
Appendix 4 – Ecological Appendices

Contents

Appendix 4a	NVC and Bryophyte Survey
Appendix 4b	Macrophyte Survey Notes
Appendix 4c	European Protected Species Surveys
Appendix 4d	Otter Habitat Assessment Report
Appendix 4e	Fish Survey Report (June 2009)
Appendix 4f	Fish Survey Report (January 2010)

Appendix 4a NVC and Bryophyte Survey

NVC AND BRYOPHYTE SURVEY OF WOODLAND AT
PULPIT ROCK,
LOCH LOMOND, JUNE 2007



Ben Averis

**6 Stonelaws Cottages, East Linton, East Lothian, EH40 3DX
Telephone: 01620 870 280. E-mail: abg.am.averis@virgin.net**

2007

**A report commissioned by Scott Wilson Scotland Ltd
23 Chester Street, Edinburgh, EH3 7ET**

NVC AND BRYOPHYTE SURVEY OF WOODLAND AT
PULPIT ROCK,
LOCH LOMOND, JUNE 2007

Ben Averis

6 Stonelaws Cottages, East Linton, East Lothian, EH40 3DX
Telephone: 01620 870 280
E-mail: abg.am.averis@virgin.net

2007

A report commissioned by:
Scott Wilson Scotland Ltd
23 Chester Street, Edinburgh, EH3 7ET

CONTENTS

1 INTRODUCTION	1
2 METHODS	1
3 DESCRIPTIONS OF VEGETATION TYPES	2
4 BRYOPHYTE FLORA	7
5 ACKNOWLEDGMENTS	9
6 REFERENCES	9
APPENDIX 1 – Bryophyte species list	10
APPENDIX 2 – Vegetation map	14
APPENDIX 3 – Photographs	15

1 INTRODUCTION

This survey was commissioned by Scott Wilson Ltd, in order to map and describe the vegetation and bryophyte flora of woodland at Pulpit Rock on the western side of Loch Lomond. This information is required to inform decisions about proposed road improvements here.

The survey area is a narrow strip of woodland on NE-E-facing slopes extending from NS 324 138 south-eastwards to NS 329 131. It is about 750 m long (NW-SE) and varies in width from about 40 m up to about 200 m. The north-westernmost part is grazed by sheep, but the remainder has no stock-grazing though the whole site is accessible to deer. Parts of the central area are extremely steep and are evidently ungrazed.

Nomenclature in this report follows Stace (1997) for vascular plants and Blockeel & Long (1998) for bryophytes.

2 METHODS

The fieldwork was carried out on 19th June 2007.

NVC survey

I classified the vegetation according to the National Vegetation Classification (NVC) (Rodwell 1991a, 1991b, 1992, 1995, 2000), to sub-community level wherever possible. I mapped the vegetation onto a 1:5,000 scale base map supplied by Scott Wilson. I labelled mapped vegetation units with their NVC codes. Some areas have complex mosaics of two or more NVC types, so I labelled these with the appropriate NVC codes, adding an estimated percentage cover value for each code. Some vegetation is intermediate between two NVC types, so I classed it as such using a hyphen between the two NVC codes: e.g. W4b-W7.

Bryophyte survey

I made a list of all bryophyte species which I found during the survey. I recorded the approximate quantity of each species here, using four categories: 'rare', 'occasional', 'frequent' and 'abundant'. I also recorded the habitats in which each species was found, and mapped the locations of uncommon species of particular interest (mapped as 'target notes').

Other information recorded

Harriet Lindsay (an ecologist from Perth) was present during this survey, and made a list of all vascular plants species seen. She will be passing that list on to Scott Wilson Ltd.

3 DESCRIPTIONS OF VEGETATION TYPES

17 types of vegetation and habitat were recorded in this survey. These are listed in Table 1 and described below. The vegetation map is in Appendix 2.

Table 1 List of vegetation types recorded by Ben Averis in this survey of woodland at Pulpit Rock, Loch Lomond, on 19th June 2007

- W4a *Betula pubescens-Molinia caerulea* woodland, *Dryopteris dilatata-Rubus fruticosus* sub-community
W4b-W7 Woodland intermediate between W4b *Betula pubescens-Molinia caerulea* woodland, *Juncus effusus* sub-community and W7b *Alnus glutinosa-Fraxinus excelsior-Lysimachia nemorum* woodland, *Carex remota-Cirsium palustre* sub-community
W7b *Alnus glutinosa-Fraxinus excelsior-Lysimachia nemorum* woodland, *Carex remota-Cirsium palustre* sub-community
W11a *Quercus petraea-Betula pubescens-Oxalis acetosella* woodland, *Dryopteris dilatata* sub-community
W11b *Quercus petraea-Betula pubescens-Oxalis acetosella* woodland, *Blechnum spicant* sub-community
W17a *Quercus petraea-Betula pubescens-Dicranum majus* woodland, *Isoetes myosuroides-Diplophyllum albicans* sub-community
W17b *Quercus petraea-Betula pubescens-Dicranum majus* woodland, Typical sub-community
W17c *Quercus petraea-Betula pubescens-Dicranum majus* woodland, *Anthoxanthum odoratum-Agrostis capillaris* sub-community
W24 *Rubus fruticosus* agg-*Holcus lanatus* underscrub
W25 *Pteridium aquilinum-Rubus fruticosus* agg underscrub
M23b *Juncus effusus/acutiflorus-Galium palustre* rush-pasture, *Juncus effusus* sub-community
M25c *Molinia caerulea-Potentilla erecta* mire, *Angelica sylvestris* sub-community
U4a *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland, Typical sub-community
U20a *Pteridium aquilinum-Galium saxatile* community, *Anthoxanthum odoratum* sub-community
MG6 *Lolium perenne-Cynosurus cristatus* pasture
Shingle
Road

