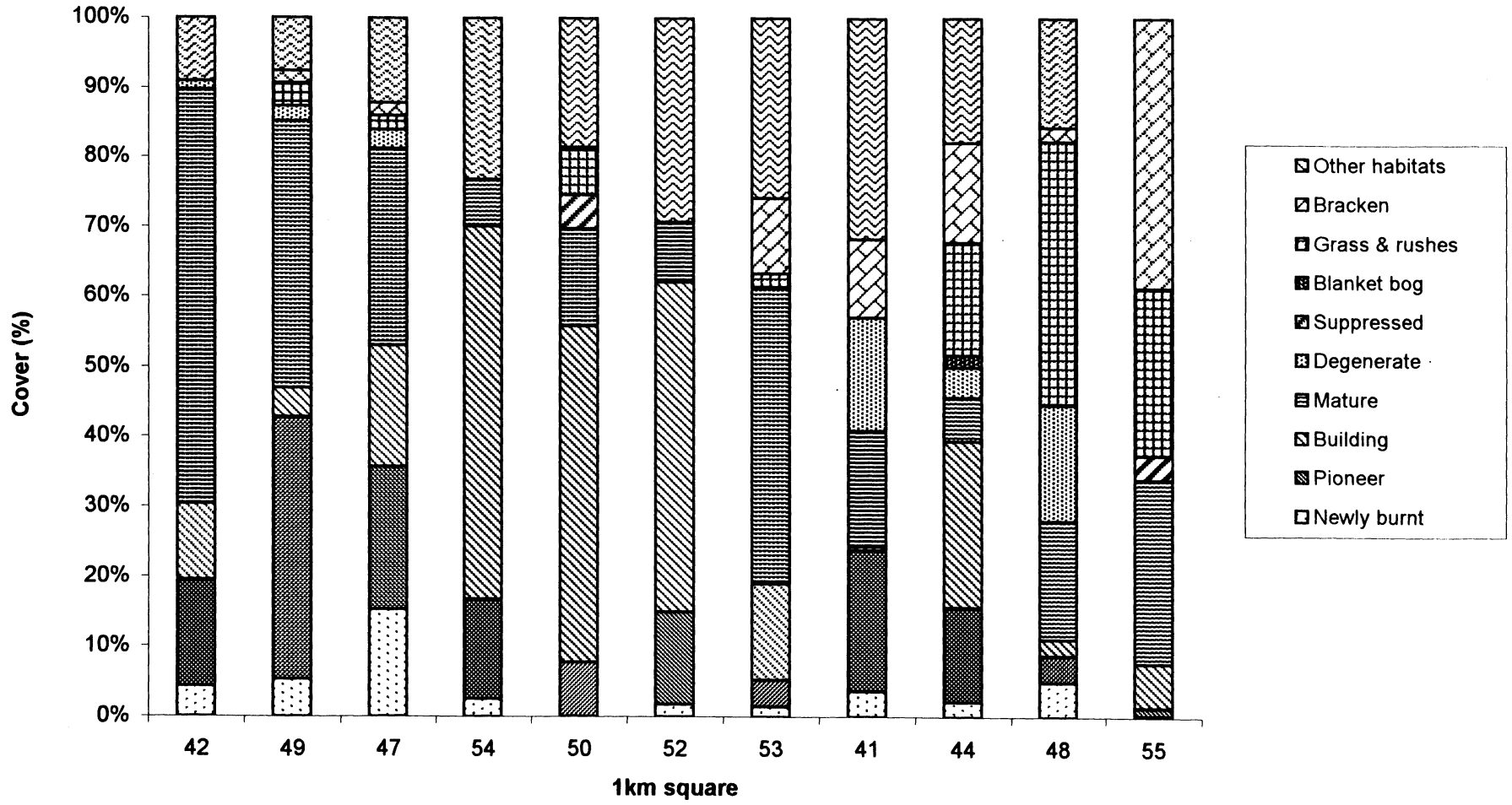


Figure 11b: North York Moors Heather Condition Survey: Survey Sector West
(heather classes sorted by sum of % cover mature, degenerate and suppressed heather)

