

BRYOPHYTE SURVEY OF HEATHLAND AT
THE SIDE,
ENNERDALE, CUMBRIA, OCTOBER 2001

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1 INTRODUCTION

Brief general description of the site

The Side is a NNE-facing slope south of Ennerdale Water in the western part of the English Lake District (Map 1). It is mostly steep, but halfway up the slope at about 300-400 m there is a gently sloping bench. The slope is generally rocky and includes the conspicuous cliffs of Boathow Crag. The vegetation is mostly heathland dominated by heather *Calluna vulgaris*. On the higher ground the slope flattens out onto an exposed plateau at 500-630 m, with mixtures of *Calluna* heath, *Vaccinium myrtillus* heath, grassland and bog. Below about 250-300 m on the lower parts of the slope the heathland passes into bracken-dominated vegetation, and below 200 m the vegetation is mainly deciduous woodland (Side Wood) extending down to the shores of Ennerdale Water at 112 m. The bedrock is mapped as being in the category of *Granite, syenite, granophyre & allied types* (British Geological Survey 1979); a larger-scale map shows it to be mainly granophyre (which is coarse-grained and acidic), with some small areas with intrusions of finer-grained, more basic igneous rock. The site is used for sheep-grazing. A path, well used by walkers, runs along the lower, northern edge of Side Wood, downslope of the heath, but the heathy slopes of The Side are not much frequented by walkers and lack well-used footpaths.

Climate

The climate is wet and oceanic. Data from the 20th century show an average annual rainfall of about 150-200 cm (Meteorological Office 1952), and an average of about 180 wet-days (1 mm or more of rain) a year (Ratcliffe 1968). Winters are cool to cold, with a January mean daily temperature of about 0.5-3.0°C (Meteorological Office 1975). Summers are fairly warm, with a July-August mean daily temperature of about 11.5-14.0°C (Meteorological Office 1975). The annual temperature range is quite small by general British standards. Cloud cover obscures bright sunshine for an average of about 70% of the day (Page 1982). Nitrate deposition has been estimated to be at a high concentration of about 0.5-0.7 g N m⁻² (Pitcairn & Fowler 1989). Sulphur dioxide pollution in 1987 was estimated to be at a fairly low concentration of about 4-8 µg S m⁻³ (Hill *et al.* 1991).

Purpose of this survey

The Side is owned by the National Trust, who commissioned this survey for the following purposes:

- to carry out a brief (one day) field survey of bryophytes within the heath communities of The Side, focussing on notable species.
- collation of any other available information on the bryophyte interest of this area.
- preliminary assessment of the bryological significance in a regional/national context.
- a brief report to be produced including a map showing the extent of ground surveyed, locations of notable species and recommendations for any additional survey.

Previous bryophyte surveys in heathland at The Side

I have no records from previous bryophyte surveys here, except that my wife Alison found the oceanic liverwort *Herbertus aduncus* while walking through the site in summer 1988.

Nomenclature used in this report

The botanical nomenclature in this report follows Stace (1997) for vascular plants, Blockeel & Long (1998) for bryophytes, and Purvis *et al.* (1992) for lichens.

2 METHODS

I carried out the fieldwork on 19 October 2001.

I walked into the site from the NW, upslope of Boathow Crag, then SE across the high plateau to about 640 m above Iron Crag in the SE, then back NW across the higher part of the plateau for a short distance before descending down the steeper slopes of The Side, exploring both steeper and more gentle slopes, and the lower parts of Boathow Crag, and finally dropping down from Boathow Crag to the woodland and lake below.

I made a list of all bryophyte species which I saw, recording the quantity of each species using four categories: abundant; frequent; occasional; rare. I recorded the locations, abundance and habitats of species of particular interest: I marked these locations onto a 1:25,000 map and made accompanying notes for each location.

I did not explore the steepest areas because physical access was either impossible or too dangerous.