W4a *Betula pubescens-Molinia caerulea* woodland, *Dryopteris dilatata-Rubus fruticosus* sub-community

This is wet acid woodland with a canopy of *Betula pubescens* and field/ground layer vegetation dominated by extensive carpets of the moss *Sphagnum palustre* and abundant, long-leaved tussocks of *Molinia caerulea*. Other grasses occur thinly among the *Molinia* and *Sphagnum*: *Anthoxanthum odoratum* and *Holcus mollis*. The small, low-grown herbs *Oxalis acetosella*, *Galium saxatile*, *Potentilla erecta* and *Lysimachia nemorum* are scattered among the moss carpets which also include *Sphagnum fallax*, *Thuidium tamariscinum*, *Hylocomium splendens*, *Scleropodium purum*, *Rhytiadelphus loreus* and *Polytrichum commune*. *Rubus fruticosus* and *Lonicera periclymenum* trail through the vegetation in places, and there are scattered tufts of *Dryopteris dilatata*, *Carex echinata* and *Hyacinthoides non-scripta*, a few plants of *Myrica gale* and one or two ash and hazel seedlings. There are two small patches of this type of woodland on flattish to gently sloping ground among drier W11 and W17 woodland in the south-east of the site.

W4b-W7 Woodland intermediate between W4b *Betula pubescens-Molinia caerulea* woodland, *Juncus effusus* sub-community and W7b *Alnus glutinosa-Fraxinus excelsior-Lysimachia nemorum* woodland, *Carex remota-Cirsium palustre* sub-community

This is alder-dominated woodland with a field layer in which abundant *Molinia caerulea* or *Sphagnum* (as in W4) is accompanied by an abundance of mesotrophic herbs (as in W7). It occurs in two locations here.

In the north-west it occupies a wet basin in which carpets of *Sphagnum palustre* grow with abundant *Galium palustre*, *Carex echinata*, *Ranunculus flammula* and *Juncus bulbosus*, and smaller amounts of *Crepis paludosa*, *Viola palustris* and *Dryopteris dilatata*. The canopy here includes some *Betula pubescens* and *Salix cinerea*.

In the south-east a more species-rich form of W4b-W7 woodland occupies drier, sandy, more or less level ground along the loch shore. Here, tussocks of *Molinia* are co-dominant with abundant *Potentilla erecta*, *Filipendula ulmaria* and *Succisa pratensis*, and smaller quantities of *Scutellaria galericulata*, *Carum verticillatum*, *Galium palustre*, *Hieracium* sp., *Lotus pedunculatus*, *Myrica gale*, *Viola riviniana*, *Achillea ptarmica*, *Angelica sylvestris*, *Ranunculus acris*, *Phalaris arundinacea*, *Lysimachia vulgaris* and *Conopodium majus*. Despite this long list the vascular cover is not continuous and there are many small patches of open, moist sandy ground partly covered with the moss *Mnium hornum* and the liverwort *Pellia epiphylla*. There is also a little ash, rowan and downy birch in the canopy, and one bush of guelder rose was seen too. It appears likely that periodic inundation by loch water is responsible for maintaining this area as a wet woodland and for causing some ground disturbance which prevents vascular cover from becoming complete.

W7b *Alnus glutinosa-Fraxinus excelsior-Lysimachia nemorum* woodland, *Carex remota-Cirsium palustre* sub-community

This is wet, herb-rich woodland with a canopy of alder, ash, sessile oak and hazel. The field layer consists of varied, short to tall (20-50 cm) mixtures of the herbs *Filipendula ulmaria*, *Primula vulgaris*, *Angelica sylvestris*, *Geranium robertianum*, *Epilobium montanum*, *Lysimachia nemorum*, *Fragaria vesca*, *Valeriana officinalis*, *Crepis paludosa* and *Cardamine pratensis*. *Lonicera periclymenum* trails through parts of the vegetation, and there are scattered tufts of the ferns *Athyrium filix-femina* and *Dryopteris dilatata*. Graminoids occur commonly but rather sparsely: mainly *Holcus lanatus* and the sedges *Carex binervis* and *C. pallens*. *Rubus idaeus* is locally prominent, overtopping the rest of the field layer. Mosses are very common, especially *Calliergonella cuspidata* but also smaller amounts of other species such as *Philonotis fontana*, *Palustriella commutata* and *Bryum pseudotriquetrum*. This W7b woodland occupies small areas along the lower slopes, mainly as a narrow strip of wet woodland immediately above the main road.