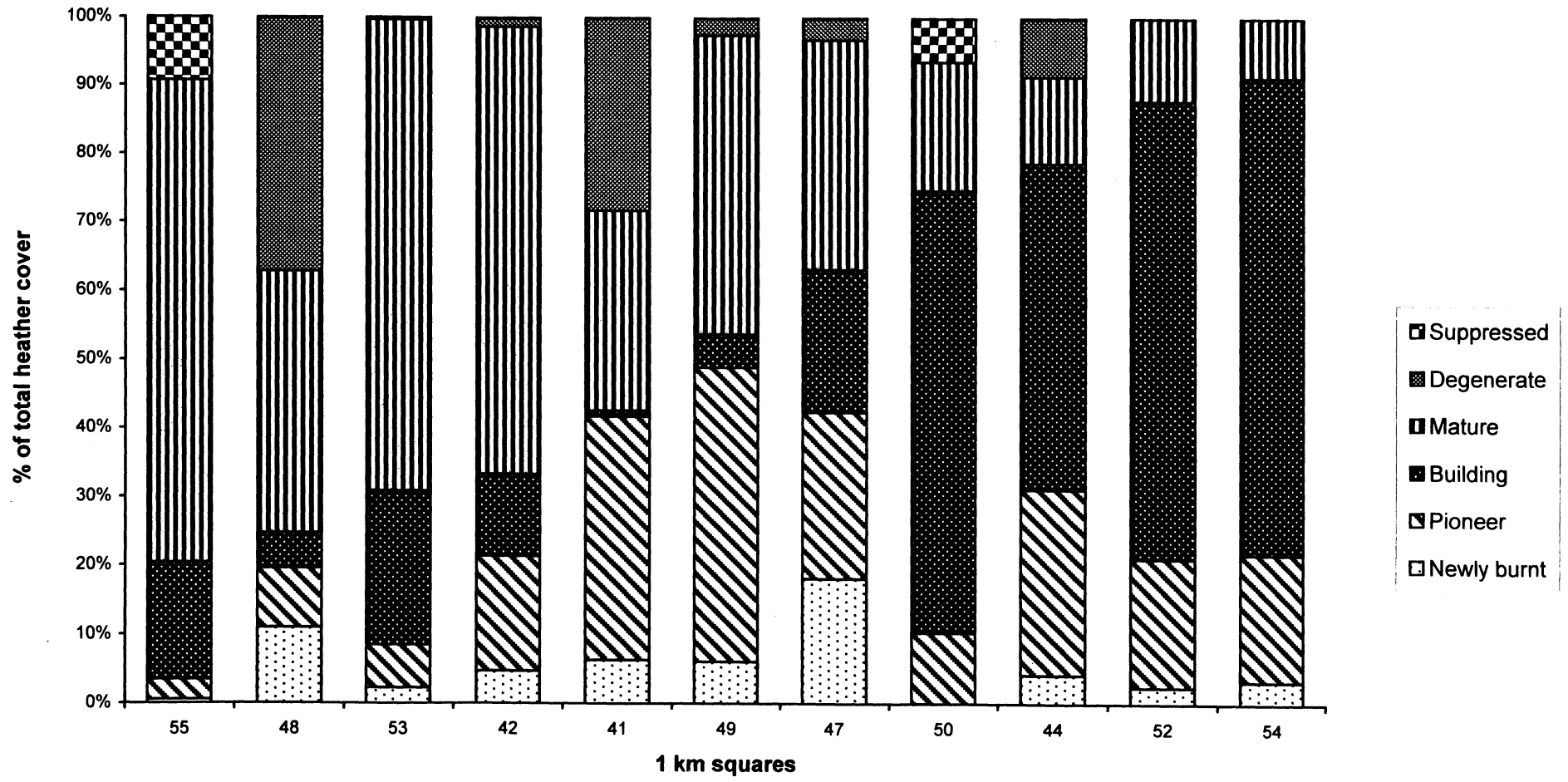


Figure 12a: North York Moors Heather Condition Survey: Survey Sector South (sorted by sum of non-heather habitats)

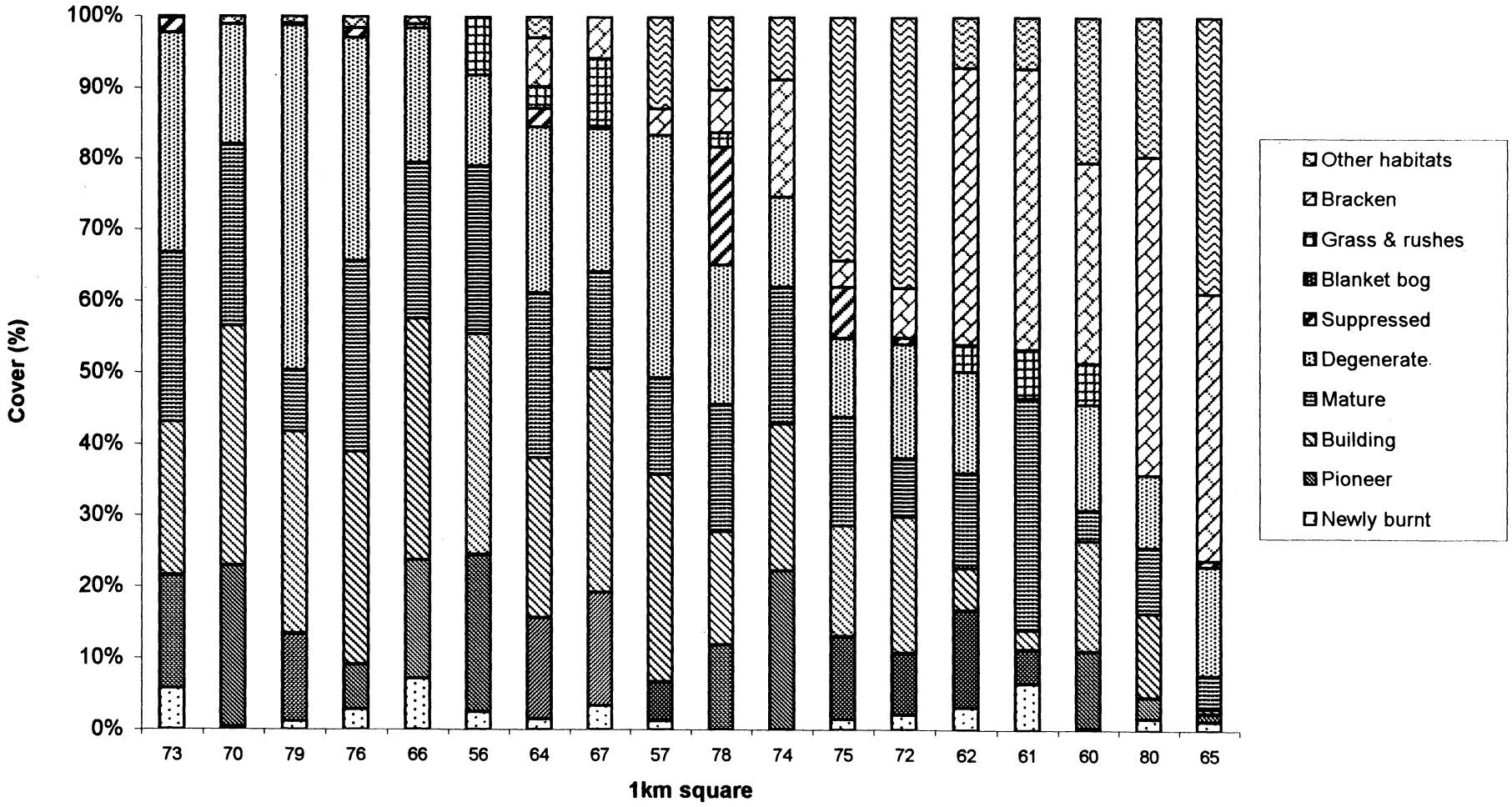
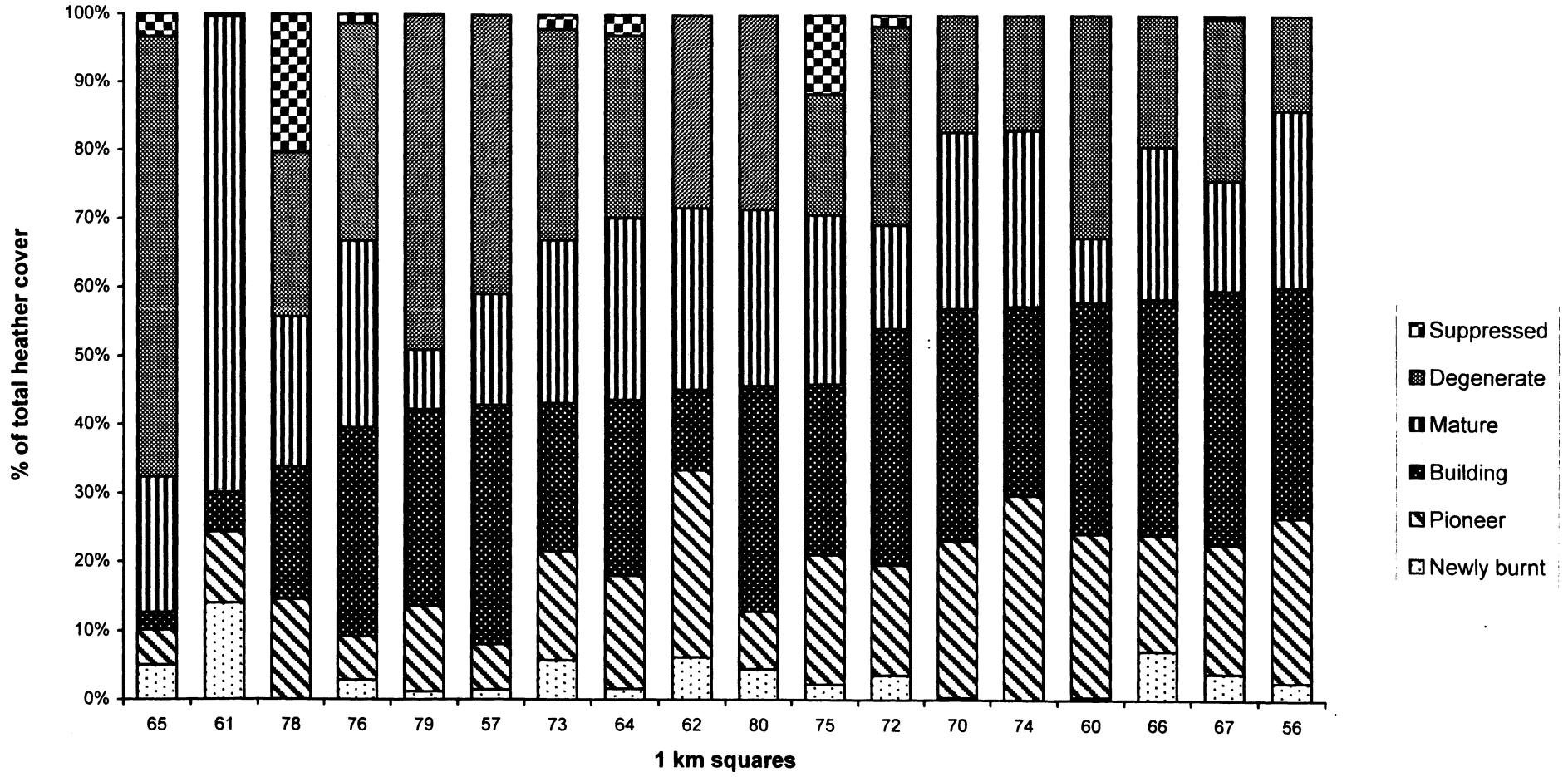


