VEGETATION SURVEY OF INBYE FARMLAND WITHIN THE CAIRNGORMS NATIONAL PARK: BADENOCH AND STRATHSPEY

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SUMMARY

BACKGROUND

This was a survey to obtain information on the extent and distribution of species-rich grasslands and wetlands on lowland farmland in the Badenoch and Strathspey area within the Cairngorms National Park. The survey was initially based on a sift of IACs fields designed to extract all fields classified as permanent pasture or rough grazing – leading to a sample size of 1,486 fields. However, it became clear during the preliminary stages of the survey that restricting the survey to just those fields would result in ignoring some of the most interesting areas – often corners of cropped fields or areas fenced off due to agri-environment schemes. Therefore surveyors were instructed to pick up and survey opportunistically any other fields they encountered which seemed to fit the remit. Fields considered to be clearly dominated by upland vegetation were generally dismissed from the survey.

This resulted in a total of 1,390 fields being surveyed, of which 50 were dismissed, 979 from the original IACS sample and 361 'new' fields were surveyed.Thus, the number of fields included in the analysis of results was 1,340.

The survey area was divided into eight subareas on the basis of geographical, edaphic, landform and land management differences between various areas of the strath.

MAIN FINDINGS

The commonest species-rich grassland type was U4c, followed by CG10a, with MG5 being apparently relatively unusual. The commonest wetland types of interest were S9 and S27, with S11, M27 and M10 also being frequent. M9, S4 and *Carex lasiocarpa* swamps were much scarcer.

There was very little difference in overall vegetation diversity between the different subareas, although the Avielochan, Insh, Laggan-Balgowan, Kingussie-Newtonmore, Carrbridge-Dulnain Bridge and Deishar subareas clearly had more species-rich grassland than the two northeasternmost subareas. Kingussie-Newtonmore, Laggan-Balgowan, Insh and Deishar had significantly more wetland vegetation types of interest than the remaining areas. *Helianthemum nummularium* appeared to be almost confined to the area between Carrbridge and Grantown, while *Cirsium heterophyllum* also seemed to exhibit a northern tendency in its distribution. At least 10% of fields were recorded as having conspicuous quantities of fungi, often waxcaps *Hygrocybe*.

Although there were inconsistencies with the structure data collected, it was clear that 35-40% of all grassland and wetland fields had at least some heterogeneous or tall vegetation.

The actual areas occupied by most of the vegetation types of interest were not especially large, e.g., U4c only covers 184 ha of the total area, therefore the main value of these communities may often be in terms of their frequency across the area, providing refuges for species of various different taxonomic groups. However, balanced against that is the fact that the aggregate of all unimproved vegetation types across the 'old' fields amounted to 2,310 ha or c. 40% of the total, while 74% of these fields contained at least some unimproved vegetation. These unimproved areas provide very important habitats for a wide range of invertebrates, mammals, birds and fungi, including several of national significance.

It was noted that the 'new' fields had higher proportions of the more species-rich or unusual communities, particularly marked for vegetation types like CG10, U4c and S27.

Any attempts to compare this work against previous surveys of species-rich grasslands in Scotland are difficult because of the tendency of other surveys to concentrate on the best areas, combined with differences in focus – several other surveys were looking specifically at hay meadows. A very provisional assessment in the context of these other surveys suggests that the frequency of at least moderately species-rich grasslands in Badenoch and Strathspey is unusual.

The late timing of the survey led to an inability to provide much information on the frequency of occurrence of many more unusual species, especially orchids. It may also have led to the underestimation of the area of meadow types such as MG5.

Surveyors often encountered areas which had been closed off to stock and had become dominated by rank grasses, with a resultant loss in species diversity. Slight increases in grazing or mowing might help to restore a wider range of flowering plants to these areas.