3 RESULTS

General vegetation

The sequence of vegetation, from the high plateau downslope through Side Wood to Ennerdale Water, is roughly as follows (codes are those of the National Vegetation Classification - see Appendix 3 for key to NVC codes):

- > **c. 620 m:** Short, heavily grazed bilberry heath (H18c) + grassland (U4a + U5a + some U5e) + a little *Calluna* heath (H12a + HY) on highest part of high, exposed plateau, above about 620 m.
- c. 560-620 m:** Rather short *Calluna* heath (H12a) + short, heavily grazed bilberry heath (H18c) + grassland (U5a + a little U4e) on high plateau at about 560-620 m.
- c. 500-560 m:** Rather short to medium height *Calluna* heath (H12a) + heavily grazed grassland (U5a) + some wet heath (M15d) and bog (M17a + M19) on lower, flat to very gently sloping part of exposed plateau (c. 500-560 m).
- c. 400-500 m:** Tall, lightly grazed *Calluna* heath (H12a + H21a) + occasional small bryophyte-dominated springs (M32) on steep slope.
- c. 300-400 m:** Lightly grazed dry and wet heaths (H12a, H21a, M15b + some M15a flushes) on gently sloping 'bench'
- c. 250-300 m:** Lightly grazed *Calluna* heath (H12a + H21a) and bracken (U20) on steep slope
- c. 200-250 m:** Mainly bracken (U20) on lightly grazed to moderately grazed steep slope above wood
- < **c. 200 m:** Deciduous woodland (Side Wood) (W11 + W17) + some bracken (U20) on steep lower slopes extending downslope to Ennerdale Water. Mostly moderately grazed to heavily grazed, but ungrazed at SE end.

Bryophyte flora

I have recorded a total of 56 bryophyte species at this site.

The quantity of each species recorded by me here is given in Appendix 1. This appendix indicates the habitats in which each species was found, and also the European distribution of each species according to the phytogeographical classification by Hill & Preston (1998).

The 'Target Notes' for the locations of species of particular interest are shown in the map in Appendix 2. Botanical details are also given on this map.

4 EVALUATION

The total number of 56 bryophyte species recorded here is moderately high for an area of mainly acidic heathland lacking large streams, ravines, trees and habitats with significant base-enrichment. Comparable areas of heathland in western Scotland can have much higher species totals (e.g. about 150 species on the SE slope of Roineabhal in the Outer Hebrides; A.B.G. Averis 1994), though such places generally have more streams, and their bryophytes also benefit from the more markedly oceanic climate and the smaller amount of pollution/acidification.

The bryophyte flora of The Side encompasses several of the European phytogeographical groups of Hill & Preston (1998), varying from Boreo-arctic-montane (northern) to Southern-temperate (southern), and from Hyperoceanic (western) to Eurasian, Eurosiberian and Circumpolar (extending well to the east). Most species here are widespread in Europe. Those with the most northern distribution patterns in Europe are the mosses *Andreaea rupestris*, *Calliergon sarmentosum*, *Drepanocladus revolvens*, *Racomitrium lanuginosum* and *R. sudeticum*, and the liverwort *Anthelia julacea*. No species with markedly southern European distributions were found here, but five are distinctly western (oceanic) in Europe: the mosses *Breutelia chrysocoma* and *Campylopus atrovirens*, and the liverworts *Gymnomitrium crenulatum*, *Herbertus aduncus* and *Scapania gracilis*. Oceanic bryophytes evidently need a wet climate with cool summers and mild winters; even in the most wet, equable parts of the British Isles they are found mainly in sheltered, rocky woods and steep, rocky, NW-E-facing hillsides. The western Highlands and western Ireland are especially rich areas. Some oceanic species also occur in other wet, equable parts of the world, but some - including *Scapania gracilis* which was found in this survey - are known only from Europe and Macaronesia.

I did not find any non-native bryophyte species during this survey.

Although the bryophyte flora of this site is not notably rich it does contain small or localized populations of some nationally uncommon species - the liverworts *Anastrepta orcadensis*, *Bazzania tricrenata*, *Gymnomitrium crenulatum*, *G. obtusum* and *Herbertus aduncus* - and is about as rich as can be expected in such habitats in this part of Britain. I found the scarcer species mainly on the steeper NE-facing slopes of Boathow Crag. This is not surprising because the slope aspect and abundance of rocks here must combine to give a more humid, sheltered and equable microclimate than in most other parts of the site. The scarce species found here generally favour cool, humid conditions.