W11a *Quercus petraea-Betula pubescens-Oxalis acetosella* woodland, *Dryopteris dilatata* sub-community

This is woodland of downy birch, sessile oak and smaller amounts of hazel, rowan and ash. There is also some young birch and ash regeneration. The field layer is rather lush (30-50 cm) and consists mainly of a rather tangled assemblage of *Lonicera periclymenum*, *Rubus fruticosus*, *Dryopteris dilatata*, *D. filix-mas* and *Hyacinthoides non-scripta*, with abundant *Oxalis acetosella* and some *Blechnum spicant*, *Pteridium aquilinum*, *Potentilla erecta*, *Galium saxatile*, *Viola riviniana*,

Holcus mollis, *Deschampsia flexuosa*, *Anthoxanthum odoratum*, *Teucrium scorodonia*, *Solidago virgaurea* and *Athyrium filix-femina*. Mosses are abundant, especially *Thuidium tamariscinum* but also some *Hylocomium splendens* and *Polytrichum formosum*. W11a is common here on well-drained gently to steeply sloping ground. The abundance of bramble and honeysuckle indicates that grazing is less intensive here than in the next sub-community.

W11b *Quercus petraea*-*Betula pubescens*-*Oxalis acetosella* woodland, *Blechnum spicant* sub-community

This woodland has a canopy similar to that of the W11a described above, but the field layer is a little shorter (20-40 cm), more grassy and evidently more grazed. Swards of *Anthoxanthum odoratum* and *Holcus mollis* contain scattered *Deschampsia flexuosa*, *Potentilla erecta*, *Galium saxatile*, *Hyacinthoides non-scripta*, *Blechnum spicant*, *Pteridium aquilinum* and *Dryopteris filix-mas*. The mosses *Thuidium tamariscinum*, *Scleropodium purum* and *Hylocomium splendens* are common. W11b occurs on gently to moderate slopes in the more grazed northern part of the site, with other small patches further south.

W17a *Quercus petraea*-*Betula pubescens*-*Dicranum majus* woodland, *Isoetes myosuroides*-*Diplophyllum albicans* sub-community

This resembles the W17b described below but with a sparser vascular element and a more prominent and varied bryophyte element. This difference reflects the steeper and more rocky habitat compared with W17b. Indeed, the species particularly characteristic of this sub-community are plants of rock (and bark) rather than soil: *Hymenophyllum wilsonii*, *H. tunbrigense*, the mosses *Isoetes myosuroides* and *Racomitrium lanuginosum* and the liverworts *Diplophyllum albicans*, *Frullania tamarisci*, *Bazzania trilobata*, *B. tricrenata*, *Scapania gracilis*, *Plagiochila spinulosa*, *Saccogyna viticulosa*. The Nationally Scarce *Sematophyllum micans* (moss) and *Plagiochila atlantica* (liverwort) occur in small quantity on rock faces here. Other bryophytes which are not mainly saxicolous occur, such as the mosses *Dicranum scoparium*, *Mnium hornum* and *Leucobryum glaucum*. W17a is scattered widely but not extensively here, among W17b/c and W11b woodland. It is the main habitat of oceanic bryophytes at this site.

W17b *Quercus petraea*-*Betula pubescens*-*Dicranum majus* woodland, Typical sub-community

This is woodland of downy birch, sessile oak and smaller amounts of hazel, rowan and holly. The field layer is distinctively heathy, with abundant to dominant *Vaccinium myrtillus* some 30-50 cm tall. *Deschampsia flexuosa* is scattered plentifully among the blaeberry, and there is also a little *Molinia caerulea*, *Blechnum spicant*, *Dryopteris filix-mas*, *Pteridium aquilinum*, *Melampyrum pratense* and *Galium saxatile*. In some places *Lonicera periclymenum* trails through lush growths of blaeberry bushes. Deep carpets of the mosses *Thuidium tamariscinum*, *Hylocomium splendens*, *Plagiothecium undulatum*, *Hypnum jutlandicum*, *Dicranum majus*, *Sphagnum quinquefarium* and *Polytrichum formosum* are extensive, muffling the lower woody stems of the blaeberry bushes, in some places with *H. jutlandicum* climbing up those lower stems. W17b is common here on steep, well-drained slopes where grazing is evidently minimal or absent.

W17c *Quercus petraea*-*Betula pubescens*-*Dicranum majus* woodland, *Anthoxanthum odoratum*-*Agrostis capillaris* sub-community

This resembles the W17b described above but has little or no *Vaccinium myrtillus* and correspondingly more *Deschampsia flexuosa*. This difference indicates the greater intensity of grazing in W17c compared with W17b. *Anthoxanthum odoratum* and *Oxalis acetosella* can occur in small quantity, but less plentifully than in the W11 woodland at this site.

W24 *Rubus fruticosus* agg-*Holcus lanatus* underscrub

This vegetation, dominated by a dense tangle of *Rubus fruticosus*, forms a strip just south-west of the main road to the north-east of Pulpit Rock. The vegetation was not examined in detail, but scattered young birch, alder and hazel were noted.

W25 *Pteridium aquilinum*-*Rubus fruticosus* agg. underscrub

This vegetation, co-dominated by *Pteridium aquilinum* and *Rubus fruticosus*, occurs in small quantity with the bramble-dominated W24 described above. Again, the flora was not examined in detail.