Figure 12b: North York Moors Heather Condition Survey: Survey Sector South
(heather classes sorted by sum of % cover mature, degenerate and suppressed heather)



4 DISCUSSION

4.1 An overview of moorland management in the North York Moors and its influence on the vegetation of the area

With the exception of the small moorland remnants towards the fringes of the National Park (the Bridestones and Troutsdale Moors, Cawthorne and Appleton Moors, Newton Mulgrave and Ugthorpe Moors and Far Moor Plantation Survey Blocks) the composition and structure of the moorland vegetation is determined by the management of the moors as commercial grouse shoots. Although the majority of the moorland is also grazed by sheep this practice is often subsidiary to grouse management in its influence on the vegetation present.

The observations on moorland management below largely refer to the central moorland block (Hawnby and Snilesworth Moors, Bransdale Moor, Danby Low and High Moors, Spaunton Moor, Westerdale Moor, Wheeldale Moor, Goathland Moor and Fylingdales Moor) and do not apply to the four peripheral Survey Blocks listed in the above paragraph, except where they are specifically referred to.

4.1.1 Burning

Virtually all the heather dominated moorland in the central moorland block is burnt in a controlled manner to promote conditions that will support the high population densities of grouse that are required for commercial shoots. Controlled burning is not only carried out on the dry heath but also on areas of wet heath and blanket mire and the pattern of burning varies across these habitats. On dry heath burn patches tend to be small, generally less than 30m wide and of varying length so that a very intimate mosaic of burn patches of different ages is produced. On wet heath burn patches tend to be much larger, often 100m plus in width, so that there is far less small-scale variation in heather age in stands of wet heath. The burning pattern on blanket mires tends to be somewhat intermediate between these two patterns.

The frequency of burning tends to be high on all three habitats as the growth rate of heather *Calluna* tends to be higher in the North York Moors than elsewhere in northern England. This high burning frequency has had a profound effect on the species composition of the vegetation communities present. The main effect has been to drastically reduce the species diversity of the communities. Frequent repeated burning favours heather *Calluna* over other heathland species and consequently this species is dominant in the principal vegetation communities of the moors. On the dry heaths in particular this dominance is almost to the exclusion of other species, especially in stands of H9 heather - wavy hair-grass heath, where wavy hair-grass, which does not have a persistent seed bank, has more-or-less been eliminated. The short burning cycle that is generally practised has resulted in stands of heath with a poorly developed bryophyte (moss and liverwort) layer, as this layer generally develops in stands that are around twenty years old (most stands of heath in the North York Moors are re-burnt within fifteen years of the last burn and many moors are burnt on an eight to ten year rotation). The effect of short burning rotations on the bryophyte layer of dry heath is well demonstrated by the 'RadHaz' zone at the Ministry of Defence early warning station at Fylingdales. The 'RadHaz' zone has been neither burnt nor grazed for some thirty to forty years and has a well developed bryophyte layer below the tall, leggy heather. This contrasts sharply with the heath immediately outside the zone which is burnt and has the very sparse bryophyte layer typical of the majority of the moorland in the Park. This area at Fylingdales demonstrates how more diverse areas of dry heath could become with less frequent or no burning.

