

**A SURVEY AND ASSESSMENT OF
TRADITIONALLY MANAGED HAYMEADOWS
AND ASSOCIATED GRASSLANDS
IN LOCHABER**

A report to the
Highland Biodiversity Project
2003

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SUMMARY

Traditionally-managed haymeadows and associated grasslands are an important resource, rare on a national scale, with the crofting townships of Lochaber and Skye containing the largest extent of these grasslands remaining in Scotland. These flower-rich grasslands are used both as pasture and as haymeadows, and are particularly important for a unique range of plants and insects, and in some areas for corncrakes. However, these grasslands are increasingly threatened by neglect, agricultural improvement or diversification, and decrofting of land for housing.

This 2003 grassland survey comprised a National Vegetation Classification (NVC) survey and an assessment of habitat condition of the best grasslands in Lochaber, taking NVC MG5 *Cynosurus cristatus-Centaurea nigra* grassland as the benchmark of quality. A management survey was also carried out, where land managers and grazing clerks were interviewed to ascertain history of site management. A total of 39 previously-studied sites and 11 new sites were surveyed.

Analysis of the survey results and comparison with the data of previous surveys carried out in Lochaber in 1987, 1991, 1993 and 1994, showed a general decline in a variety of parameters. These included the range of NVC communities encountered, the occurrence of notable species, the nature conservation grading assigned to sites, and the extent and species-richness of the MG5 grassland community. This overall impoverishment in nature conservation value was linked closely with trends in agricultural improvement identified during the management survey, including the increased use of artificial fertilisers and herbicides, the gradual move from hay to silage production, an increasing dominance of sheep grazing over cattle grazing, a minor increase in the number of sites abandoned to neglect or horse pasture, and the frequent ploughing and reseeded of sites to give more productive grass-dominated, herb-poor swards.

A range of negative influences continue to threaten the remaining haymeadow resource in Lochaber, notably decrofting for housing developments, the increased age structure and retirement of many crofters, agricultural improvement and intensification, year-round grazing, scrub/bracken/gorse invasion, and increased horse grazing and neglect. However, it is hoped that damaging trends can be reversed, and that many of the survey sites can be conserved or restored through appropriate agricultural practice, aided by sensitive management and conservation schemes such as the Countryside Premium Scheme and the Ardnamurchan Grassland Scheme

ACKNOWLEDGEMENTS

The author is extremely grateful to the following individuals for their advice, support and information given during the preparation of this report: Janet Bromham of the Highland Biodiversity Project; Brian Eardley, Fraser Symonds, and John Mackenzie of Scottish Natural Heritage; and Margaret MacMillan and Uilleam Smith of the Crofters' Commission.

The author is also indebted to the very many helpful crofters, grazing clerks and landowners who gave access permission for the survey fieldwork and supplied historical management information for the survey sites, in particular: Donald Kennedy, Mrs May Angus, Miss Mairi MacDonald, Miss Kathleen Cameron, Mrs Ann Mackay, Miss Gwen McTaggart, Mrs Margaret Langan, Alexander MacLeod, and William MacLachlan.

6 INTRODUCTION

The Skye and Lochalsh Local Biodiversity Action Plan has identified traditionally managed haymeadows and associated grasslands as an important resource, rare on a national scale. The crofting townships of Lochaber and Skye have the largest extent of these grasslands remaining in Scotland. These flower-rich grasslands are used both as pasture and as haymeadows, and occur typically on well drained, unimproved and unproductive soils. They are particularly important for a unique range of plants and insects, and in some areas for corncrakes. However, these grasslands are increasingly threatened by neglect, agricultural improvement or diversification, and decrofting of land for housing. An inventory of their current extent and status is vital for their future conservation.

This grassland survey was undertaken to provide a detailed National Vegetation Classification (NVC) survey and an assessment of habitat condition of the best grasslands within the Lochaber area. For the purposes of the survey, NVC MG5 *Cynosurus cristatus-Centaurea nigra* grassland was taken as the benchmark of quality, and formed the basis for site selection. For the 2003 survey, 39 sites studied in previous surveys were resurveyed and 11 new sites were surveyed. Information on the management history of the sites was also gathered through interviews with site managers, enabling the identification of trends and providing a baseline for future analysis of their condition and management.

7 OBJECTIVES

7.1 Objective 1

To provide a National Vegetation Classification (NVC) survey and an assessment of habitat condition of key sites for hay meadow and other grassland habitats in Lochaber.

7.2 Objective 2

To establish effectiveness of management regimes at maintaining the conservation value of key grassland sites, through interviews with existing land managers, and through comparison with previous survey information.

8 METHODOLOGY

8.1 Site Selection

Previous surveys of traditionally managed haymeadows and associated grasslands in Lochaber (Orange, 1987; Rigby, 1991; Milnes & Martin, 1993; Milnes & Eardley, 1994), identified a wide range of sites of varying nature conservation interest (*Appendix 1: Previous Surveys*). For the 2003 survey, field records from these surveys were examined, and 39 high quality sites selected for resurvey. High quality in terms of haymeadow and associated grassland conservation in Lochaber was judged partly by a grading system (see *section 3.3*), and partly by apparent species-richness and extent of NVC community MG5 *Cynosurus cristatus-Centaurea nigra* grassland, a habitat described by Rodwell (1992) as, “the typical grassland of grazed hay-meadows treated in the traditional fashion”.

A second tier of 11 previously unsurveyed sites was also selected for survey, according to their apparent species-richness and extent of the NVC MG5 community. These were identified during an initial two-day familiarisation tour of the area, carried out with SNH Area Officer, Brian Eardley.

8.2 Field Survey Procedure

8.2.1 *Vegetation Survey*

Fieldwork for the survey was carried out between 15th July and 30th August 2003. Access permission was sought from owners/tenants before entering sites. For each survey site where full access was possible, a NVC survey of the habitat was undertaken following the methodology described in the original project brief and in conjunction with the NVC Handbook (Rodwell, 1996).