VEGETATION SURVEY OF INBYE FARMLAND WITHIN CAIRNGORMS NATIONAL PARK: BADENOCH AND STRATHSPEY

Report by Brendan O'Hanrahan

1 OBJECTIVES, REMIT

The objective of the survey was to obtain information on the extent and distribution of species-rich grasslands and wetlands on farmland in the Badenoch and Strathspey area within the Cairngorms National Park. Unenclosed hill ground was intended to be excluded from this remit and thus, 'inbye' farmland – that which is enclosed and, usually, improved at some stage in its history - was considered to be the subject of the survey.

In practice, the exact definition of 'inbye' sometimes proved difficult, e.g., where hill ground had been enclosed but unimproved or, vice versa, where unenclosed ground had frequent areas of relatively intensively grazed rough grassland and other vegetation types which were typical of the bottom of the strath or otherwise lowland in character (N.B. in keeping with local usage, the term 'the strath' will be used throughout the report as shorthand for the entire Badenoch and Strathspey area which is the subject of this report). The former case was commonly encountered, e.g., in the Gaskbeg, Badenedin and Aultcharn areas. The latter was more unusual, but is illustrated by some of the ground in and around Glenshirra.

The division between what was included and what was excluded therefore inevitably retained some subjectivity and may have been interpreted differently by different surveyors. In general, ground which was a) unimproved, b) dominated by heath and bog NVC (National Vegetation Classification, see below) types such as H10, H12, M17, M15 and M19, and c) lacked 'lowland' fen or wetland types, e.g., S4, S9, S11, S27 and M27, was excluded.

It was much easier to agree on how to treat woodland – any field or (where dealing with a potentially 'new' unit) clearly discretely bounded unit which consisted of more than 75% woodland (though this proportion was not rigid – some discretion was left to surveyors) was excluded or dismissed from the survey. Since the Forest Research arm of The Forestry Commission, Scotland (FCS) has recently embarked on a detailed survey of all semi-natural woodland in Scotland, it seems appropriate to leave detailed coverage of this habitat to such specialists.

2 BACKGROUND

The area to be surveyed stretched from Glenshirra and Kinlochlaggan in the southwest, just north of Dalwhinnie in the south, into Glen Feshie as far as Achlean, to Auchterteang and Clachbain in the north above Carrbridge and Dulnain Bridge and then to Auchnagallin and Culfoichbeg in the northeast beyond Cromdale (see Fig 1).

The area ranged in altitude from c. 165 m by the Spey near Cromdale to just over 400 m at Dirdhu, on the road to Tomintoul. The fields at Lethendryvuole, on the western side of the A9 from Carrbridge, were also close to 400 m in altitude. Several parts of the site were at or just over 300 m asl: Catlodge, Phones, Glen Feshie, Tulloch, Auchterteang, Glenbeg, Tombain, the Auchnafearn-Ballieward area, the part of the Haughs of Cromdale in the survey area, Aultcharn, Connage and Corriechullie.

2.1 Geology and soils

The solid geology of the lowland parts of Badenoch and Strathspey consists of three groups of rock: two metamorphic - the Dalradian rocks of the Grampian Group and the Central Highland Migmatite Complex - and one igneous, consisting of several granite intrusions (plutons) of varying sizes. With the exception of two smaller plutons (Boat of Garten and Tore Hill) which occur in the middle of the study area the remaining areas of granite are largely on the periphery (these are the Monadhliath, Cairngorm, Grantown and Drumgask-Strath Mashie plutons). The Central Highland Migmatite Complex mainly outcrops in the Carrbridge-Dulnain Bridge area, with smaller outliers in the Inverdruie-Torr Alvie and Newtonmore-Balgowan areas. The majority of the Central Highland Migmatite Complex metamorphic rock is rather

gneiss-like with local bands of quartzite, calc-silicates and schistose rocks. In the case of the more extensive Grampian Group schistose rock types (mainly fine-grained psammite, though with occasional coarser semipelites and calc-silicates) are dominant, with some quartzite and a few outcrops of the much rarer so-called metacarbonates (effectively a metamorphic form of limestone), e.g., Finlarig, Laggan Hill and Coldholme north of Dulnain Bridge, north of Dunachton, around Revack and north of Loch an Eilein. There are also a few small intrusions of metabasic amphibolite in the area, e.g., Craig Revack, Muckrach Lodge and Ord Bàn (Highton 1999, Rock 1989).