Herbertus aduncus is the single most notable of these species. It has a very strongly oceanic distribution in Europe and even within the British Isles. It is found mainly on cool, NW-E-facing hillsides, especially in the western Highlands where it is the most conspicuous and consistent member of a group of oceanic liverworts in various types of oceanic heath (NVC H20c *Vaccinium myrtillus*-*Racomitrium lanuginosum* heath, *Bazzania tricrenata*-*Mylia taylorii* sub-community and H21b *Calluna vulgaris*-*Vaccinium myrtillus*-*Sphagnum capillifolium* heath, *Herbertus aduncus*-*Mastigophora woodsii* sub-community). These liverworts are very vulnerable to burning, so their presence in heaths often appears to be a sign that there has been little or no burning in the past (Ratcliffe 1968, A.M. Averis 1994). This is consistent with the fact that they are commonest in rocky habitats, where the rockiness can be

expected to limit the spread of fire. So, in the heath at Boathow Crag the presence of some cushions of *H. aduncus* together with many patches of *B. tricrenata*, *M. taylorii* and *A. orcadensis* can be taken as an indication of good 'health' of the heath, and perhaps also a relatively high degree of naturalness. Alison Averis's 1988 record of *H. aduncus* is from *Calluna* heath on a smaller steep slope well to the east of Boathow Crag: this again is a good find, especially as it is in a less 'cliffy' and more accessible habitat than is usual for this species.

Other features of the bryophyte flora are not really notable, though neither are they a sign of poor quality habitat and inappropriate past management. Through most of the heathland in the slopes of The Side, the heath vegetation generally is only lightly grazed, and shows little sign of having been greatly modified for a long time. The heather is tall and vigorous, and there is a generally good abundance and diversity of bryophytes.

The site has good examples of H12 and H21 heaths. The diversity of common mosses in both of these heathland types is greater than in much of the H12 heath on grouse moors in parts of northern England, where the bryophyte diversity has evidently declined as a result of regular burning of heather and also as a result of atmospheric pollution. It is interesting to see *Erica cinerea* growing commonly in much of the drier heath here. Much of the oceanic character of heaths in western Britain and Ireland is owing to the presence of this oceanic species, but *E. cinerea* is rare in or absent from many of the more heavily managed heaths south of the Highlands, even on many suitable-looking, dry, well-lit, low-altitude slopes (e.g. in parts of Wales).

It is good to see areas of wet heath (NVC type M15b) among the drier heaths on the gently sloping middle parts of The Side. Wet heath is common and extensive in the Scottish Highlands, but further south it is generally much scarcer and usually more fragmented and modified. The wet heath at The Side has more of a Highland appearance, as do the extensive, wild-looking areas of lightly grazed, rocky heath on this slope as a whole.

The numerous small springs and flushes scattered among the *Calluna* heaths on The Side add greatly to the overall diversity, and to the bryophyte flora (e.g. *Breutelia chrysocoma*, *Bryum pseudotriquetrum* and *Anthelia julacea*) and the vascular flora (e.g. *Saxifraga stellaris* and *Chryso-splenium oppositifolium*).

The high plateau also has a wild character but its vegetation is clearly modified by heavy grazing and much heathland has been converted into grassland. The vegetation here is not very notable botanically, with no bryophytes of special interest found in this survey. The vascular flora includes scattered plants of the clubmoss *Diphasiastrum alpinum*. The presence of small areas of prostrate *Calluna* heath (HY) is interesting because prostrate *Calluna* heaths are scarce south of the Highlands.

The small exclosures - ungrazed over the last 10 years - show that the vegetation of the site as a whole would be rather different if grazing were reduced or eliminated. On the high plateau the vegetation in the three exclosures is more heathy than that outside, with grasses flowering more abundantly and the moss/lichen layer generally deeper and more extensive. The vegetation is a little taller inside the plateau exclosures than on the surrounding grazed ground. One young rowan, 20 cm tall, was seen in the highest exclosure at about 640 m - a high altitude for trees, especially in such an exposed situation. However, this might just be a case of establishment and

short-term survival rather than successful long-term survival. In the mid-slope enclosure at NT 117 133 the heath is tall and vigorous on both sides of the fence, but the absence of grazing inside the enclosure has allowed *Molinia caerulea* to flower well and its leaves to grow taller and more conspicuously, and has also allowed some young rowans to grow (two seen, growing to heights of about 70 cm and about 150 cm). I did not visit the next enclosure downslope, just above the wood.