An overview was firstly gained by walking each site, and a sketch map was drawn delimiting stands of different community types. One voucher quadrat was then recorded from each main community on the site, the quadrat size depending on the vegetation type; 2x2m for short herbaceous vegetation, and 4x4m for tall herbaceous vegetation. A species list was compiled of all vascular plants and bryophytes within the quadrat, and for each species an estimate was then made of its cover/abundance using the Domin scale, with a DAFOR rating also being given to each species to reflect its frequency and abundance within each community (see *Appendix 2*). Species absent from the quadrat but present in the homogeneous stand were also recorded using a DAFOR rating. The survey concentrated on grassland communities, and these were always recorded in detail. Other habitats within sites, such as mire, woodland and scrub communities, or agricultural weeds, were recorded in detail only where they showed particular interest.

Standard grassland cards were used in the field to provide a standardised format of data recording, including the recording of environmental data, site descriptions, community and quadrat descriptions, species lists and target notes (see *Appendix 7*). Nomenclature followed the authorities listed in

Appendix 3. Photographs were also taken of examples of the main vegetation types found on the sites (see Appendix 6).

Occasionally, site managers were concerned about excessive trampling and access permission was not granted, or they could not be contacted prior to the survey. In these cases where the recording of full quadrat data was not possible, sketch maps and species lists, with DAFOR ratings, were constructed from the site margins.

8.2.2 Management Survey

At the time of the vegetation survey, current management was also recorded. Where owners, tenants, and/or grazing clerks could be contacted and were willing to undertake short interviews, the following series of questions was asked to establish historical management of the sites:

- What is the current land-use of the site e.g. hay, silage, pasture, etc.?
- Has the site been ploughed and/or reseeded in the past, and if so, when?
- Is organic farmyard manure and/or artificial mineral fertiliser regularly applied?
- Have herbicides been used on the site?
- Is the site mown, and if so, how often and when?
- Is the site grazed, and if so, when and by what livestock?
- If mown, is the aftermath grazed?
- Is the site part of a management or conservation scheme e.g. Countryside Premium Scheme (CPS), Ardnamurchan Grassland Scheme (AGS)?
- Are there any other relevant issues e.g. has the site ever been cropped for root crops or cereals; has the site been neglected, etc.?

8.3 Data processing & Site Evaluation

Data gathered in the vegetation survey was used to classify plant communities by NVC type, using the relevant *British Plant Communities* volumes (Rodwell, 1991, 1992). An evaluation was also made on a site-by-site basis of nature conservation value, largely based on the methodology adopted in previous surveys. Here, sites were graded on a scale of A-E (Table 1), based on degree of species-richness, the occurrence of notable species (Table 2), and the proportion of the site supporting the benchmark community, MG5. Size of sites, current management, and overall impressions of the communities present were also taken into account.

8.4 Comparison with Previous Survey

Finally, the results of the 2003 survey were compared with the results of previous surveys, in order to establish trends in site condition and management.

Table 1 - System used for grading sites (after Milnes & Martin, 1993)

Grade	Conservation Value	Species-richness	Notable species
GRADE A	HIGH	Main community areas species-rich	Abundant
GRADE B	MODERATELY HIGH	Site generally of average species-richness, with occasional species-rich areas	Frequent
GRADE C	MODERATE	Site generally of average species-richness	Occasional
GRADE D	LOW	Site generally species-poor, with restricted areas of average species-richness	Rare
GRADE E	VERY LOW	All communities species-poor	Absent

N.B. Average species-richness was taken as being approximately 18-20 vascular plant species per quadrat, derived from the lists of species associated with each NVC sub-community given in Rodwell (1992).

Table 2 - Notable species considered to add value
to a site (after Lusby, in Orange 1987)

Species	Abbreviation
<i>Antennaria dioica</i>	Ad
<i>Alchemilla</i> spp	As
<i>Carum verticillatum</i>	Cv
<i>Crepis paludosa</i>	Cp
<i>Dactylorhiza purpurella</i>	Dp
<i>Drosera anglica</i>	Da
<i>Galium boreale</i>	Gb
<i>Geranium sylvaticum</i>	Gs
<i>Geranium pratense</i>	Gp
<i>Gymnadenia conopsea</i>	Gc
<i>Listera ovata</i>	Lo
<i>Orchis mascula</i>	Om
<i>Parnassia palustris</i>	Pp
<i>Platanthera bifolia</i>	Pb
<i>Platanthera chlorantha</i>	Pc
<i>Polygonum viviparum</i>	Pv
<i>Saxifraga hypnoides</i>	Sh
<i>Trollius europaeus</i>	Te

9 RESULTS

9.1 Description of survey sites

(see *Figure 1: Lochaber Survey Site Locations*, and *Appendix 4: Site Maps*)

9.1.1 Ormsaigbeg (*Map 2*)

Ormsaigbeg is a linear crofting community, 1km south-west of Kilchoan on the southern side of the Ardnamurchan peninsula. The fields lie between 10m and 40m above sea level (asl.), on moderate to steep south-east facing slopes above Kilchoan Bay. Soils are derived from the underlying geology of Jurassic Lower Lias, and raised beach and fluvio-glacial sands.

9.1.2 Kilmory (*Map 3*)

Kilmory is a small crofting township, 1km from the sea, on the north side of the Ardnamurchan peninsula. The survey site is north facing, and lies between 40m and 50m asl. The underlying geology is Tertiary basalt and spilite, with some intrusive agglomerates, and a drift of raised beach and fluvio-glacial sands, producing humic-iron podsol soils.

9.1.3 Anaheilt and Scotstown (*Map 4*)

Anaheilt and Scotstown lie in the narrow glen of the Strontian River draining into Loch Sunart. The survey sites lie scattered on either side of the minor public road from Strontian, between 10m and 50m asl., on gentle slopes or on the river floodplain. The soils are mainly humic-iron podsols, derived from the underlying intrusive granites, syenites and granophyres, with occasional patches of forest brown earth.