M23b *Juncus effusus/acuteiflorus*-*Galium palustre* rush-pasture, *Juncus effusus* sub-community

This is grazed and partly trampled rushy vegetation on damp ground just NE of Pulpit Rock. Tufts of *Juncus effusus* some 25-40 cm tall are scattered abundantly among mixtures of *J. acuteiflorus*, *J. bulbosus*, *Carex echinata*, *Galium palustre*, *Valeriana officinalis*, *Ranunculus flammula*, *Ranunculus repens* and *Deschampsia cespitosa*. Adjacent drier ground has short U4a grassland (see below).

M25c *Molinia caerulea*-*Potentilla erecta* mire, *Angelica sylvestris* sub-community

M25 mires typically consist mainly of tall, long-leaved tussocks of *Molinia caerulea*, but in the M25 here the *Molinia* tussocks are shorter (10-30 cm) and noticeably grazed, with much space in between them. This space is not completely vegetated: there are patches of bare shingle among the assemblage of *Lotus corniculatus*, *Viola riviniana*, *Rubus fruticosus*, *Filipendula ulmaria*, *Caltha palustris*, *Succisa pratensis*, *Potentilla erecta*, *Galium boreale*, *Ranunculus flammula*, *Mentha aquatica*, *Carex viridula* ssp. *oedocarpa*, *Phalaris arundinacea*, *Hydrocotyle vulgaris* and the moss *Climacium dendroides*. There is a small area of this vegetation on shingly ground on the loch shore just WSW of Rubha Ban. M25c is a relatively herb-rich form of *Molinia*-dominated vegetation; in this way it has much in common (and indeed many species in common) with the W4b-W7 woodland immediately to the south-west. The ground here is less wet than is usual for M25, but the wetness necessary for the above flora is evidently maintained by periodic inundation from the loch.

U4a *Festuca ovina*-*Agrostis capillaris*-*Galium saxatile* grassland, Typical sub-community

This is short (10-20 cm) grazed grassland consisting mainly of *Agrostis capillaris*, *Galium saxatile* and the mosses *Rhytidiadelphus squarrosus* and *Polytrichum commune*. Smaller quantities of *Potentilla erecta*, *Anthoxanthum odoratum*, *Danthonia decumbens*, *Carex binervis*, *Juncus effusus* and the moss *Scleropodium purum* complete this rather species-poor sward. There are also a few seedlings of birch and rowan. This U4a grassland occurs in association with the damper M23b mire in the grazed area immediately NE of Pulpit Rock.

U20a *Pteridium aquilinum*-*Galium saxatile* community, *Anthoxanthum odoratum* sub-community

Tall (1-1.5 m) fronds of bracken *Pteridium aquilinum* grow abundantly here over a much shorter (30 cm) grassy assemblage of *Holcus mollis* and *Anthoxanthum odoratum* dotted with scattered plants of *Oxalis acetosella* and discontinuous moss carpets of *Hylocomium splendens*, *Thuidium tamariscinum* and *Scleropodium purum*. This vegetation forms woodland glades on gentle slopes above and to the south-east of the steeper slopes along the main road.

MG6 *Lolium perenne*-*Cynosurus cristatus* pasture

This is lush (50 cm) grassland dominated by *Lolium perenne* and *Holcus lanatus*, mixed with smaller quantities of *Poa trivialis*, *Festuca rubra*, *Cynosurus cristatus* and dotted with scattered plants of *Conopodium majus* and *Rumex obtusifolius*. An underlay of *Trifolium repens* and *Ranunculus repens* occurs patchily. This vegetation occupies a small woodland glade just to the east of the main road in the south-east of the site. It is surrounded by W11 woodland.

Shingle

This is an area of shingle along the loch shore at Rubha Ban. Much of the shingle is bare, but there are scattered plants in places: for example in the south is an area containing much *Lotus corniculatus*, *Rumex acetosella*, *Centaurea nigra* and *Agrostis stolonifera*, and smaller quantities of *Plantago lanceolata*, *Teucrium scorodonia*, *Senecio jacobea*, *Valeriana officinalis*, *Viola riviniana*, *Achillea ptarmica*, *Rubus fruticosus*, *Epilobium montanum*, *Rosa sherardii* and young ash and alder.

Road

This refers to the main road (A82) running NE-SW through the site.

Summary

Most of the vegetation types found in this survey are at least moderately common and widespread in north-western Britain, and in this way the site contains typical west Highland woodland. It is notable, however, that W17a *Quercus petraea*-*Betula pubescens*-*Dicranum majus* woodland, *Isoetecium myosuroides*-*Diplophyllum albicans* sub-community has a strongly western distribution in Britain and is one of the most important habitats for oceanic bryophytes (a group of species for which Britain and Ireland are internationally important). This is reflected in the occurrence of several such species, including some which are uncommon (see below). M25c *Molinia caerulea*-*Potentilla erecta* mire, *Angelica sylvestris* sub-community is not a common type of vegetation, being thinly but widely scattered in the west.

4 BRYOPHYTE FLORA

I found a total of 103 bryophyte species during this survey (67 mosses and 36 liverworts). These species are listed in Appendix 1, which also indicates their placement into European phytogeographical groups by Hill & Preston (1998).