The effect of repeated burning on the wet heath and blanket mires is, perhaps, even more deleterious to plant diversity than it is on the dry heath. The *Sphagnum* mosses that should be

characteristic of these communities tend to be very scarce in stands of these habitats on the North York Moors, as do may other typical mire plant species. This is almost certainly a consequence of the repeated burning that has been practised over the past century or more.

Frequent rotational burning practices on wet heath and blanket mire communities may not be necessary to promote heather regeneration, as this can occur through vegetative layering. There are significant nature conservation advantages to retaining wet heath and blanket mire, as these are known to support not only diverse plant communities but also a range of invertebrate species that are not found in dry heath.

In addition to controlled burning for grouse several of the central moors, most notably Snilesworth Moor, Glaisdale Moor and Wheeldale Moor, have experienced extensive uncontrolled burns over the past fifty years. In the hottest parts of these fires the peaty soil caught fire and in these areas the regeneration of heath vegetation has been exceedingly slow, such that many decades on there are still extensive tracts of bare eroding soil.

In general the peripheral Survey Blocks are not managed by controlled burning.

4.1.2 Grazing

All the main Survey Blocks are grazed by sheep, with the exception of Rievaulx Moor and a few small areas such as Stoupe Brow, Harland Moor and the Fylingdales RadHaz Zone. Unlike many upland areas in Britain high grazing levels are not a significant factor affecting the moorland vegetation. Of the main Survey Blocks only one, Spaunton Moor shows extensive evidence of high grazing pressure. However, even here, this is concentrated along the roads which traverse the moor. On the other moors heavy grazing pressure is localised and tends to be concentrated on foddering and gathering sites, often on access points onto the moor. Where grazing pressure is, or has been, intense it can lead to the replacement of heather and other dwarf-shrubs by grasses and, in time, result in the replacement of dry and wet heath by grassland communities. This can effect can be seen on peripheral areas of moorland, such as along Castleton Rigg.

A notable feature of the grazing regimes on the North York Moors is that there is no discernible difference in the grazing impact on areas of common land and on tenanted moors, whereas in the Pennines and Lake District areas of common land tend to be stocked at much higher levels than tenanted moors, often resulting in heavy grazing impacts and loss of dwarf-shrub cover.

Ungrazed moorland is uncommon both nationally and in the North York Moors. A feature of ungrazed moors, largely the peripheral Survey Blocks, together with Rievaulx Moor and the MoD RadHaz zone, is encroachment by trees, particularly birch and pine. Rievaulx Moor is cut and burnt, but not grazed, yet has a high frequency of birch and pine saplings, suggesting that grazing has a significant part to play in preventing trees from re-establishing on the moors than does burning.

4.1.3 Woodland

The pollen record suggests that much of the present moorland exists as a result of woodland clearance by man beginning some 10,000 years before present (b.p.). This process gathered pace in the Neolithic Period (5,000 years b.p.) with the most significant clearances occurring in the Iron Age and Romano-British Periods (2,650-1600 years b.p.; Spratt 1990). In the North York Moors this woodland would have mainly consisted of oak, birch and hazel possibly with scattered Scot's Pine predominantly on what is now the moorland plateau, with oak being more common on the valley sides (on ground which today is often covered by bracken). Management by man via burning and subsequent stock grazing has arrested the

natural succession to open woodland. Confirmation of this can be seen on the few areas of moorland which are unmanaged today, such as at Stony Moor and Troutsdale Moor, where woodland is encroaching onto open heath in the absence of grazing and burning.

Semi-natural broadleaved woodland is not a major feature of the moorland in the North York Moors and there may be scope for increasing its cover within the larger moorland blocks, for example in valleys and on steep banks, where long-term bracken clearance may be both unsustainable and uneconomic. On the smaller isolated areas of moorland, such as Troutsdale and Stony Moor however, it is likely that all open heath communities will be replaced by open woodland within the next few decades, without intervention from man.

4.1.4 Bracken control

The extent to which bracken has been controlled by spraying varies considerably from moor to moor. Overall 17% (2% of the total moorland area) of the total area of bracken was recorded as having been sprayed, however on Hawnby and Snilesworth Moors and Westerdale Moor over 25% of the total bracken area had been sprayed, while on Goathland Moor only 1% of the bracken had been sprayed (Figure 5). While these figures give an estimate of the proportion of sprayed bracken in Survey Blocks relative to each other it should be noted that this is likely to be an underestimate of the area sprayed as it does not include the area of sprayed stands where the replacement vegetation has developed into a recognisable National Vegetation Classification community, nor where control has been unsuccessful and bracken has re-grown.

The extent of bracken spraying in the North York Moors is much greater than it is in other upland areas in England. Current bracken control programmes in many parts of the North York Moors appear to be targeted at all bracken stands, regardless of location, threat to grazing and shooting interests and wildlife interest. A balance needs to be struck, so that bracken control is targeted at those stands which pose a serious threat to farming and shooting interests, such as those where there is clear evidence of encroachment onto areas of moorland plateau. On the steep ground, in particular, where spraying is frequently unsustainable, both environmentally and economically, the planting of new native woodland can, perhaps, be used to control bracken through the shading effects of the developing tree canopy, which reduces the vigour of bracken plants and may prevent the bracken spreading out onto the moor. It is, however, important to retain areas of unwooded bracken as well, as they constitute an important wildlife habitat in its own right, providing essential breeding habitat for whinchat and a number of invertebrates, and support populations of uncommon plants, such as chickweed wintergreen *Trientalis europaea.* Bracken stands are also an important landscape feature, attracting visitors and income to the Park in autumn. Bracken control policies, both at the scale of the individual moor and the scale of the North York Moors as a whole, need to meet all these needs.