9.1.4 Sallachan (*Map 5*)

The Sallachan survey fields lie close to the shoreline of Camas Shallachain, 1km north of Sallachan Point on the western shores of Loch Linnhe. The fields are south-west facing, and lie below 10m asl. The geology is quartz-feldspar-granulites, and raised beach and fluvio-glacial sands, yielding humic-iron podsols.

9.1.5 Clovullin (*Map 6*)

Clovullin is a linear settlement on the west shores of Loch Linnhe, 1km south-west of the Corran Narrows. Much of the managed grassland lies on level ground between the minor public road to Clovullin village and the A861, 5m to 20m asl. As at nearby Sallachan, the soils are humic-iron podsols, derived from quartz-feldspar-granulites, and raised beach and fluvio-glacial sands.

9.1.6 *Cuil (Map 7)*

Cuil lies on Cuil Bay, 1km west of Duror on the eastern side of Loch Linnhe. The fields lie close to the shore, with a south-west aspect, 3m to 10m asl. The soils are once again humic-iron podsols derived from raised beach and fluvioglacial sands, overlying Dalradian slates, phyllites and mica-schists.

9.1.7 *Ardsheal (Map 8)*

Ardsheal lies 1km west of Kentallen on the eastern shores of Loch Linnhe. The three surveyed fields lie close to the shoreline, 3m to 15m asl. The underlying geology is a block of intrusive granites, syenites and granophyres bordering slates, phyllites and mica-schists, giving humic-iron podsols also derived from raised beach and fluvioglacial sands.

9.1.8 *Onich and Bunree (Map 9)*

Onich and Bunree townships lie 15km south-west of Fort William, on the eastern side of Loch Linnhe. Most of the managed grassland lies between the loch and the A82 public road, with the survey sites lying between 3m and 20m asl., on gentle south-west facing slopes adjacent to the loch shore. The underlying geology at the Bunree sites is quartz-feldspar-granulites, and at Onich a complex of quartzite, grits, mica schists and Dalradian limestone. The soils are humic-iron podsols also partly derived from raised beach and fluvioglacial sands.

9.1.9 *Glencoe (Map 10)*

Glencoe village is a crofting township at the western end of Glencoe, at the confluence of the River Coe and Loch Leven. The survey sites lie either side of the A82 on the flat valley bottom, 10-20m asl. The underlying geology is mainly marine alluvium, with outcrops of Ballachulish limestone, and deposits of freshwater alluvium. The soils of most fields are alluvial humic-iron podsols, with localised accumulations of forest brown earths.

9.1.10 *Inverroy (Map 11)*

The crofting township of Inverroy lies north of the River Spean in Glen Spean, 6km west of Spean Bridge. The survey sites lie either side of the A86 and railway, on flat to gently sloping south facing ground, between 70m and 140m asl. The geology underlying the area comprises a band of limestone running north-west to south-east, with slate, phyllite and mica-schist to the east. The soils are alluvial humic-iron podsols in the valley bottom, with humic-iron podsols, peaty gleys and humic gleys on the sloping valley sides, derived from acidic fluvioglacial and raised beach sands and gravels.

9.1.11 *Bohuntine (Map 12)*

The township of Bohuntine lies west of the River Roy in Glen Roy, 5km north-east of Roybridge. The survey sites lie between 150m and 175m asl., on gently sloping south-east facing ground. The underlying geology is largely slates, phyllites and mica schists, with a band of intrusive porphyritic igneous rock. The soils at the south-west end of the township are humic-iron podsols, and at the north-east end of the area are generally peaty podsols, with some humic-iron podsols and peat.

9.1.12 *Murlaggan (Map 13)*

Murlaggan is a small township in Glen Spean, approximately 10km east of Spean Bridge. The surveyed fields lie between 130m and 170m asl., on either side of the A86 and railway on the north side of the River Spean. The sites lie above Dalradian slates, phyllites and mica-schists, and Moine quartz-feldspar-granulites, with the soils being mainly humic-iron podsols partly derived from raised beach and fluvio-glacial sands, with some alluvial soils.

9.2 **Results of vegetation survey 2003**

(see Appendix 5: Site Summary Tables, and Appendix 7: Grassland Cards)

9.2.1 *Vegetation types recorded 2003: Main Communities*

MG1 *Arrhenatherum elatius* grassland

c *Filipendula ulmaria* sub-community

e *Centaurea nigra* sub-community

The MG1 *Arrhenatherum elatius* grassland community generally occurred in two different circumstances. Firstly, it was found as a main community where a change in land-use from haymeadow (MG5a/c) to pasture had taken place. This artificial succession was generally caused by persistent grazing pressure, with or without the use of artificial fertilisers, and resulted in an expansion of coarser grasses, sometimes with an accompanying invasion of shrub species e.g. *Ulex europaeus*.

The community was generally dominated by tall, coarse grasses, particularly *Arrhenatherum elatius*, *Dactylis glomerata*, and *Holcus lanatus*, with occasional finer leaved species such as *Festuca rubra*, *Poa pratensis* and *Poa trivialis*. Herb species included frequent tall herbs such as *Heracleum sphondylium*, *Centaurea nigra*, *Trifolium repens*, *Trifolium pratense*, *Plantago lanceolata* and *Rumex acetosa*.

MG3 *Anthoxanthum odoratum*-*Geranium sylvaticum* grassland

a *Bromus hordeaceus* sub-community

b *Briza media* sub-community

Where MG3 occasionally occurred on the survey sites, it was always as a transition community with MG5a/c. As with MG5, MG3 is a haymeadow

community, described by Rodwell (1992) as, "an upland grassland confined to areas where traditional haymeadow treatment has been applied in a harsh sub-montane climate". On the survey sites the community was characterised by a dense growth of grasses including *Agrostis capillaris*, *Anthoxanthum odoratum*, *Dactylis glomerata*, *Festuca rubra* and *Holcus lanatus*, and herbs such as *Geranium sylvaticum*, *Alchemilla* spp, *Conopodium majus*, *Lathyrus pratensis*, *Plantago lanceolata*, *Rumex acetosa*, *Bellis perennis*, *Cerastium fontanum*, *Trifolium repens*, and *Ranunculus acris*.