The bryophyte flora is moderately rich. Most species found in this survey are common and widespread in Britain, but some are notable because they are uncommon (U) or have a strongly western, oceanic distribution in Europe (O). These species are listed below (NS = Nationally Scarce = recorded in <100 10km squares in Great Britain):

Mosses

Breutelia chrysocoma (O)
Campylopus atrovirens (O)
Dicranum scottianum (U,O)
Hyocomium armoricum (O)
Ptychomitrium polyphyllum (O)
Sematophyllum micans (U,O, NS)

Liverworts

Douinia ovata (U,O)
Harpanthus scutatus (U)
Herbertus aduncus (U,O)
Lejeunea patens (O)
Plagiochila atlantica (U,O, NS)
Plagiochila killarniensis (O)
Plagiochila punctata (O)
Plagiochila spinulosa (O)
Saccogyna viticulosa (O)
Scapania gracilis (O)

Britain and Ireland are the European headquarters of western, oceanic bryophyte species. The western Highlands are particularly important in this respect because they contain a significant proportion of the habitats rich in these plants. A total of fifteen oceanic species in this small area of woodland at Pulpit Rock indicates an oceanic bryophyte flora of at least moderate richness by west Highland standards.

The most notable species found in this survey are the moss *Sematophyllum micans* and the liverwort *Plagiochila atlantica*. These are notable because:

- They are Nationally Scarce
- They have western, oceanic distributions in Europe (Hill & Preston 1998)
- They are strongly associated with Ancient woodland, evidently because of their need for a delicate balance of high humidity and moderate light – a balance easily upset by tree-felling (Averis 1991).

The target notes for the locations of species of particular interest are given in Table 2 below. Filmy ferns *Hymenophyllum* spp. are included here because these small, bryophyte-sized oceanic ferns share with oceanic bryophytes a need for humid, sheltered conditions and commonly grow among oceanic bryophyte assemblages in western Britain. *H. tunbrigense* is particularly notable because it is uncommon nationally. It is more shade-demanding (and more shade-tolerant) than *H. wilsonii*. The locations where the target notes were recorded are shown in Map 1.

Table 2 Target Notes for bryophyte and filmy fern interest recorded by Ben Averis in this survey of woodland at Pulpit Rock, Loch Lomond, on 19th June 2007

- T1. NS 3241 1373. Moss *Sematophyllum micans* on low, sloping rock face in bouldery area of woodland. Other bryophytes on and among rocks here include mosses *Ptilium cristacastrensis* and *Neckera crispa*, and liverworts *Bazzania tricrenata*, *B. trilobata*, *Plagiochila spinulosa*, *P. punctata*, *P. killarniensis*, *Scapania gracilis*, *Saccogyna viticulosa* and *Mylia taylorii*. Filmy fern *Hymenophyllum wilsonii* on rocks here too, with oceanic bryophytes.
- T2. NS 3249 1368. Moss *Dicranum scottianum* and liverwort *Douinia ovata* on E side of very large boulder (Pulpit Rock). Other species here include liverwort *Scapania gracilis*.
- T3. NS 3260 1364. A few shoots of the liverwort *Herbertus aduncus* among other bryophytes on a steep bank. Liverwort *Douinia ovata* on oak trunk nearby (to N). Liverwort *Bazzania tricrenata* on rocky banks and log in this general area, and some also on a tree base (unusual habitat for this species). Liverworts *B. trilobata*, *Plagiochila spinulosa* and *Scapania gracilis*, and filmy fern *Hymenophyllum wilsonii* on rocks and banks in this general area.
- T4. NS 3263 1364. Filmy fern *Hymenophyllum tunbrigense* on steep rock face and on base of birch trunk.
- T5. NS 3265 1359. Moss *Dicranum scottianum* (good population) on base of birch trunk.
- T6. NS 3267 1358. Liverwort *Harpanthus scutatus* on rocky bank.
- T7. NS 3284 1335. Liverwort *Plagiochila killarniensis* on rock.
- T8. NS 3290 1323. Liverwort *Plagiochila killarniensis* on rock.
- T9. NS 3287 1325. Steep-sided gully running WNW-ESE down steep ESE-facing slope within woodland. Steep S-facing rock faces on N side of gully have liverwort *Plagiochila atlantica* and moss *Dicranum scottianum*. Steep N-facing rocky banks on S side have good population of filmy fern *Hymenophyllum tunbrigense*. Other species in this general area include liverworts *Plagiochila spinulosa*, *P. punctata*, *Saccogyna viticulosa* and *Scapania gracilis*, and filmy fern *Hymenophyllum wilsonii*.

The locations where I found *Sematophyllum micans* and *Plagiochila atlantica* are the most bryophyte-rich places found during this survey. They are good examples of rocky habitat which is rich in oceanic bryophytes and filmy ferns, and for which the woods of the western Highlands are internationally important. Such habitats are of high conservation value, and every effort should be made to maintain them. The high humidity in the shade and shelter of the tree canopy is evidently essential to these plants. Therefore it is important to avoid letting in too much light and wind (for example by felling nearby trees) because this could cause an unfavourable decrease in humidity.

5 ACKNOWLEDGMENTS

This survey was commissioned by Scott Wilson Ltd.. Nick Dadds (Scott Wilson, Edinburgh) organised the survey and provided me with a map of the site. During the fieldwork I was accompanied by Nick and also by his friend Harriet Lindsay, an ecologist from Perth.