The schist consists principally of mixtures of psammites and semipelites, with the latter tending to be slightly more base-rich than the former (normally derived from sandy deposits). However, the thin bands of more base-rich calc-silicates, which are scattered almost throughout the area, are probably important local sources of mineral enrichment (Highton 1999).

However, the source of most of the base-rich soil which supports species-rich or calcicolous vegetation in the strath is glacial drift, whether as a mantle or in the form of moraines. These morainic deposits are found particularly along the main glacial axes – the Spey and Feshie and, to a lesser extent, the Dulnain, the Nethy and the Truim.

One particularly rich set of moraines appeared to be that running parallel to and south of the Spey between Gartenbridge (Boat) and Rothiemoon (Nethy Bridge), including notably rich calcareous grassland at Tomachrochar, Tomdhu and East Croftmore, as well as good wetlands at Tomachrochar and Mains of Garten.

The dominant soils in this study area are podzols, mainly humus-iron podzols but with more peaty podzols the further you move away from the floodplains. There are some limited areas of alluvial soils – principally south of Kincraig and along the river Nethy. Gleys (mainly peaty gleys) and rankers are more scattered, though both are widespread, with gleys being particularly prominent in the Laggan-Balgowan subarea (Bruneau 2006).

2.2 Climate

The Badenoch and Strathspey area has a more continental climate than most of the rest of Scotland, characterised by colder winters with significant snowfall and generally lower rainfall than comparable mountain areas elsewhere. Unfortunately, the only long-term weather stations operated by the Meteorological Office (Met Office) in the region are either at much higher altitudes than the area of interest to this project (e.g., Cairngorm, the Cairnwell or Allt a' Mharcaidh) or on Deeside – Braemar and Balmoral.

Continental climates tend to have much wider temperature ranges than oceanic areas and this is borne out by Met Office data for Braemar showing that temperatures in the last 25 years have had a minimum of -27.2° C (in 1982) and a maximum of 27.1° C in 1995. Similarly, the January-July temperature range for Braemar between 1930-1960 was 12.5° C (Green 1981). It should be emphasised that this 'continental' character is only relative to the more clearly oceanic parts of Scotland – overall Badenoch and Strathspey still have an oceanic climate. The temperature maximum record referred to may well have been exceeded in the last two (2005 and 2006) very warm summers, with several unofficial reports of temperatures at or over 30° C in the Aviemore-Cairngorm area. For the period 1931-60, the Braemar station recorded average temperatures of 0.6° C for January and 12.9° C for July-August (Ellis & McGowan 2006). However, it is likely that, at least for the summer months, these figures no longer reflect the pattern of recent years, when, presumably due to global warming, the frequency of warm summers certainly seems to have increased. Harrison (1997) reported a spatially averaged increase of 0.4° C for Scotland since the late 1960s.

Records kept at Achnagoichan (Coylumbridge) suggest that the strath receives around 50 days of snowfall per annum, though this again may have declined in recent years (Brown & Clapperton 2002).

Annual total precipitation in Strathspey is usually less than 900 mm (Ellis & McGowan 2006), compared to much of the western Scottish seaboard at the same latitude, which can receive an average of 1600 mm.

Braemar had an average of 1,120 hours of sunshine annually between 1931-60, whereas the Highlands average was under 1,100 (Ellis & McGowan 2006).

This area is thus significantly drier, warmer and, at least locally (e.g., around Kincraig and Inverdruie), more sheltered than most of the straths in the rest of the Highlands.

2.3 Agriculture

Farming is dominated by a mixture of beef cattle (with suckler cows playing an important role) and sheep (a mixture of breeding ewes and fattening hoggs), supplemented by arable ground, Dairy farming has all but disappeared in the National Park, with just one surviving dairy farm – Mains of Tullochgribban, east of Duthil.