My bryophyte species list is obviously not complete: no survey can claim to be totally comprehensive. However, from what I saw during my visit to this site, I would not expect many more significant bryophytes to occur here, at least in the more accessible heathland habitats. I suspect that the steep N-ENE-facing crags in the SE (Iron Crag, from NY 119128 ESE to NY 123127 and from there SSE to NY 126120) could well support the same species as those which I found on the lower parts of Boathow Crag. It is also possible that all of these crags may support some species of interest which were not found by me in this survey. Interesting species which I might expect here are the oceanic liverworts *Lepidozia pearsonii* and *Plagiochila spinulosa*, and the suboceanic *Sphenolobopsis pearsonii*. If they are present on any of these crags I would expect them to be in steeper, less accessible places. Another notable species which might possibly occur is the uncommon oceanic liverwort *Scapania ornithopodioides*. This 'choice' species is found in Great Britain mainly in the western Highlands, but there are a few records from heathy cliffs in the Lake District and Snowdonia. However, I would expect that the climate at The Side is not wet enough for this species, which really favours areas with at least 220 wet days annually. Therefore, balancing the existing records with the rather limited 'promise' of further bryophyte finds, I would not class this as a site with a pressing need for a more detailed bryophyte survey.

Table 1 Number of bryophyte species in each phytogeographical group, and their percentage representation of the total flora recorded at The Side, Ennerdale, Cumbria

<i>Phytogeographical group</i>	No.	%
11 Oceanic Arctic-montane	0	0
12 Suboceanic Arctic-montane	0	0
13 European Arctic-montane	0	0
14 Eurosiberian Arctic-montane	0	0
15 Eurasian Arctic-montane	0	0
16 Circumpolar Arctic-montane	1	2
21 Oceanic Boreo-arctic Montane	0	0
22 Suboceanic Boreo-arctic Montane	0	0
23 European Boreo-arctic Montane	0	0
24 Eurosiberian Boreo-arctic Montane	0	0
26 Circumpolar Boreo-arctic Montane	5	19
32 Suboceanic Wide-boreal	0	0
34 Eurosiberian Wide-boreal	0	0
35 Eurasian Wide-boreal	0	0
36 Circumpolar Wide-boreal	5	19
41 Oceanic Boreal-montane	2	4
42 Suboceanic Boreal-montane	2	4
43 European Boreal-montane	3	5
44 Eurosiberian Boreal-montane	0	0
45 Eurasian Boreal-montane	0	0
46 Circumpolar Boreal-montane	2	4
51 Oceanic Boreo-temperate	0	0
52 Suboceanic Boreo-temperate	10	18
53 European Boreo-temperate	8	14
54 Eurosiberian Boreo-temperate	0	0
55 Eurasian Boreo-temperate	0	0
56 Circumpolar Boreo-temperate	6	11
63 European Wide-temperate	0	0
64 Eurosiberian Wide-temperate	0	0
65 Eurasian Wide-temperate	0	0
66 Circumpolar Wide-temperate	1	2
70 Hyperoceanic Temperate	2	4
71 Oceanic Temperate	0	0
72 Suboceanic Temperate	4	7
73 European Temperate	4	7
74 Eurosiberian Temperate	0	0
75 Eurasian Temperate	0	0
76 Circumpolar Temperate	0	0
80 Hyperoceanic Southern-temperate	1	2
81 Oceanic Southern-temperate	0	0
82 Suboceanic Southern-temperate	0	0
83 European Southern-temperate	0	0
84 Eurosiberian Southern-temperate	0	0
85 Eurasian Southern-temperate	0	0
86 Circumpolar Southern-temperate	0	0
91 Mediterranean-Atlantic	0	0
92 Submediterranean-Subatlantic	0	0
93 Mediterranean-montane	0	0
Unclassified	0	0
Introduced	0	0
Total no. of species	56	100
Number of oceanic species*	5	19