6 REFERENCES

- Averis, A.B.G. (1991).** *A Survey of the Bryophytes of 448 Woods in the Scottish Highlands.* Scottish Field Survey Unit Report No.S54. Nature Conservancy Council, Edinburgh.
- Blockeel, T. L. & Long, D. G. (1998).** *A check-list and census catalogue of British and Irish bryophytes.* British Bryological Society.
- British Geological Survey (1979).** *1:625,000 Geological Map of the United Kingdom. 3rd. Edition (solid).*
- Hill, M.O. & Preston, C.D. (1998).** The geographical relationships of British and Irish bryophytes. *J.Bryol.* **20**, 127-226.
- Rodwell, J.S. (Ed.) (1991a).** *British Plant Communities. Volume 1 - Woodlands and Scrub.* Cambridge University Press, Cambridge.
- Rodwell, J.S. (Ed.) (1991b).** *British Plant Communities. Volume 2 - Mires and Heaths.* Cambridge University Press, Cambridge.
- Rodwell, J.S. (Ed.) (1992).** *British Plant Communities. Volume 3 - Grasslands and montane communities.* Cambridge University Press, Cambridge.
- Rodwell, J.S. (Ed.) (1995).** *British Plant Communities. Vol. 4 - Aquatic communities, swamps and tall-herb fens.* Cambridge University Press, Cambridge.
- Rodwell, J.S. (Ed.) (2000).** *British Plant Communities. Volumes 5 - Maritime Cliffs, Sand Dunes, Saltmarshes and Other Vegetation.* Cambridge University Press, Cambridge.
- Stace, C.A. (1997).** *New Flora of the British Isles. 2nd Edition.* Cambridge University Press.

APPENDIX 2 - List of bryophyte species found in this survey

Phyt column = phytogeographical classes. For each vascular plant and bryophyte species the appropriate phytogeographical class is given, following the classification by 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

Quantity column = abundance (1 = rare, 2 = occasional, 3 = frequent, 4 = abundant)

Appendix 1 (cont.)

Phyt	Species (mosses)	Quantity	Habitat(s)
46	<i>Amphidium mougeotii</i>	1	moist rock faces
26	<i>Andreaea rupestris</i>	1	rock faces
56	<i>Atrichum undulatum</i>	1	soily ground
56	<i>Bartramia pomiformis</i>	1	well-drained rock faces
56	<i>Brachythecium plumosum</i>	1	wet rocks
56	<i>Brachythecium rivulare</i>	2	moist banks on lower slopes
73	<i>Brachythecium rutabulum</i>	1	moist soily ground
70	<i>Breutelia chrysocoma</i>	2	moist banks on lower slopes
36	<i>Bryum pseudotriquetrum</i>	1	moist banks on lower slopes
76	<i>Calliergonella cuspidata</i>	2	moist banks on lower slopes
70	<i>Campylopus atrovirens</i>	1	rock faces on lower slopes
72	<i>Campylopus flexuosus</i>	2	rocks and logs
36	<i>Climacium dendroides</i>	1	moist ground
53	<i>Ctenidium molluscum</i>	1	moist rocks and banks
43	<i>Dicranella palustris</i>	1	moist banks on lower slopes
43	<i>Dicranodontium denudatum</i>	2	rocks, logs and tree bases
56	<i>Dicranum majus</i>	3	ground and banks
36	<i>Dicranum scoparium</i>	3	ground, rocks, logs and trees
80	<i>Dicranum scottianum</i>	2	rock faces and birch bases
73	<i>Eurhynchium praelongum</i>	1	ground
73	<i>Eurhynchium striatum</i>	2	ground
56	<i>Fissidens adianthoides</i>	1	wet rocky banks
73	<i>Fissidens dubius</i>	2	rock faces
72	<i>Heterocladium heteropterum</i>	2	moist, shaded rock faces
84	<i>Homalothecium sericeum</i>	2	rock faces
72	<i>Hookeria lucens</i>	2	moist, shaded banks and recesses
73	<i>Hylocomium brevirostre</i>	2	ground and banks
36	<i>Hylocomium splendens</i>	4	ground and banks
43	<i>Hylocomium umbratum</i>	3	ground and banks
71	<i>Hyocomium armoricum</i>	2	wet rocks and ground
72	<i>Hypnum andoi</i>	3	tree trunks
66	<i>Hypnum cupressiforme</i>	3	rocks and trees
72	<i>Hypnum jutlandicum</i>	4	ground, rocks and tree bases
52	<i>Isothecium myosuroides</i>	4	rocks and trees
73	<i>Leucobryum glaucum</i>	2	rocks and banks
73	<i>Mnium hornum</i>	3	ground, banks, rocks and tree bases
73	<i>Neckera crispa</i>	2	steep rock faces
56	<i>Palustriella commutata</i>	1	moist banks on lower slopes
66	<i>Philonotis fontana</i>	1	moist banks on lower slopes

56	<i>Plagiothecium denticulatum</i>	1	moist banks on lower slopes
----	-----------------------------------	---	-----------------------------

Appendix 1 (cont.)