MG5 *Cynosurus cristatus*-*Centaurea nigra* grassland

- a *Lathyrus pratensis* sub-community
- c *Danthonia decumbens* sub-community

As outlined in the main report, MG5 *Cynosurus cristatus*-*Centaurea nigra* grassland has been used in the 2003 survey as the ultimate benchmark of haymeadow nature conservation quality. Rodwell (1992) has described the community as, "the typical grassland of grazed hay-meadows treated in the traditional fashion".

The *Cynosurus cristatus*-*Centaurea nigra* grassland communities encountered showed a wide range of variability. Of the 53 different areas of MG5 community identified on the survey sites, 11 most resembled the overall MG5 data, 32 fitted into the MG5a *Lathyrus pratensis* sub-community, and 10 into the MG5c *Danthonia decumbens* sub-community.

The MG5 grass component was dominated by *Holcus lanatus*, *Agrostis capillaris*, *Anthoxanthum odoratum*, with frequent *Festuca rubra*, and occasional *Cynosurus cristatus*. A range of herb species included *Trifolium repens*, *Trifolium pratense*, *Rhinanthus minor*, *Plantago lanceolata*, *Ranunculus repens*, *Ranunculus acris*, *Euphrasia officinalis*, *Centaurea nigra*, *Hypochaeris radicata* and *Leucanthemum vulgare*, with occasional *Lotus corniculatus*. Differences between the sub-communities were often small, but generally the MG5a *Lathyrus pratensis* sub-community included frequent *Lathyrus pratensis*, *Vicia cracca*, and *Vicia sepium*, with the MG5c *Danthonia decumbens* sub-community showing abundant *Festuca* spp., frequent *Potentilla erecta* and *Succisa pratensis*, and only occasional *Danthonia decumbens*.

MG6 *Lolium perenne*-*Cynosurus cristatus* grassland

- a Typical sub-community
- b *Anthoxanthum odoratum* sub-community

MG6 grassland occurred in the 2003 survey occasionally as a pure community, but more often in transition to MG5 and to MG7. The MG6 community on the sites has often been derived from MG5 communities through an increase in grazing pressure, where grazing continued from the spring into the summer has prevented early flowering herbs from setting seed. This change of community has been exacerbated where artificial mineral fertilisers have replaced farmyard manure, enhancing the growth of grasses at the expense of the herbs.

The community was generally dominated by *Lolium perenne*, with frequent *Agrostis capillaris*, *Holcus lanatus*, *Cynosurus cristatus* and occasional *Dactylis*

glomerata, *Poa pratensis* and *Poa trivialis*. Where differences were detected between sub-communities, *Anthoxanthum odoratum* was preferential in the MG6b sub-community and *Phleum pratense* in the MG6c sub-community. Occasional herb species included *Trifolium repens*, *Plantago lanceolata*, *Ranunculus repens*, *Ranunculus acris*, *Achillea millefolium*, and *Cerastium fontanum*

MG7 *Lolium perenne* leys

The frequent occurrence of a MG7 *Lolium perenne* ley community was an indication of recent reseeding of a survey site. The management of the community to yield a silage crop, with autumn-winter-early spring grazing, and the frequent application of artificial fertilisers often gave rise on the survey sites to a MG6-MG7 transition community.

In spite of this agricultural treatment however, some swards maintained a relatively high species-richness, particularly at Sallachan, Cuil and Ardsheal, with abundant *Rhinanthus minor*, frequent *Centaurea nigra* and *Vicia cracca*, and occasional *Leucanthemum vulgare*. Generally however, MG7 communities were dominated by *Lolium perenne*, with a sparse cover of herbs such as *Trifolium repens* and *Ranunculus repens*.

MG10 *Holcus lanatus*-*Juncus effusus* rush-pasture

a Typical sub-community

MG10 *Holcus lanatus*-*Juncus effusus* rush-pasture occurred within the survey sites in the damper hollows, and generally in mosaic with other grassland communities. *Juncus effusus* was the dominant species with abundant *Holcus lanatus*, frequent *Agrostis stolonifera* and occasional *Poa trivialis*. The herb cover was species-poor, with occasional *Ranunculus repens*, *Ranunculus acris*, *Trifolium repens*, *Rumex acetosa*, and *Cerastium fontanum*.

U4 *Festuca ovina*-*Agrostis capillaris*-*Galium saxatile* grassland

b *Holcus lanatus*-*Trifolium repens* sub-community

c *Lathyrus montanus*-*Stachys betonica* sub-community

U4 tended to be found on the survey sites only on steep banks and field edges away from the influence of agricultural improvement. The community was often herb-rich, and sometimes difficult to distinguish from MG5 grassland communities. The U4 sward was dominated by grasses such as *Festuca rubra*, *Festuca ovina*, *Festuca vivipara*, *Agrostis capillaris* and *Anthoxanthum odoratum*, with *Holcus lanatus* frequent in the U4b sub-community, and *Nardus stricta* and *Danthonia decumbens* as occasional species. Other frequent species included *Luzula* spp., *Potentilla erecta*, *Succisa pratensis*, *Ranunculus acris*, *Ranunculus repens*, *Rumex acetosa*, *Trifolium repens*, *Trifolium pratense*, *Euphrasia officinalis* and *Conopodium majus*, with occasional *Calluna vulgaris*.

U20 *Pteridium aquilinum-Galium saxatile* community

a *Anthoxanthum odoratum* sub-community

U20 *Pteridium aquilinum-Galium saxatile* community on the survey sites generally marked the cessation of active management leading to the spread of a *Pteridium aquilinum*-dominated sward onto former haymeadows and pasture. Frequent sub-dominant grasses in the community included *Anthoxanthum odoratum*, *Agrostis capillaris* and *Festuca ovina*, with occasional herbs such as *Potentilla erecta* and *Galium saxatile*.