* Oceanic spp. total = sum of spp. in phytogeographical groups 11+21+41+51+70+71+80+81+91

Table 2 Bryophyte species of particular interest recorded at The Side, Ennerdale, Cumbria

(o) = oceanic species; (u) = species which are uncommon in the British Isles ('uncommon' = based on a subjective assessment rather than the number of 10x10 km square records, because the latter does not always give the best indication of rarity).

<u>Mosses</u>	<u>Abundance at Side Wood</u>
<i>Breutelia chrysocoma</i> (o)	occasional
<i>Campylopus atrovirens</i> (o)	rare
 <u>Liverworts</u>	
<i>Anastrepta orcadensis</i> (u)	occasional
<i>Bazzania tricrenata</i> (u)	occasional
<i>Gymnomitrium crenulatum</i> (ou)	rare
<i>Gymnomitrium obtusum</i> (u)	rare
<i>Herbertus aduncus</i> (ou)	occasional
<i>Scapania gracilis</i> (o)	frequent
<hr/>	
Total number of oceanic bryophyte spp.	5
Total no. of uncommon bryophyte spp.	5
<hr/>	

5 ACKNOWLEDGMENTS

John Hooson (National Trust) arranged for this survey to be carried out. My wife Alison kindly read and commented on through a first draft of this report.

6 REFERENCES

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APPENDIX 1 - BRYOPHYTE SPECIES RECORDED BY BEN AVERIS IN HEATHLAND AT THE SIDE, ENNERDALE, CUMBRIA IN OCTOBER 2001

Phy column: European phytogeographical classes (Hill & Preston 1998):

- 11 Oceanic Arctic-montane
- 12 Suboceanic Arctic-montane
- 13 European Arctic-montane
- 14 Eurosiberian Arctic-montane
- 15 Eurasian Arctic-montane
- 16 Circumpolar Arctic-montane
- 21 Oceanic Boreo-arctic Montane
- 22 Suboceanic Boreo-arctic Montane
- 23 European Boreo-arctic Montane
- 24 Eurosiberian Boreo-arctic Montane
- 26 Circumpolar Boreo-arctic Montane
- 32 Suboceanic Wide-boreal
- 34 Eurosiberian Wide-boreal
- 35 Eurasian Wide-boreal
- 36 Circumpolar Wide-boreal
- 41 Oceanic Boreal-montane
- 42 Suboceanic Boreal-montane
- 43 European Boreal-montane
- 44 Eurosiberian Boreal-montane
- 45 Eurasian Boreal-montane
- 46 Circumpolar Boreal-montane
- 51 Oceanic Boreo-temperate
- 52 Suboceanic Boreo-temperate
- 53 European Boreo-temperate
- 54 Eurosiberian Boreo-temperate
- 55 Eurasian Boreo-temperate
- 56 Circumpolar Boreo-temperate
- 63 European Wide-temperate
- 64 Eurosiberian Wide-temperate
- 65 Eurasian Wide-temperate
- 66 Circumpolar Wide-temperate
- 70 Hyperoceanic Temperate
- 71 Oceanic Temperate
- 72 Suboceanic Temperate
- 73 European Temperate
- 74 Eurosiberian Temperate
- 75 Eurasian Temperate
- 76 Circumpolar Temperate
- 80 Hyperoceanic Southern-temperate
- 81 Oceanic Southern-temperate
- 82 Suboceanic Southern-temperate
- 83 European Southern-temperate
- 84 Eurosiberian Southern-temperate
- 85 Eurasian Southern-temperate
- 86 Circumpolar Southern-temperate
- 91 Mediterranean-Atlantic
- 92 Submediterranean-Subatlantic
- 93 Mediterranean-montane

Appendix 1 (cont.)