4.1.5 Other management issues

Drainage in the form of moorland gripping is clearly evident on many of the few areas of blanket mire on the moors. This, no doubt, contributes to the dry nature of the blanket mire in the North York Moors. This practice is no longer carried out on a large scale, although old grips remain and continue to drain these mires. Blocking of old grips could help to reduce erosion and run-off and create new wet areas which would be valuable to wildlife, particularly breeding waders and invertebrates.

On a number of moors heather cutting is used either in combination with controlled rotational burning or as a replacement for this practice. It is not clear as yet how cutting rather than burning moorland vegetation affects the botanical diversity of moorland and some research

into the long-term effects of cutting in comparison to burning would be a valuable addition to knowledge of the effects of moorland management practices on plant and animal communities.

4.1.6 Conclusion

A sense of balance in moorland management is clearly important if the North York Moors is to be maintained in the long-term for its sporting, farming, nature conservation and recreational interests. Whilst management for grouse and sheep are important considerations and these activities maintain management mechanisms on the ground, such management needs to be sympathetic to the requirements of bird, plant and invertebrate species which are important for nature conservation and which are not at present best served by current practices. The information now available in this report has highlighted the need to identify areas of moorland where longer burning rotations (25 - 35 years) can be introduced, as well as areas to be left free of burning and areas which can be converted to native broadleaved woodland, either through natural regeneration or via planting. This information must now be used to develop and modify existing management practices to maintain species diversity to meet nature conservation aims, whilst still maintaining viable farming and sporting industries.

4.2 Future work

Clearly these two surveys have produced much data which has only been partially analysed with the time and resources available. For each of the heather condition squares bird data exists which could be further analysed along with the National Vegetation Classification (NVC) / heather structure data to provide some further insights in to the habitat requirements of certain bird species. It is hoped to take this further analysis forward in the near future.

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APPENDIX 1 Glossary of National Vegetation Classification communities recorded during the North York Moors Upland Habitats Survey

NVC Communities and sub-communities		Common Name	Comments
Heaths			
H9	Calluna vulgaris - Deschampsia flexuosa heath	heather - wavy hair-grass dry heath	One of the two main dry heath communities in the North York Moors
c	species-poor sub-community		The most common type
d	Galium saxatile sub-community	heath bedstraw sub-community	A grassy type
e	Molinia caerulea sub-community	purple moor-grass sub-community	A wetter type
H10a	Calluna vulgaris - Erica cinerea heath, typical sub-community	heather - bell heather dry heath	Occurs mainly on disturbed soil
H12	Calluna vulgaris - Vaccinium myrtillus heath	heather - bilberry dry heath	One of the two main dry heath communities in the North York Moors
a	Calluna vulgaris sub-community	heather sub-community	The most common type in the NYMs
c	Galium saxatile - Festuca ovina sub-community	heath bedstraw - sheep's fescue sub-community	A grassy type
Wet heath			
M15a	Trichophorum cespitosum - Erica tetralix wet heath, Carex panicea sub-community	deer-grass - cross-leaved heath wet heath, carnation sedge sub-community	Only found in association with M10a flushes
M16	Erica tetralix - Sphagnum compactum wet heath	cross-leaved heath - bog moss wet heath	The main wet heath community in the NYMs
a	typical sub-community		A wetter type
d	Juncus squarrosus - Dicranum scoparium s.c.	heath rush - Dicranum moss sub-community	A dryer type and the most common in the NYMs
Other mires			
M6	Carex echinata - Sphagnum recurvum/auriculatum mire	star sedge - bog moss flush	The main flush community in the NYMs
c	Juncus effusus sub-community	soft rush sub-community	The most common type of rushy flush in the NYMs
d	Juncus acutiflorus sub-community	sharp-flowered rush sub-community	A less common type of rushy flush
M10a	Carex dioica - Pinguicula vulgaris mire, Carex viridula ssp. oedocarpa - Juncus bulbosus sub-community	dioecious sedge - common butterwort flush, common yellow-sedge - bulbous rush sub-community	A base rich-flush
M18a	Erica tetralix - Sphagnum papillosum mire, Sphagnum magellanicum - Andromeda polifolia sub-community	cross-leaved heath - bog moss mire, bog moss - bog rosemary sub-community	A raised mire community
M19a	Calluna vulgaris - Eriophorum vaginatum blanket mire, Erica tetralix sub-community	heather - hare's-tail cotton-grass blanket mire, cross-leaved heath sub-community	The main blanket bog community in the NYMs
M21	Narthecium ossifragum - Sphagnum papillosum mire	bog asphodel - bog moss mire	A nationally rare valley mire community
M23a	Juncus effusus/acutiflorus - Galium saxatile rush pasture, Juncus acutiflorus sub-community	soft rush/sharp flowered rush - marsh bedstraw rush pasture, sharp-flowered rush sub-community	A mesotrophic flush community, often herb-rich
M25	Molinia caerulea - Potentilla erecta mire	purple moor-grass - tormentil mire	A grassy mire community
a	Erica tetralix sub-community	cross-leaved heath sub-community	The main type, with a heathy element
b	Anthoxanthum odoratum sub-community	sweet vernal-grass sub-community	A drier, grassy type
c	Angelica sylvestris sub-community	wild angelica sub-community	A herb-rich type
M32	Philonotis fontana - Saxifraga stellaris spring	Philonotis moss - starry saxifrage spring	A mossy spring community
Swamps			
S4	Phragmites australis reedbed	common reed reedbed	Reedbeds
S7	Carex acutiformis swamp	lesser pond sedge swamp	A tall sedge swamp
S11	Carex vesicaria swamp	bladder sedge swamp	A tall sedge swamp
Acid grasslands			
U2b	Deschampsia flexuosa grassland, Vaccinium myrtillus sub-community	wavy hair-grass acid grassland, bilberry sub-community	This grassland often replaces bracken when it is sprayed out
U4	Festuca ovina - Agrostis capillaris - Galium saxatile grassland	sheep's fescue - common bent grass - heath bedstraw acid grassland	The main grassland on better drained unimproved soils
a	typical sub-community		The unimproved grassy type
b	Holcus lanatus - Trifolium repens sub-community	Yorkshire fog - white clover sub-community	The semi-improved type
e	Vaccinium myrtillus - Deschampsia flexuosa s.c.	bilberry - wavy hair-grass sub-community	A more heathy type
U5	Nardus stricta - Galium saxatile grassland	mat-grass - heath bedstraw acid grassland	The main grassland on poorer drained unimproved soils
a	species-poor sub-community		The unimproved grassy type
b	Agrostis canina - Polytrichum commune s.c.	velvet bent - Polytrichum moss sub-community	A slightly flushed type
d	Calluna vulgaris - Danthonia decumbens s.c.	heather - heath grass sub-community	A more heathy type