9.2.2 *Vegetation types recorded 2003: Subsidiary Communities*

MG1 *Arrhenatherum elatius* grassland

c *Filipendula ulmaria* sub-community

e *Centaurea nigra* sub-community

MG3 *Anthoxanthum odoratum-Geranium sylvaticum* grassland

MG5 *Cynosurus cristatus-Centaurea nigra* grassland

a *Lathyrus pratensis* sub-community

c *Danthonia decumbens* sub-community

MG10 *Holcus lanatus-Juncus effusus* rush-pasture

a Typical sub-community

U4 *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland

b *Holcus lanatus-Trifolium repens* sub-community

M1 *Sphagnum auriculatum* bog pool community

M4 *Carex rostrata-Sphagnum recurvum* mire

M5 *Carex rostrata-Sphagnum squarrosum* mire

M6 *Carex echinata-Sphagnum recurvum/auriculatum* mire

M9a *Carex rostrata-Calliergon cuspidatum/giganteum* mire

M10 *Carex dioica-Pinguicula vulgaris* mire

a *Carex demissa-Juncus bulbosus* sub-community

M15 *Scirpus cespitosus*-*Erica tetralix* wet heath

- a *Carex panicea* sub-community
- b Typical sub-community
- d *Vaccinium myrtillus* sub-community

M23 *Juncus effusus/acuteiflorus*-*Galium palustre* rush-pasture

- a *Juncus acuteiflorus* sub-community
- b *Juncus effusus* sub-community

M24 *Molinia caerulea*-*Potentilla erecta* mire

- c *Juncus acuteiflorus* sub-community

M25 *Molinia caerulea*-*Potentilla erecta* mire

- a *Erica tetralix* sub-community
- b *Anthoxanthum odoratum* sub-community

M26 *Molinia caerulea*-*Crepis paludosa* mire

- b *Festuca rubra* sub-community

M27 *Filipendula ulmaria*-*Angelica sylvestris* mire

- a *Valeriana officinalis*-*Rumex acetosa* sub-community

M28 *Iris pseudacorus*-*Filipendula ulmaria* mire

- a *Juncus effusus*-*Juncus acuteiflorus* sub-community

H10 *Calluna vulgaris*-*Erica cinerea* heath

- c *Festuca ovina*-*Anthoxanthum odoratum* sub-community

9.2.3 *Notable species*

As can be seen in *Table 3 (Notable species; occurrence on 2003 survey sites)*, of the 16 notable species listed in *Table 2 (Notable species considered to add value to a site)*, only eight species were found on sites during the 2003 survey, occurring on only 10 out of the total of 50 survey sites. The most widespread species was *Platanthera chlorantha*, occurring on five sites, generally in the MG5c *Danthonia decumbens* sub-community, but also in U4 *Festuca ovina*-*Agrostis capillaris*-*Galium saxatile* grassland. *Alchemilla* spp occurred on four sites, usually in MG5a/c grassland sub-communities and sometimes in M23 *Juncus effusus /acuteiflorus*-*Galium palustre* rush pasture. *Gymnadenia conopsea* was also found on four sites, in both grassland and mire communities.

No notable species were found on sites recently reseeded and dominated by MG6/MG7 communities.

Table 3 - Notable species; occurrence on 2003 survey sites

Species	Abbreviation	No. of sites
<i>Antennaria dioica</i>	Ad	0
<i>Alchemilla</i> spp	As	4
<i>Carum verticillatum</i>	Cv	1
<i>Crepis paludosa</i>	Cp	1
<i>Dactylorhiza purpurella</i>	Dp	1
<i>Drosera anglica</i>	Da	0
<i>Galium boreale</i>	Gb	0
<i>Geranium sylvaticum</i>	Gs	2
<i>Geranium pratense</i>	Gp	0
<i>Gymnadenia conopsea</i>	Gc	4
<i>Listera ovata</i>	Lo	0
<i>Orchis mascula</i>	Om	0
<i>Parnassia palustris</i>	Pp	0
<i>Platanthera bifolia</i>	Pb	2
<i>Platanthera chlorantha</i>	Pc	5
<i>Polygonum viviparum</i>	Pv	0
<i>Saxifraga hypnoides</i>	Sh	0
<i>Trollius europaeus</i>	Te	0

9.2.4 Nature conservation value

As can be seen in Table 4 (*Nature conservation grading of 2003 survey sites*), the nature conservation value of sites was generally moderate to low, with 42 sites being graded C, D or E, and only eight sites being graded as A or B.

Table 4 - Nature conservation grading of 2003 survey sites

Nature conservation grading	No. of sites
A	1
B	7
C	17
D	7
E	18

9.2.5 *Extent and species-richness of MG5 communities*

Table 5 (Extent of MG5 communities on 2003 survey sites) shows that the mean percentage coverage of MG5 (including transition communities) on previously surveyed sites which were resurveyed in 2003 was 39%, compared with a mean coverage of 81% on newly surveyed sites in 2003.

Table 5 - Extent of MG5 communities on 2003 survey sites

Resurveyed/new sites	Mean % coverage MG5
resurveyed sites	39
new sites	81

Table 6 (Species-richness of MG5 communities on 2003 survey sites) shows that the mean number of species per site in MG5 communities (including transition communities) in 2003 on resurveyed sites was 22, compared with a mean number of species per site of 26 on newly surveyed sites in 2003.

Table 6 - Species-richness of MG5 communities on 2003 survey sites

Resurveyed/new sites	Mean no. of species in MG5 community per site
resurveyed sites	22
new sites	26

9.3 Results of management survey 2003 (see *Appendix 5: Site Summary Tables*)

9.3.1 *Land-use*

As illustrated by *Table 7 (Land-use of 2003 survey sites)*, the majority of sites (67%) surveyed in 2003 were managed for a silage crop, usually with some degree of grazing during the autumn, winter and/or spring. Only 7% of the sites were actively managed as haymeadow.