Mosses

Phyt	Species	Abundance	Habitats
46	<i>Amphidium mougeotii</i>	rare	rocks
26	<i>Andreaea rupestris</i>	occasional	rocks
56	<i>Bartramia pomiformis</i>	rare	rocks
70	<i>Breutelia chrysocoma</i>	occasional	flushed ground
36	<i>Bryum pseudotriquetrum</i>	rare	wet flushes
26	<i>Calliergon sarmentosum</i>	rare	wet flushes
70	<i>Campylopus atrovirens</i>	rare	wet rocks/banks
72	<i>Campylopus flexuosus</i>	occasional	ground
43	<i>Dicranella palustris</i>	rare	wet flushes/springs
56	<i>Dicranum majus</i>	rare	ground
36	<i>Dicranum scoparium</i>	frequent	ground; banks; rocks
26	<i>Drepanocladus revolvens</i>	rare	wet flushes/springs
36	<i>Hylocomium splendens</i>	abundant	ground
72	<i>Hypnum jutlandicum</i>	abundant	ground
52	<i>Isoetecium myosuroides</i>	rare	rocks
73	<i>Leucobryum glaucum</i>	occasional	ground
73	<i>Mnium hornum</i>	rare	ground; rocks
66	<i>Philonotis fontana</i>	rare	wet flushes/springs
52	<i>Plagiothecium undulatum</i>	frequent	ground
56	<i>Pleurozium schreberi</i>	abundant	ground
36	<i>Polytrichum commune</i>	occasional	wet ground
52	<i>Pseudotaxiphyllum elegans</i>	rare	among rocks
52	<i>Racomitrium aciculare</i>	rare	wet rocks
72	<i>Racomitrium aquaticum</i>	rare	moist rocks
53	<i>Racomitrium fasciculare</i>	occasional	rocks
52	<i>Racomitrium heterostichum</i>	occasional	rocks
26	<i>Racomitrium lanuginosum</i>	frequent	rocks; ground
26	<i>Racomitrium sudeticum</i>	occasional	rocks
56	<i>Rhizomnium punctatum</i>	rare	flushes; springs
52	<i>Rhytidiadelphus loreus</i>	abundant	ground
53	<i>Rhytidiadelphus squarrosus</i>	rare	ground
56	<i>Sphagnum capillifolium</i>	abundant	damp ground generally
53	<i>Sphagnum denticulatum</i>	frequent	flushes; springs; wet ground generally
53	<i>Sphagnum fallax</i>	rare	wet flushes
53	<i>Sphagnum papillosum</i>	frequent	wet ground
52	<i>Sphagnum subnitens</i>	rare	wet ground
52	<i>Sphagnum tenellum</i>	frequent	wet ground
73	<i>Thuidium tamariscinum</i>	occasional	ground; banks
73	<i>Ulota crispa</i>	rare	heather stems

Appendix 1 (cont.)

Liverworts

Phyt	Species	Abundance	Habitats
42	<i>Anastrepta orcadensis</i>	occasional	mossy banks
36	<i>Aneura pinguis</i>	rare	flushes
16	<i>Anthelia julacea</i>	rare	wet flushed ground
46	<i>Barbilophozia floerkei</i>	frequent	rocks; banks
43	<i>Bazzania tricrenata</i>	occasional	mossy banks
72	<i>Calypogeia fissa</i>	rare	moist ground/banks
56	<i>Cephalozia bicuspidata</i>	rare	moist ground/banks
52	<i>Diplophyllum albicans</i>	occasional	rocks; banks
52	<i>Frullania tamarisci</i>	rare	rocks
41	<i>Gymnomitrium crenulatum</i>	rare	rocks
43	<i>Gymnomitrium obtusum</i>	rare	rocks
41	<i>Herbertus aduncus</i>	occasional	rocky banks
53	<i>Lophozia ventricosa</i>	rare	rocks; banks
53	<i>Marsupella emarginata</i>	rare	moist rocks
42	<i>Mylia taylorii</i>	occasional	rocks; banks
80	<i>Scapania gracilis</i>	frequent	rocks; banks; ground
53	<i>Scapania undulata</i>	occasional	wet rocks; springs; flushes

APPENDIX 2 - Map of The Side, Ennerdale, Cumbria, showing approximate route taken by Ben Averis on 19 October 2001, and locations of bryophytes and other plants of particular interest found on that visit

Key to 'Target Notes' for locations of interesting plant species.