Probably the majority of arable ground is for spring barley, with lesser areas of oats and winter barley being grown. Fodder brassicas such as swedes, rape, kale and cabbage are also grown for stock. The arable ground is concentrated along the flat bottom of the strath, rarely extending far from the floodplain of the Spey.

Statistics for the 16 parishes in the Cairngorms from the 1991 agricultural census, of which five (Kingussie, Alvie, Duthil, Abernethy and Cromdale) are more or less completely within the Badenoch and Strathspey area, show that only approximately 4% (24,000 ha) was in crops and grass, though, since the total includes vast areas of hill ground, this is not surprising. The census also reported 131,000 ewes and 34,000 cattle in the 16 parishes – sheep numbers having risen by 16% since 1975. 47% of farm units in the 16 parishes were managed by full-time occupiers, while 27% were managed by part-time occupiers (Thomson 2002).

The system for paying sheep subsidies has changed significantly over the last ten years, with the headage-based Sheep Annual Premium and Hill Livestock Compensatory Allowances (HLCA) scheme being replaced by the Less Favoured Area Support Scheme (LFASS), which is awarded on an area basis. This is likely to have contributed to a 15% decline in sheep numbers in the National Park between 1990 and 2003 (Rowse 2006). Although the main impact of these changes has probably been felt on hill farms, nonetheless this decline, which is forecast to continue, is likely to lead to a reduction in sheep numbers on lowland pasture as well. Cattle numbers, which declined by c. 9% between 1990 and 1995, have remained relatively stable since then – at c. 27,500 head for the Park as a whole (Rowse 2006).

A majority of farmers in Badenoch and Strathspey are still tenant farmers (though c. 50% for the Cairngorms as a whole, according to the 1991 census), with most being descended from at least one previous farming generation in the strath (obs. from contact with farmers during survey). There are several particularly large estates – Seafield, Rothiemurchus, Cluny, Ralia, Tulchan, Muckrach etc. These vary in their practice as far as farming is concerned, with e.g., Seafield having apparently no direct involvement in agricultural management, whereas Muckrach, Cluny and Rothiemurchus have most of their ground in hand and employ farm managers.

Crofting tenure is widely scattered across the strath, though generally relatively thinly, with the exception of clusters such as Tulloch, Balgowan and Newtonmore. There are just over 100 registered crofts in the strath. A significant, though unknown, proportion of crofters consists of owner-occupiers, having taken advantage of right-to-buy legislation at various times over the last half-century. Examples of this are at Corriechullie, Lethendry and Raebreck.

Farm sizes therefore vary widely, though the majority of those included within this survey have around 7-15 fields, giving a very rough average farm size (excluding any hill ground) of c. 70 ha.

Although SEERAD (Scottish Executive Environment and Rural Affairs Department) were not able to give any exact figures for the take-up of agri-environment schemes like the almost phased-out ESAs (Environmentally Sensitive Areas) and RSS (Rural Stewardship Scheme), which in turn is about to be replaced by Land Management Contracts, they did give an indication of participation rates by civil parish. Apparently the great majority of farms in Kingussie parish (which includes Newtonmore and Laggan) and all or virtually all of the farm units in Alvie parish are participating, a high proportion of the lowland units in Duthil (which includes Aviemore) and Abernethy are in and Cromdale, though still with a majority of potential farmers, has perhaps the lowest proportion of the five parishes (for a map of these civil

parishes, see Thomson (2002)). By the end of the ESA scheme (i.e., the last opportunity to enter) in 2000, SEERAD estimate that c. 90% of all potential participants in the Cairngorms had joined the scheme. By 2003 there were 43 RSS agreements within the Cairngorms (*sensu lato*), covering 63,000 ha. There are several farms within the Badenoch and Strathspey area involved with the Organic Aid Scheme (OAS), these being in the parishes of Abernethy, Cromdale and Kingussie (Rowse 2006).

Farmers in the Cairngorms receive a significantly higher level of agri-environment subsidies than the UK average – c. 15% of total subsidies received, compared to the normal figure of 4-5% (Rowse 2006).