NVC Communities and sub-communities		Common Name	Comments
Bracken			
U20	Pteridium aquilinum - Galium saxatile community	bracken – heath bedstraw community	Stands of bracken
b	Vaccinium myrtillus - Dicranum scoparium s.c.	bilberry – Dicranum moss sub-community	The main bracken stand community
c	species-poor sub-community		A very species-poor type
Semi-natural woodlands			
W1	Salix cinerea - Galium palustre woodland	grey willow - marsh bedstraw woodland	A wet woodland associated with fens
W7	Alnus glutinosa - Fraxinus excelsior - Lysimachia nemorum woodland	alder - ash - yellow pimpernel woodland	Present along streams and on flushed slopes
W16b	Quercus spp - Betula spp - Deschampsia flexuosa woodland, Vaccinium myrtillus - Dryopteris dilatata sub-community	oak - birch - wavy hair-grass woodland, bilberry - broad buckler-fern sub-community	Present on dry valley sides
W18	Pinus sylvestris - Hylocomium splendens woodland	Scot's pine - Hylocomium moss woodland	Areas where pine has seeding into dry heath resemble this Scottish woodland type
W23	Ulex europaeus - Rubus fruticosus scrub	gorse - bramble scrub	gorse scrub
Neutral grasslands			
MG6b	Lolium perenne - Cynosurus cristatus grassland, Anthoxanthum odoratum sub-community	rye-grass - crested dog's-tail grassland, sweet vernal-grass sub-community	A slightly acidic semi-improved pasture community
MG9	Holcus lanatus - Deschampsia cespitosa grassland	Yorkshire fog - tufted hair-grass grassland	A damp grassland community
MG10	Juncus effusus - Holcus lanatus rush pasture	soft rush - Yorkshire fog rush pasture	Present on poorly drained semi-improved ground

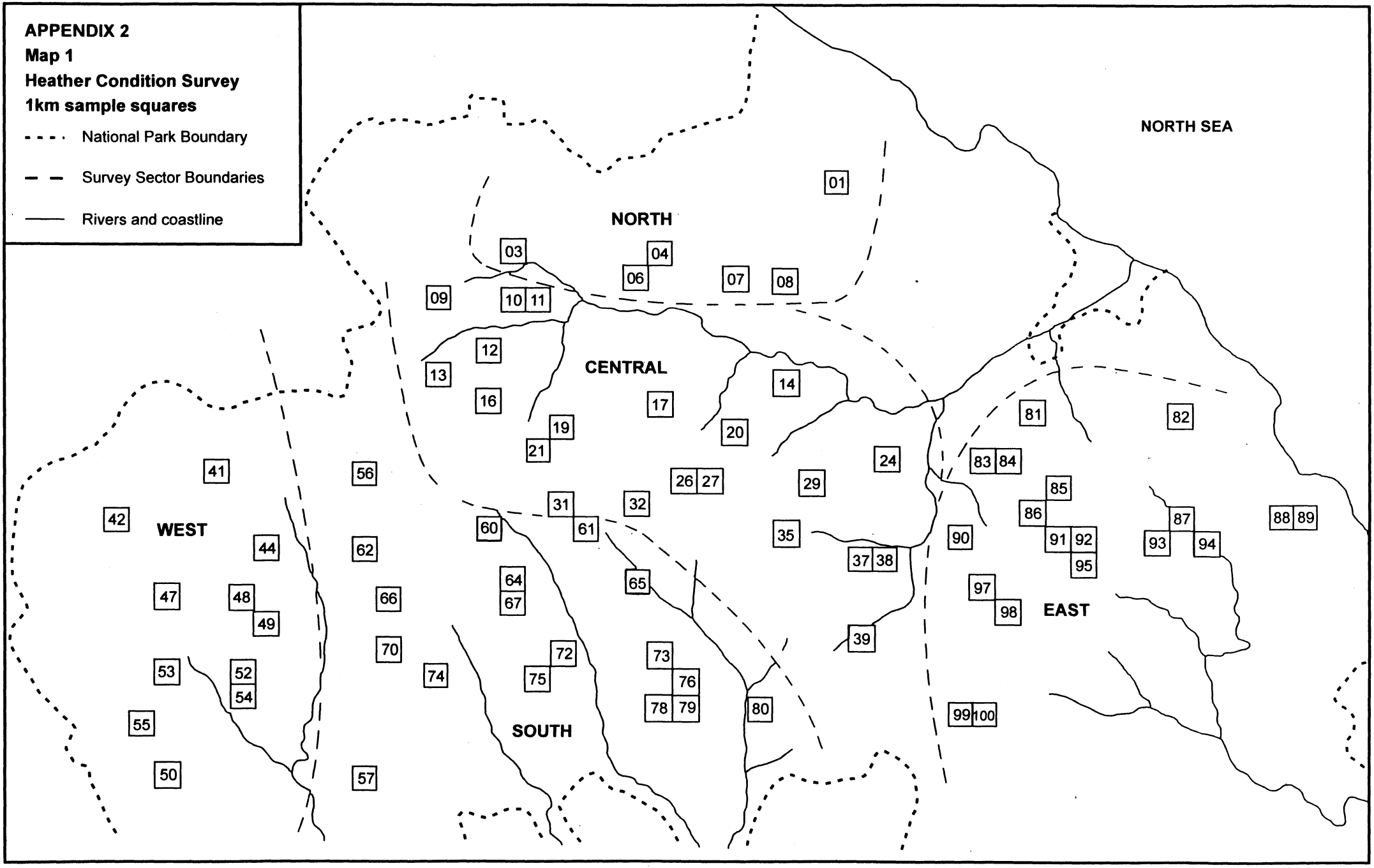
Glossary of plant names recorded during the North York Moors Upland Habitats Survey