Table 7 - Land-use of 2003 survey sites

Land-use type	No. of sites
haymeadow (\pm grazing)	3
silage (\pm grazing)	28
permanent pasture (inc. <i>ad hoc</i>)	11
wildlife habitat (\pm grazing)	6
neglected	2

9.3.2 General management

It was not always possible to gain definitive information on the ploughing and reseeded of many of the sites surveyed in 2003. Many crofting tenants were unsure when, if ever, sites had been most recently ploughed and/or reseeded. However, using the presence of MG7 (and MG6) communities, along with dominance of swards by species such as *Lolium perenne* and *Phleum pratense* as a guide, it is estimated that approximately 80% of the 50 survey sites have been ploughed and reseeded within the last 25 years.

Again, definitive information was often difficult to ascertain regarding fertiliser applications, but it seems likely that all 31 sites presently managed to yield a hay or silage crop as a primary objective, do receive regular applications of artificial fertiliser and/or organic farmyard manure. Of these, approximately 10% receive only organic manure. Definitive information regarding the positive recent use of herbicides was given for only three sites.

All 31 hay and silage fields surveyed in 2003 are mown only once a year, in July or August, weather permitting.

Of the 50 sites surveyed, only 6% are never actively grazed by livestock, although these are likely to be grazed to some extent by wild herbivores. The majority of sites (56%) are grazed only by sheep, 16% are grazed only by cattle, and 16% by both sheep and cattle. The remaining 6% are grazed largely by horses.

Four sites (all farmed by the same crofter in Inverroy) are managed under the terms of the Countryside Premium Scheme (CPS), with two sites in Ardnamurchan being managed under the Ardnamurchan Grassland Scheme (AGS); in all cases nature conservation is a primary objective.

9.4 Comparison of results of previous surveys with 2003 survey

(see Appendix 5: Site Summary Tables)

9.4.1 Vegetation types

In terms of the range of NVC sub-communities present on the 39 resurveyed sites, there has been an overall trend of impoverishment from the surveys of 1993/4 compared to the 2003 survey. In the earlier surveys, 41 different sub-communities were identified on the 39 sites, compared to 30 sub-communities identified on the same sites in 2003. Of the vegetation types lost, 10 are grassland sub-communities.

9.4.2 Notable species

As can be seen in Table 8 (*Notable Species: Comparison of occurrence between 1993/4 and 2003 on resurveyed sites*), there has been a marked impoverishment in terms of notable species found on the survey sites. *Alchemilla* spp. were the most widespread species found during the 1993/4 surveys, being found on 11 sites, compared to only four sites in 2003. Other species showed a similar trend of disappearance within habitats, particularly *Platanthera chlorantha*.

Table 8 - *Notable Species: Comparison of occurrence between 1993/4 and 2003 on resurveyed sites*

Species	Abbreviation	1993/4	2003
<i>Antennaria dioica</i>	Ad	0	0
<i>Alchemilla</i> spp	As	11	4
<i>Carum verticillatum</i>	Cv	3	1
<i>Crepis paludosa</i>	Cp	4	1
<i>Dactylorhiza purpurella</i>	Dp	2	1
<i>Drosera anglica</i>	Da	0	0
<i>Galium boreale</i>	Gb	0	0
<i>Geranium sylvaticum</i>	Gs	5	2
<i>Geranium pratense</i>	Gp	1	0
<i>Gymnadenia conopsea</i>	Gc	5	4
<i>Listera ovata</i>	Lo	0	0
<i>Orchis mascula</i>	Om	0	0
<i>Parnassia palustris</i>	Pp	1	0
<i>Platanthera bifolia</i>	Pb	2	2
<i>Platanthera chlorantha</i>	Pc	9	5
<i>Polygonum viviparum</i>	Pv	1	0
<i>Saxifraga hypnoides</i>	Sh	0	0
<i>Trollius europaeus</i>	Te	1	0

9.4.3 Nature conservation value

As can be seen in *Table 9 (Nature conservation grading: Comparison between 1987, 1993/4 and 2003 on resurveyed sites)*, the nature conservation value of sites exhibited a disappointing decline. With 22% of sites graded A in 1987, and 16% graded A in 1993/4, there was a drop to only 2% of sites graded A in 2003. At the lower end of the grading, no sites were graded E in 1987 or 1993/4, whereas widespread reseeding with *Lolium* and *Phleum* dominated swards in recent years resulted in 36% of sites being graded E in the 2003 survey.

Table 9 - Nature conservation grading: Comparison between 1987, 1993/4 and 2003 on resurveyed sites

Nature conservation grading	Survey year		
	1987	1993/4	2003
A	5	6	1
B	0	11	7
C	5	19	17
D	13	2	7
E	0	0	18
<i>Total no. sites surveyed per year</i>	23	38	50

9.4.4 Extent and species-richness of MG5 communities

As can be seen in *Table 10 (Extent of MG5 communities: Comparison between 1993/4 and 2003 on resurveyed sites)*, the mean coverage per site by MG5 communities (including transition communities) dropped markedly from 75% in 1993/4 to 39% in 2003.

Table 10 - Extent of MG5 communities: Comparison between 1993/4 and 2003 on resurveyed sites

Survey year	% coverage MG5	
	new sites	resurveyed sites
1993/4	n/a	75
2003	81	39

Table 11 (*Species-richness of MG5 communities: Comparison between 1993/4 and 2003 on resurveyed sites*), shows that the mean number of species per site in MG5 communities (including transition communities) dropped from 29 in 1993/4 to 22 in 2003. These losses in both extent and species-richness of MG5 communities have largely been the result of the expansion of MG6 and MG7 communities, as former haymeadows are ploughed and reseeded.

Table 11 - *Species-richness of MG5 communities: Comparison between 1993/4 and 2003 on resurveyed sites*

Survey year	Mean no. of species in MG5 community per site	
	new sites	resurveyed sites
1993/4	n/a	29
2003	26	22

9.4.5 Land-use

As can be seen in Table 12 (*Land-use: Comparison between 1993/4 and 2003 on resurveyed sites*), there are also marked changes in land-use trends, with 48% of sites in 1993/4 still being managed (in a largely traditional way) as haymeadows, and only 7% managed for silage. This contrasts with the situation in 2003, where only 7% of sites were haymeadows, whereas 67% of sites were managed for silage production.