SNH sponsored a review in 2001 of changes in agriculture which had recently occurred, and those likely to occur; 85 farms in Badenoch and Strathspey were included. The survey reported that there had been a significant number of farms sold, a partial move to part-time farming and an increase in diversification. Farm sizes had also grown, accompanied by a decline in mixed farming (Rowse 2006).

3 METHODS

3.1 Field selection – original list.

The original intention was to survey 1500 fields which had been sifted from all of the IACS fields belonging to farm units which were both within the Cairngorms National Park and in the Badenoch and Strathspey area. The criteria used to sift out fields were that they should have been classified as either permanent pasture or rough grazing in 2005 – the most recently available IACS set.

Upon examination of the scale of the task after the award of the contract, it was agreed that there were too many large fields included within this number which would be disproportionately time-consuming and many of which would probably not qualify as 'inbye', i.e., that they would be hill grazings, which were not considered to be within the remit of the project. Therefore, all fields greater in size than 50 ha were removed, which left a total of 1486.

3.2 Field selection – additional fields

It quickly became clear during the course of the survey that restricting the survey to those fields categorised as permanent pasture and rough grazing would result in ignoring some of the most interesting areas – areas which clearly otherwise qualified. Such areas had been excluded for a number of reasons – sometimes because they had been fenced off due to participation in ESA (Environmentally Sensitive Area) or RSS (Rural Stewardship Scheme) schemes, sometimes because they constituted a small area of a field otherwise classified as arable or sometimes because they were on long-term rotation. There was also a perception that failing to survey these obviously interesting areas would effectively bring the survey (and its results) into disrepute – on several occasions when surveyors were talking to farmers while obtaining access permission the farmers were surprised to discover that particular fields which they were keen to point out to the surveyor as being interesting were not on the map as fields to be surveyed.

Therefore, after discussions with David Bale and Will Boyd Wallace it was agreed that surveyors should opportunistically survey fields which were considered to come within the remit detailed above. These so-called 'new' fields differed from the originals in that they lacked an original FIELDID no (numbers from 1500 upwards were assigned to them) and that the boundaries for these fields did not always correspond to IACS boundaries (to an extent which is still unclear). Their boundaries therefore do not as yet exist in digitised form, though grid references for their approximate centre points were recorded.

3.3 Access permission

No field was knowingly entered without first obtaining permission from at least the primary land manager. Because of data protection concerns SEERAD-held information on who the land managers for each field unit was not available at the beginning of the project; therefore a large part of the first month and a half of the project was spent in establishing who farmed which fields – in total at least 14 man-days were spent on this task.

Initially a number of key individuals were approached for their help – mainly people who were both farmers and involved with the National Park, often as Board members. In a second stage of this process,

several farmers whom we knew of or had been pointed to as likely to know their local areas particularly well were approached to try and fill in the gaps.

Parallel to this SNH's (Scottish Natural Heritage) owner-occupier database for SSSIs (Sites of Special Scientific Interest) in the strath was made available to us and we were able to consult this at Achantoul to obtain details of a large number of owners and occupiers – particularly along the Spey.

Ultimately almost every farm manager (in the wider sense i.e., owners, tenants, crofters and farm managers) whose land we wished to survey was contacted by telephone and, in the majority of cases, at least for active farmers resident in the area, visited. We found that actually visiting farmers was very helpful in two ways: firstly, many farmers preferred to actually meet whoever was going on their land and time spent talking to farmers almost certainly assisted in the general perception of the project among the farming community, and secondly, after the decision to try and survey all suitable areas, not just the initial 1486 fields, was made, it was often very useful to ask the farmers themselves if there were any areas outside those marked on our maps which would be worth visiting.

Permission was refused on only three occasions. In one other case we were asked to postpone the survey until 2007. It is difficult to provide an exact figure for the number of farmers/land management units covered by the survey due to a few complicated cases where land is managed by one person or entity but title is held in two or even several forms. However, at least 94 farm management units (and probably over one hundred) were surveyed as part of this project in 2006.