Scientific name	Common name	Scientific name	Common name	Scientific name	Common name
Agrostis canina	velvet bent	Deschampsia flexuosa	wavy hair-grass	Myrica gale	bog myrtle
Agrostis capillaris	common bent	Dicranum scoparium	moss	Nardus stricta	mat-grass
Agrostis stolonifera	creeping bent	Drosera rotundifolia	round-leaved sundew	Narthecium ossifragum	bog asphodel
Aira caryophyllea	silvery hair-grass	Dryopteris dilatata	broad buckler-fern	Pedicularis sylvatica	lousewort
Aira praecox	early hair-grass	Empetrum nigrum nigrum	crowberry	Plagiomnium undulatum	moss
Alnus glutinosa	alder	Erica cinerea	bell heather	Polygala serpyllifolia	milkwort
Andromeda polifolia	bog rosemary	Erica tetralix	cross-leaved heath	Polytrichum commune	moss
Aneura pinguis	liverwort	Eriophorum angustifolium	common cotton-grass	Polytrichum juniperinum	moss
Anthoxanthum odoratum	sweet vernal-grass	Eriophorum vaginatum	hare's-tail cotton-grass	Potentilla erecta	tormentil
Aulacomnium palustre	moss	Festuca ovina	sheep's fescue	Pteridium aquilinum	bracken
Betula sp.	birch	Fraxinus excelsior	ash	Quercus sp.	oak
Blechnum spicant	hard fern	Galium saxatile	heath bedstraw	Rumex acetosella	sheep's sorrel
Brachythecium rutabulum	moss	Gymnadenia conopsea	fragrant orchid	Sorbus aucuparia	rowan
Calluna vulgaris	heather	Hylocomium splendens	moss	Sphagnum auriculatum	bog moss
Campylopus introflexus	moss	Hypnum cupressiforme	moss	Sphagnum capillifolium	bog moss
Carex binervis	green-ribbed sedge	Hypnum jutlandicum	moss	Sphagnum compactum	bog moss
Carex echinata	star sedge	Juncus bulbosus	bulbous rush	Sphagnum magellanicum	bog moss
Carex nigra	common sedge	Juncus conglomeratus	conglomerate rush	Sphagnum papillosum	bog moss
Carex panicea	carnation sedge	Juncus effusus	soft rush	Sphagnum recurvum	bog moss
Carex pilulifera	pill sedge	Juncus squarrosus	heath rush	Trientalis europaea	chickweed wintergreen
Carex viridula ssp oedocarpa	common-yellow sedge	Leucobryum glaucum	moss	Trichophorum cespitosum	deer grass
Cladonia impexa	lichen	Lysimachia nemorum	yellow pimpernel	Vaccinium myrtillus	bilberry
Cladonia squamosa	lichen	Lophocolea bidentata	liverwort	Vaccinium oxycoccus	cranberry
Danthonia decumbens	heath grass	Molinia caerulea	purple moor-grass	Vaccinium vitis-idaea	cowberry

APPENDIX 2 North York Moors 1km Heather Condition and Bird Survey sample squares

100km	Grid Ref	Heather Condition Square No	Bird Survey Square No	RSPB Sector	Area
NZ	7713	1	1	N	Newton Mulgrave Moor
NZ	6410	3	2	N	Wayworth Moor
NZ	7010	4	3	N	Danby Low Moor
NZ	6909	6	5	N	Haw Rigg
NZ	7309	7	6	N	Beacon Hill
NZ	7509	8	7	N	Lealholm Moor
NZ	6108	9	8	C	Warren Moor
NZ	6408	10	9	C	East of Kildale Moor
NZ	6508	11	10	C	Kempswithen
NZ	6305	12	11	C	Great Hograh Beck
NZ	6105	13	12	C	Middle Head
NZ	7505	14	13	C	Glaisdale Moor
NZ	6304	16	14	C	Baysdale Moor
NZ	7004	17	15	C	South of Jack Sledge Moor
NZ	6603	19	16	C	Clough Gill
NZ	7303	20	17	C	Highdale Farm
NZ	6502	21	18	C	West of Westerdale Moor
NZ	7902	24	21	C	Murk Mire Moor
NZ	7101	26	23	C	Great Fryup Head
NZ	7201	27	24	C	Glaisdale Moor
NZ	7601	29	26	C	High Birch Water
NZ	6600	31	28	C	South Flat Moor
NZ	6900	32	29	C	Sturdy Bank
SE	7599	35	32	C	White Moor
SE	7898	37	34	C	Raven Stones
SE	7998	38	35	C	Booth Stone
SE	7895	39	36	C	Ramsden Head
NZ	5201	41	37	W	Bilsdale West Moor
SE	4899	42	38	W	Near Moor
SE	5498	44	39	W	Rowantree Crags
SE	5096	47	41	W	Douglas Ridge
SE	5396	48	42	W	South of Head House
SE	5495	49	43	W	Parci Gill
SE	5089	50	49	W	Dale Town Common
SE	5393	52	46	W	Hawnby Moor
SE	5093	53	45	W	Locker Wood
SE	5392	54	47	W	Hazel Head Moor
SE	4991	55	48	W	East of Dunsforth Hill
NZ	5801	56	50	S	Urra Moor
SE	5889	57	72	S	Rievaulx Moor East
SE	6399	60	52	S	Spout House
SE	6799	61	53	S	Round Crag
SE	5898	62	54	S	Hagg House Moor
SE	6497	64	56	S	Dickon Howe
SE	6997	65	57	S	Round Hill
SE	5996	66	58	S	Bilsdale East Moor
SE	6496	67	59	S	Golden Heights
SE	5994	70	61	S	North of Bare Hill
SE	6694	72	63	S	Petergate
SE	7094	73	64	S	Shooting House Hill