Table 12 - *Land-use: Comparison between 1993/4 and 2003 on resurvey sites*

Land-use	Survey year	
	1993/4	2003
haymeadow (\pm grazing)	20	3
silage (\pm grazing)	3	28
permanent pasture	15	11
wildlife habitat (\pm grazing)	0	6
neglected	4	2

9.4.6 General management

Despite the lack of definitive information on the ploughing and reseeded of many of the 2003 survey sites, using the presence of MG6/MG7 communities and dominance by *Lolium perenne* and *Phleum pratense* as a guide, it is possible to estimate that approximately 43% of the 39 resurveyed sites have

been ploughed and reseeded in the last 10 years. By the same token, applications of herbicide and artificial fertilisers are likely to have increased.

Mowing and grazing regimes show less dynamic changes, although there is a general trend of switching from hay to silage on most sites, and an increasing dominance of sheep grazing over cattle grazing.

As a positive trend, no sites were being managed for nature conservation at the time of the earlier surveys, whereas 14% of sites in 2003 were managed under CPS or AGS, with nature conservation as a primary objective.

10 DISCUSSION

10.1 Vegetation survey

10.1.1 Methodology

Site selection for the 2003 survey was to some extent subjective, the selection of resurvey sites (i.e. high quality sites; see section 3.1 *Site selection*), being based to a large extent on interpretation of the nature conservation gradings given to sites in previous surveys, themselves partly subjective. In addition, constraints of time and resources limited the 2003 survey to only 50 sites. While this size of sample is too small to yield statistically valid data, and to allow interpretation of overall trends, it is hoped that the survey will give some indication of the issues influencing haymeadow conservation in Lochaber.

Gaining access permission sometimes posed a problem, and proved impossible for some sites. In addition, a number of other sites had already been cut at the time of survey, necessitating the extrapolation of data gathered from field edges.

As had been found in previous surveys (Milnes & Martin, 1993; Milnes & Eardley, 1994), there were also difficulties with *goodness of fit* of data in 2003. The frequently poor fit of data to community descriptions often created difficulties in assigning the correct NVC type to a community. Therefore, although the vegetation types assigned to plant communities in this report are the closest fit available, they do sometimes display significant differences from the descriptions given in *British Plant Communities* (Rodwell 1991 & 1992). A common example of this issue in Lochaber was the difficulty of differentiating between MG5 and U4b. These vegetation types have a very similar range of species, and generally the frequency of species such as *Cynosurus cristatus* (often absent from the MG5 communities surveyed), and *Galium saxatile* (which also occurred at relatively low frequency) were used as distinguishing features.

There are two main reasons for the difficulties encountered in identifying NVC community types. The first is the problem common to all vegetation survey, that of classifying a continuum of vegetation assemblages, where a particular vegetation sample will not always slot neatly into a NVC type. The second problem is more local in effect, and is particularly relevant when trying to compare local with national floristics in the case of grasslands in Lochaber. Here, classification problems are exacerbated because few grasslands in north-west Scotland were sampled during the compilation of *Grasslands and Montane Communities* (NVC Volume 3; Rodwell, 1992). So, as Milnes and Eardley (1994) point out, whilst descriptions of communities are applicable countrywide, some allowance has to be made for regional variation when applying them to actual data, and many of the communities found could therefore be regarded as north-western variants of the NVC types assigned.

10.1.2 Vegetation types

Vegetation types encountered during the surveys showed a high degree of variability, even within sub-communities e.g. MG5 grassland. The survey sites all had very similar soil types, generally humic-iron podsols, and any variation

was therefore due to more site specific factors such as management history, drainage and aspect. The influence of past management was particularly influential, with traditional haymeadow management producing a herb-rich sward, intensive grazing producing a grass-dominated herb-poor sward, and neglect tending to promote the growth of the coarser grasses.

The age of reseedings also gave rise to variance in the species composition of swards. Where sites had been reseeded many years before and traditional haymeadow management had been practised, swards also tended to be herb-rich, with low nutrient inputs preventing the development of dominance by grass species. On the other hand, more frequent applications of artificial fertilisers (and often more intensive grazing), favoured grassy, herb-poor swards.

The 2003 survey showed a loss of more than 25% in the range of NVC sub-communities encountered on the 39 resurvey sites. This overall trend of impoverishment is probably almost entirely due to ploughing and reseedings of the formerly traditionally-managed haymeadows, with species-poor and herb-poor, grass-dominated silage mixtures.

10.1.3 *Notable species*

There was a marked impoverishment in the incidence of notable species found on the resurvey sites in 2003, compared to previous surveys. *Alchemilla* spp and *Platanthera chlorantha* suffered the greatest decline. While the gradual process of agricultural improvement through the increased use of artificial fertilisers and herbicides has caused many losses, the loss of notable species was most marked on those sites which have undergone radical habitat change through recent ploughing and reseedings, and are now dominated by MG6/MG7 communities.

10.1.4 *Nature conservation value*

The nature conservation value of sites also exhibited a disappointing decline, with only one grade *A* site in 2003 and 18 grade *E* sites. Once again, widespread reseedings with *Lolium* and *Phleum* dominated swards in recent years is the main reason for the trend.

However, caution must be exercised in interpreting differences in grading of sites for nature conservation value between previous surveys and the 2003 survey. The different sets of values are not directly comparable as previous surveys took into account all species and communities present on survey sites, judging their value in a wider nature conservation context, whereas the 2003 survey used the benchmark community MG5 to signify ultimate quality purely in the context of haymeadow nature conservation.

10.1.5 *Extent and species-richness of MG5 communities*

Mean coverage per site by MG5 communities (including transition communities) dropped markedly from 75% in 1993/4 to 39% in 2003. The mean number of species per site in MG5 communities (including transition communities) has

also dropped from 29 in 1993/4 to 22 in 2003. Again, these losses in extent and species-richness have largely been the result of the ploughing and reseeded of former haymeadows and the resulting expansion of MG6 and MG7 communities. Other contributory causes include an increase in grazing pressure and grazing time, the use of sheep rather than cattle, horse grazing and general neglect.