1. NY 110 133. Boathow Crag. Liverworts *Herbertus aduncus*, *Anastrepta orcadensis*, *Bazzania tricrenata* and *Mylia taylorii* scattered in heathland on steep, rocky slope along bottom of cliffs. Smaller liverworts *Gymnomitrium crenulatum* and *G. obtusum* on rock surfaces in this general area.

2. NY 115 130. Some small bryophyte-dominated springs and flushes dotted among *Calluna* heath in this general area, adding diversity. Species include mosses *Breutelia chrysocoma*, *Campylopus atrovirens*, *Bryum pseudotriquetrum*, *Calliergon sarmentosum*, *Dicranella palustris*, *Drepanocladus revolvens*, *Rhizomnium punctatum*, *Philonotis fontana* and *Sphagnum denticulatum*, liverworts *Aneura pinguis*, *Anthelia julacea* and *Scapania undulata*, and vascular plants *Chrysosplenium oppositifolium*, *Narthecium ossifragum* and *Saxifraga stellaris*.

3. NY 11585 13211 (grid reference taken from GPS device). One juniper bush c. 1 m tall seen here, growing in *Calluna* heath. Liverwort *Herbertus aduncus* seen by Alison Averis in summer 1988 somewhere in this general area, growing beneath tall *Calluna* (NVC H21) on steep, rocky slope.

4. NY 11835 12529 (grid reference taken from GPS device). *Diphasiastrum alpinum* growing with *Empetrum nigrum*, *Carex binervis*, *Racomitrium lanuginosum* and *Cladonia* spp. in short, grazed *Festuca-Agrostis* grassland (NVC type U4e). *Huperzia selago* present too (widespread on higher parts of plateau).

5. NY 12190 12171 (grid reference taken from GPS device). Lichen *Cetraria islandica* in mossy vegetation with grasses, *Vaccinium myrtillus*, *V. vitis-idaea* and *Empetrum nigrum* (NVC U4e and H18c) in this general area, in and around enclosure.

APPENDIX 3 - List of National Vegetation Classification (NVC) types referred to in this report

Woodland

W11 *Quercus petraea*-*Betula pubescens*-*Oxalis acetosella* woodland

W17 *Quercus petraea*-*Betula pubescens*-*Dicranum majus* woodland

Heathland

H12 *Calluna vulgaris*-*Vaccinium myrtillus* heath
a *Calluna vulgaris* sub-community

H18 *Vaccinium myrtillus*-*Deschampsia flexuosa* heath
c *Racomitrium lanuginosum*-*Cladonia* spp sub-community

H21 *Calluna vulgaris*-*Vaccinium myrtillus*-*Sphagnum capillifolium* heath
a *Calluna vulgaris*-*Pteridium aquilinum* sub-community

HY Prostrate *Calluna vulgaris* heath which does not fit clearly into any NVC heathland (mainly because it has little or no *Racomitrium lanuginosum* and *Cladonia* spp.). (The code HY has been used for this type of heath in previous survey reports by Ben and Alison Averis).

Mires (including wet heath)

M15 *Trichophorum cespitosum*-*Erica tetralix* wet heath
a *Carex panicea* sub-community
b Typical sub-community
d *Vaccinium myrtillus* sub-community

M17 *Trichophorum cespitosum*-*Eriophorum vaginatum* blanket mire
a *Drosera rotundifolia*-*Sphagnum* sub-community

M19 *Calluna vulgaris*-*Eriophorum vaginatum* blanket mire

M32 *Philonotis fontana*-*Saxifraga stellaris* spring

Acidic grasslands

U4 *Festuca ovina*-*Agrostis capillaris*-*Galium saxatile* grassland
a Typical sub-community
e *Vaccinium myrtillus*-*Deschampsia flexuosa* sub-community

U5 *Nardus stricta*-*Galium saxatile* grassland
a Species-poor sub-community
e *Racomitrium lanuginosum* sub-community

Bracken

U20 *Pteridium aquilinum*-*Galium saxatile* community