100km	Grid Ref	Heather Condition Square No	Bird Survey Square No	RSPB Sector	Area
SE	6193	74	65	S	Pockley Moor
SE	6593	75	66	S	Bog House
SE	7193	76	67	S	Loskey Ridge
SE	7092	78	69	S	Hutton Ridge
SE	7192	79	70	S	Spaunton Moor
SE	7492	80	71	S	Hartoft Moor
NZ	8504	81	73	E	Sleights Moor
NZ	9104	82	74	E	Graystone Hills
NZ	8302	83	75	E	Sheep Bield
NZ	8402	84	76	E	West of Pike Hill Ridge
NZ	8601	85	77	E	Robbed Howe Slacks
NZ	8500	86	78	E	South West of Brocka Beck
NZ	9100	87	79	E	Biller Howe Turf Rigg
NZ	9500	88	80	E	Stony Marl Moor
NZ	9600	89	81	E	Pye Rigg End
SE	8299	90	82	E	Tow Howes Rigg
SE	8699	91	83	E	Sliving Sike Slack
SE	8799	92	84	E	East of Sliving Sike Slack
SE	9099	93	85	E	Fylingdales Moor
SE	9299	94	86	E	The Island
SE	8798	95	87	E	Lilla Rigg
SE	8397	97	89	E	Cragg Stone Rigg
SE	8496	98	90	E	Fen Moor
SE	8292	99	91	E	Levisham Moor South West
SE	8392	100	92	E	Levisham Moor South


APPENDIX 2
Map 1
Heather Condition Survey
1km sample squares
National Park Boundary
Survey Sector Boundaries
Rivers and coastline
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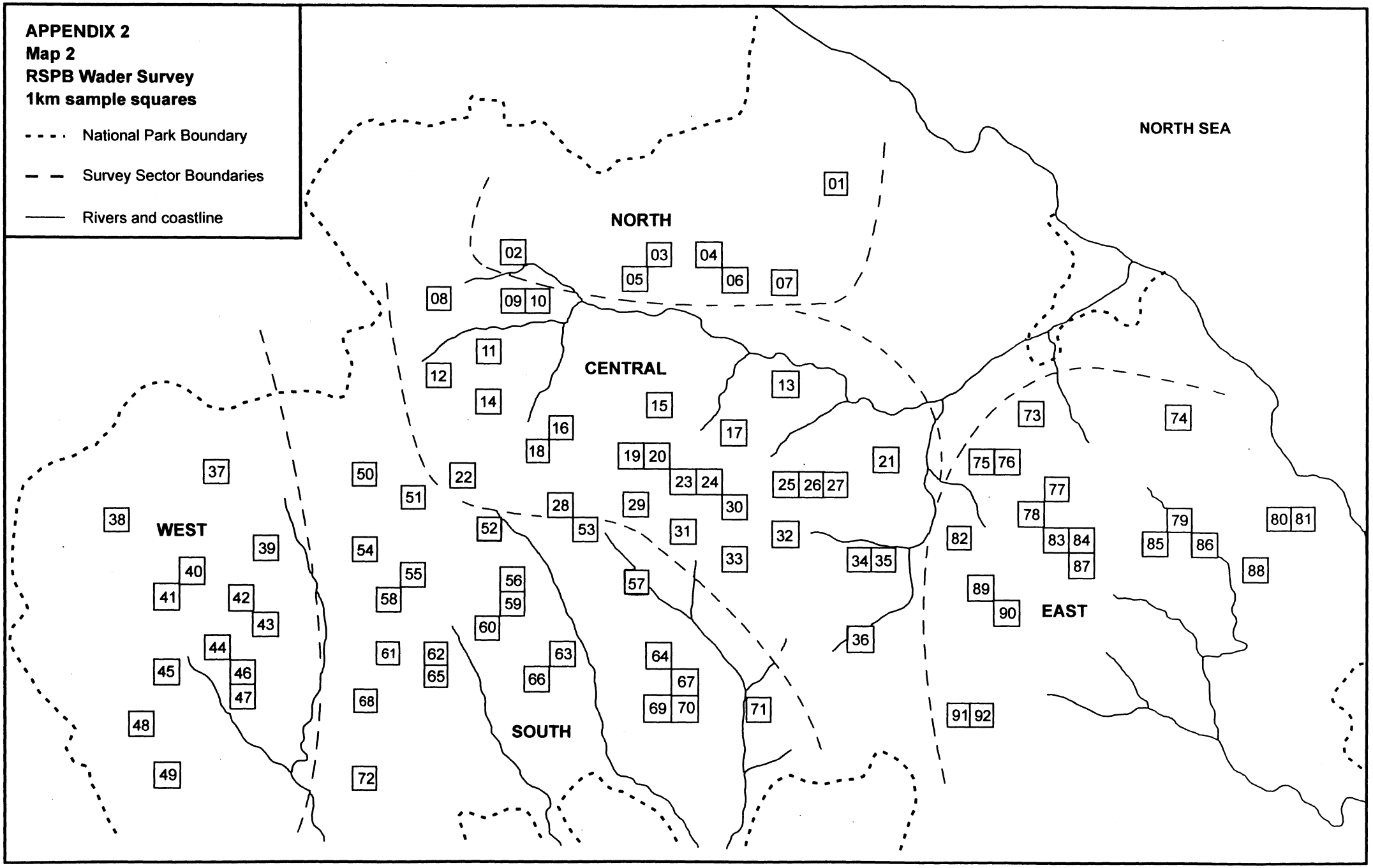
APPENDIX 2
Map 2
RSPB Wader Survey
1km sample squares
National Park Boundary
Survey Sector Boundaries
Rivers and coastline
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APPENDIX 3

An example of a Heather Condition Survey Map

North York Moors Heather Condition Sample Survey: 1996

Square: 98 Fen Moor

Key:

Heather cover:		Heather type:	
5	>75%	NB	Newly burnt
4	51-75%	P	Pioneer
3	26-50%	B	Building
2	10-25%	M	Mature
1	<10%	D	Degenerate
	No heather	S	Suppressed

Grassland type:		Other vegetation:	
A/F	Agrostis/Festuca	Pt	Bracken
F/A	Festuca/Agrostis	Ju	Rushes
Na	Nardus	W	Woodland
bM	burnt Molinia		
Mo	unburnt Molinia		
Rg	Reseeded		

Survey by R Jerram

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