10.2 Management survey

10.2.1 Methodology

Gaining access permission was generally very time consuming, and occasionally it proved impossible to find out who actually managed a site. Many site managers were also unsure about some management details, for example, when a site was last ploughed or reseeded. Where these problems occurred, grazing clerks were often very knowledgeable and helpful in giving historical management information about sites in their townships. In addition, it was usually possible to interpret recent site management history from other data, such as using the presence of MG7 (and MG6) communities, and the dominance of swards by species such as *Lolium perenne* and *Phleum pratense* as an indication of fairly recent reseeded.

10.2.2 Land-use

Land-use patterns have changed considerably from the late 1980's and early 1990's to the present day. In a relatively short space of time there has been a marked swing in land-use from traditionally-managed haymeadows to silage production. A wide range of valid reasons were quoted by crofters, grazing clerks and owners for this change in farming practice, not the least important being that in the oceanic climate of Lochaber, silage production is a much more dependable method of forage conservation than haymaking.

10.2.3 General management

Along with the widespread move from hay to silage production in Lochaber over the last few decades, has been the ploughing and reseeded of haymeadows to give highly-productive, grass-dominated species-poor swards. Data from the 2003 survey suggests that approximately 80% of the 50 survey sites have been ploughed and reseeded within the last 25 years, and approximately 43% of the 39 resurveyed sites have been ploughed and reseeded in the last 10 years. Concomitant with ploughing and reseeded have been other forms of agricultural improvement, notably an increase in the use of artificial mineral fertilisers and a decrease in the use of organic farmyard manure. Herbicide use to control agricultural weeds is also likely to have increased, replacing the traditional methods which relied more heavily on livestock and grassland husbandry.

Mowing and grazing regimes have shown less dynamic changes, although there is a general trend of switching from hay to silage on most sites, and an

increasing dominance of sheep grazing over cattle grazing. A minor increase in the number of sites abandoned to neglect or horse pasture also gives cause for concern.

The positive influence of management and conservation schemes is small but significant, with the Countryside Premium Scheme and the Ardnamurchan Grassland Scheme playing an important role in the nature conservation of haymeadows and their associated species.

10.3 The future of the haymeadow resource

A range of negative influences continue to threaten the remaining haymeadow sites. Those threats most pertinent to Lochaber include decrofting for housing developments, the increased age structure and retirement of many crofters, agricultural improvements and intensification, year-round grazing, scrub/bracken/gorse invasion, and increased horse grazing and neglect

As has been shown by the comparison of the results of the 2003 survey with the results of earlier haymeadow and grassland surveys, much of the haymeadow resource of Lochaber has already been impoverished or lost. However, it is hoped that this trend can be reversed, and that many of the survey sites can be restored through appropriate agricultural practice, aided by sensitive management and conservation schemes.

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APPENDIX 1

PREVIOUS SURVEYS

- 1. A Survey of Hay meadows and Associated Grasslands in Skye, Ardnamurchan, Sunart and Lochaber (1987) by A. Orange, with additional notes by P. Lusby.**

Alan Orange's survey concentrated mainly on haymeadows and occasional pasture. Some communities were classified to NVC level, and sites were graded for nature conservation value in two ways. The first grading system was based on the general site description, species richness and number of notable species, with a second system by P. Lusby giving a score for each site, with marks allocated for the number of grassland species, site size, management practice, notable species and other communities on the site.

- 2. Housing Survey of Lochaber (1991) by M.Rigby**

Rigby's 1991 housing survey of various settlements in Lochaber followed Phase 1 habitat survey methodology. The survey identified broad habitat types such as broadleaved woodland, semi-improved grassland and marshy grassland, describing areas of nature conservation interest in target notes. Several areas were found to contain species rich hay meadows, particularly around Onich, with isolated fields in the Great Glen.

- 3. A Survey of Some Enclosed Grasslands in Lochaber (1993) by K. Milnes & D Martin**

Katherine Milnes and David Martin sought to survey existing enclosed grassland around Glencoe, Bohuntine and Inverroy to NVC level, to determine areas of conservation interest, and to identify threats to the enclosed grassland in each township. Sites were graded on a scale of A-E based on degree of species-richness, the occurrence of notable species, size of sites, and overall impressions of the communities present.

- 4. A Survey of traditionally Managed Hay Meadows and Other Grasslands in Lochaber (1994) by K. Milnes and B. Eardley**

In 1994 Katherine Milnes and Brian Eardley undertook surveys to NVC level of existing traditionally managed hay meadows and other grasslands in Onich and Bunree, Strontian and Scotstown, Clovullin, Murlaggan, and various sites in the Great Glen and Ardnamurchan. They graded sites for nature conservation value as in 1993, identified threats to traditionally managed habitats, and compared the results of their survey where applicable to the surveys of Orange (1987) and Rigby (1991).

APPENDIX 2

DOMIN SCALE & DAFOR RATING

Domin Scale

Score	% cover/abundance	
10	91 – 100	
9	75 – 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

DAFOR Rating

Abbreviation	Rating	% cover
D	Dominant	81 – 100
A	Abundant	61 – 80
F	Frequent	41 – 60
O	Occasional	21 – 40
R	Rare	1 - 20

APPENDIX 3

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3. Liverworts

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4. Lichens

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APPENDIX 4

SITE MAPS

Map 1 Ormsaigbeg

Map 2 Kilmory

Map 3 Anaheilt and Scotstown

Map 4 Sallachan

Map 5 Clovullin

Map 6 Cuil

Map 7 Ardsheal

Map 8 Onich and Bunree

Map 9 Glencoe

Map 10 Inverroy

Map 11 Bohuntine

Map 12 Murlaggan

APPENDIX 5

SITE SUMMARY TABLES

APPENDIX 6

VEGETATION PHOTOGRAPHS

APPENDIX 7

GRASSLAND CARDS

APPENDIX 8

SITE MANAGER DETAILS