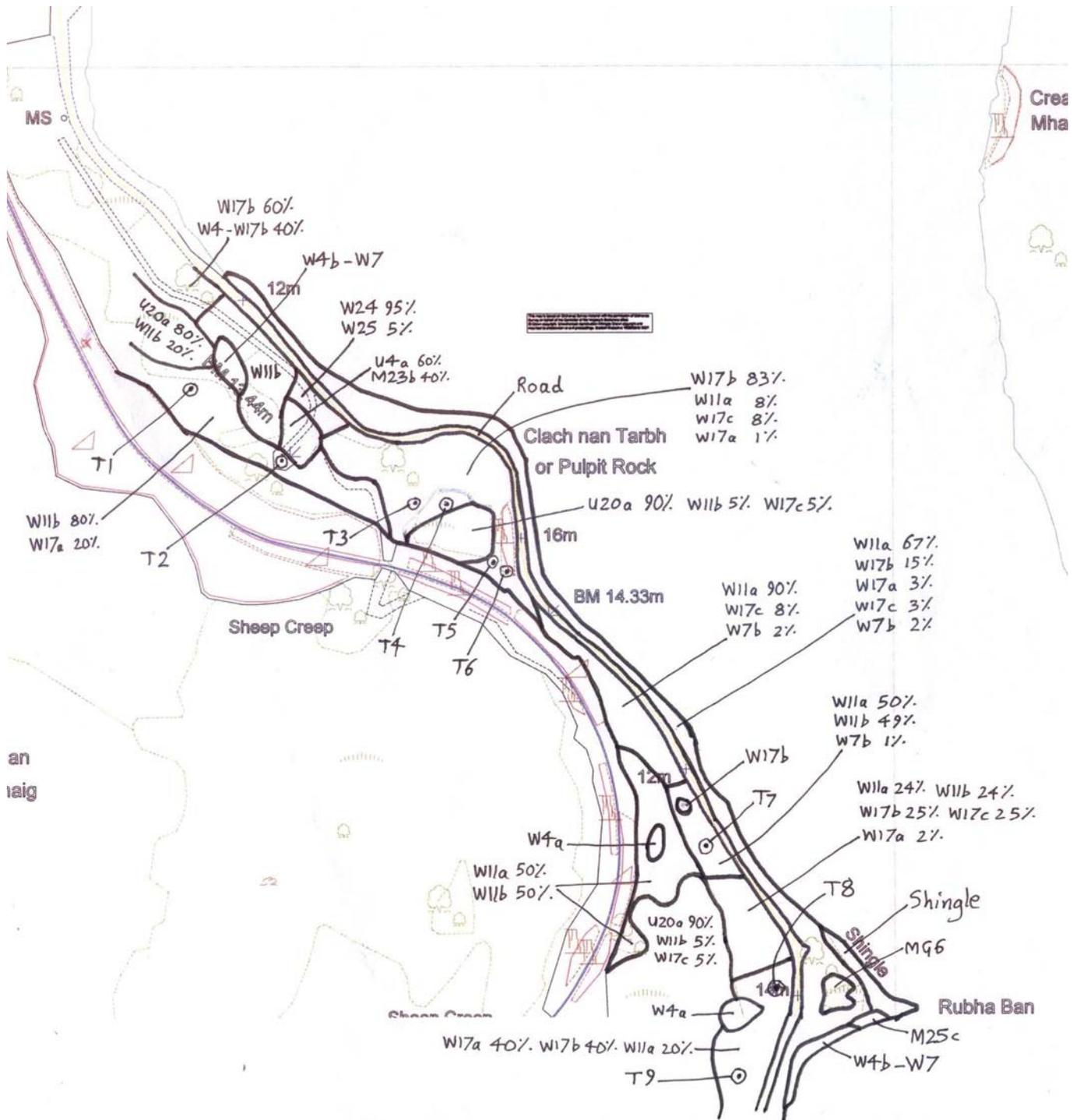
Phyt	Species (mosses)	Quantity	Habitat(s)
52	<i>Plagiothecium undulatum</i>	3	ground and banks
56	<i>Pleurozium schreberi</i>	4	ground and banks
36	<i>Polytrichum commune</i>	3	wet or moist ground
56	<i>Polytrichum formosum</i>	3	drier ground
52	<i>Pseudotaxiphyllum elegans</i>	2	banks and rocks
46	<i>Ptilium crista-castrensis</i>	1	among mosses on top of boulder
81	<i>Ptychomitrium polyphyllum</i>	1	rocks
52	<i>Racomitrium aciculare</i>	1	wet rocks and ground
72	<i>Racomitrium aquaticum</i>	2	steep rock faces
53	<i>Racomitrium fasciculare</i>	1	rocks
52	<i>Racomitrium heterostichum</i>	1	rocks
26	<i>Racomitrium lanuginosum</i>	2	rocks
56	<i>Rhizomnium punctatum</i>	1	moist ground
52	<i>Rhytidiadelphus loreus</i>	3	ground, banks and logs
53	<i>Rhytidiadelphus squarrosus</i>	2	ground and banks
56	<i>Rhytidiadelphus triquetrus</i>	1	ground
73	<i>Scleropodium purum</i>	3	ground
71	<i>Sematophyllum micans</i>	1	sloping face of low boulder
53	<i>Sphagnum denticulatum</i>	1	moist ground and banks
53	<i>Sphagnum fallax</i>	2	wet ground
26	<i>Sphagnum girgensohni</i>	1	wet ground
56	<i>Sphagnum palustre</i>	2	wet ground
73	<i>Thamnobryum alopecurum</i>	1	moist rock faces
73	<i>Thuidium tamariscinum</i>	4	ground, banks, rocks and logs
56	<i>Tortella tortuosa</i>	2	rock faces
56	<i>Trichostomum tenuirostre</i>	1	moist rock faces
73	<i>Ulota crispa</i>	3	trees

Appendix 1 (cont.)

Phyt	Species (liverworts)	Quantity	Habitat(s)
46	<i>Barbilophozia attenuata</i>	2	rocks and tree trunks
43	<i>Bazzania tricrenata</i>	2	rocks, banks, logs and tree bases
72	<i>Bazzania trilobata</i>	3	rocks, banks, logs and tree bases
72	<i>Calypogeia fissa</i>	1	soily banks
56	<i>Calypogeia muelleriana</i>	1	soily banks
56	<i>Cephalozia bicuspidata</i>	1	rocky bank
52	<i>Diplophyllum albicans</i>	3	rocks and banks
71	<i>Douinia ovata</i>	1	rock face and oak trunk
85	<i>Frullania dilatata</i>	2	trees
72	<i>Frullania fragilifolia</i>	1	rock face
52	<i>Frullania tamarisci</i>	3	rocks and trees
43	<i>Harpanthus scutatus</i>	1	rocky bank
41	<i>Herbertus aduncus</i>	1	steep, mossy bank
53	<i>Jungermannia gracillima</i>	1	wet rocks
80	<i>Lejeunea patens</i>	2	moist rock faces
56	<i>Lepidozia reptans</i>	3	rocks, banks, logs and tree bases
73	<i>Lophocolea bidentata</i>	2	rocks and banks
53	<i>Marsupella emarginata</i>	1	moist rocks
53	<i>Metzgeria furcata</i>	2	trees
72	<i>Metzgeria temperata</i>	2	rocks and trees
72	<i>Microlejeunea ulicina</i>	3	trees and a few rocks
42	<i>Mylia taylorii</i>	2	rocks and rocky banks
56	<i>Pellia epiphylla</i>	2	moist ground
73	<i>Plagiochila asplenioides</i>	1	moist banks on lower slopes
70	<i>Plagiochila atlantica</i>	1	steep rock face
80	<i>Plagiochila killarniensis</i>	1	steep rock faces
56	<i>Plagiochila porelloides</i>	2	rocks and banks
80	<i>Plagiochila punctata</i>	2	trees and rocks
80	<i>Plagiochila spinulosa</i>	3	rocks, banks and a few tree bases
56	<i>Radula complanata</i>	1	rock face
46	<i>Riccardia palmata</i>	1	logs
81	<i>Saccogyna viticulosa</i>	2	rocks and moist rocky banks
80	<i>Scapania gracilis</i>	4	rocks and trees
53	<i>Scapania nemorea</i>	2	rocks and logs
53	<i>Scapania undulata</i>	2	moist or wet rocks
56	<i>Tritomaria exsectiformis</i>	1	oak trunk

APPENDIX 2 – Vegetation map of woodland at Pulpit Rock, Loch Lomond, NS 326 136

Mapped by Ben Averis on 19th June 2007 using the National Vegetation Classification (NVC). This map also shows the locations where Target Notes (T1-T9) were recorded (on 19th June 2007) for bryophyte species of interest. Scale 1:5,000 (base map provided by Scott Wilson Ltd.)



APPENDIX 3 – Photographs

Photos 1-6 show the location of the moss *Sematophyllum micans* on a rock in the north-west of the site.

Photos 7-12 show close-up views of other species of interest found in this survey (though these photos were taken elsewhere).

Photograph 1: looking west to location of moss *Sematophyllum micans* (behind large rock at bottom of arrow) at NS 3241 1373 NW of Pulpit Rock, Loch Lomond on 19th June 2007.



Photograph 2: closer view looking west. *S. micans* behind large boulder in foreground.



Photograph 3: closer view looking west to location of moss *Sematophyllum micans* at NS 3241 1373 NW of Pulpit Rock, Loch Lomond on 19th June 2007.



Photograph 4: closer view, again looking west.



Photograph 5: rock with moss *Sematophyllum micans* at NS 3241 1373 NW of Pulpit Rock, Loch Lomond on 19th June 2007.



Photograph 6: moss *Sematophyllum micans* on rock (two yellow-green patches in centre).



Photographs 7-12: close-up photos of uncommon bryophyte species and both filmy fern species found during this survey

Note: These photos were taken at other sites on previous occasions. However, they are similar in appearance to the plants at Pulpit Rock except for *Herbertus aduncus* which was found here as just a few scattered shoots and not as the larger and more distinctive orange-coloured tufts shown here.



7. *Dicranum scottianum*



8. *Plagiochila atlantica*



9. *Douinia ovata*



10. *Herbertus aduncus*



11. *Hymenophyllum wilsonii*



12. *Hymenophyllum tunbrigense*