Once it became clear that, because of the addition of 'new' fields, not all of the original fields would be surveyed in 2006, it was decided to leave most of the Kingussie-Newtonmore subarea until a possible extension of the project. This made sense since this was an area where some difficulty was being experienced with access due to sporting estates not wanting disturbance while engaged in pheasant and partridge shooting; this appeared to be a purely seasonal problem. Other significant gaps in coverage were the Muckerach Farm-Laintachan area southeast of Nethy Bridge, Kincardine (south of Boat), parts of Glen Feshie and Culfoichmore in the far northeast; in most of these cases permission had been obtained, but it simply became too late in the season to survey these fields adequately. Due to the tendency to concentrate access efforts on farm managers with larger numbers of fields, permission for some very small holdings was not sought in 2006, especially where there was some uncertainty about who was involved.

3.4 Field procedure and data recorded

Surveyors were provided with maps printed from ArcView GIS showing the boundaries of the original 1486 fields, mostly colour-coded according to land occupancy. Although no precise records on time spent were kept, an average of 15-20 minutes was spent in each field to collect the necessary information on vegetation types present and structure. The main task for surveyors was to note all NVC vegetation types occurring in the field at least to community level (in practice, at least for those types of interest to the survey, much of the recording was at subcommunity level) as well as any other ground cover types, e.g., buildings, crops, etc. Five percent was the minimum unit for recording NVC cover, with those types which occupied less than this being arbitrarily recorded as constituting 1%. This decision was taken because I felt that, on average, these less common vegetation types made up 1% of the cover in fields, though it should be borne in mind that this covers a range from 4% to very tiny amounts being present in a field.

'New' fields were assigned 'FIELDID' numbers greater from 1500 on to separate them from the original 1,486 IACS fields.

In addition, basic information on the structure of the vegetation was recorded according to the following list of categories: short; normal grazed (this last category only used by RM); short heterogeneous; heterogeneous; tall(ish) ungrazed; woodland, crop. Table 1 below summarises the definitions of these categories, though it should be emphasised that this was a very subjective system – no definite quantitative equivalents, in terms of actual height classes, should be surmised as being associated with these. Most fields had significant - and many substantial - variation in height, tussockiness, depth of litter, dominant growth form etc. Some surveyors broke down the field into the main structure classes present with accompanying percentages, but most just recorded the dominant structure category present.

It is also important to remember that the structural appearance of a field often varies considerably over the course of a season: thus a field may be tall and lush until the first silage cut, then short for a while before the vegetation recovers, when it may be grazed for a month or two – when it would be recorded as 'normal grazed' or 'short heterogeneous', before being 'short' again at the end of the season.

Table 1. *Vegetation structure – recording categories*

Structure category	Abbreviation	Description	Very approx height range for vegetation (where relevant)
Short	SC	either short-cropped or recently mown – only scattered graminoid flowerheads; often MG7 or MG6, sometimes U4	most of field with grass sward below 10 cm
Normal grazed	G	grazed; usually with some tussocks, flowerheads frequent; usually MG6, MG7, U4; occasionally MG10; usually improved	generally 5-45 cm, with majority of grasses below 30 cm
Short heterogeneous	SH	more pronounced tussocky element, may have patches of grazed wetland, wet heath etc; flowerheads usually abundant	generally 5-60 cm, with majority of vegetation below 45 cm
Heterogeneous	H	contains prominent 'rank' element – tall grasses, rushes, sedges, mixed with shorter and/or tussocky areas	generally 10-100 cm, with majority of vegetation between 20-70 cm
Tall(ish) ungrazed	T	dominated by tall graminoids, usually ungrazed or wetland, sometimes established rank grass at edge of field	(40) 50- > 70 cm
Woodland	W	discrete areas dominated by trees or scrub	n/a
Crop	C	Mainly cereals or brassicas	n/a

Surveyors also noted if a field had been mown, although some of the surveyors with less experience of farming found it difficult to tell if, for example, a field had been cut for silage at the beginning of the summer and then subsequently grazed.

It had initially been intended to record other characteristics of the field which might relate to its condition, e.g., whether it was poached and how weedy it was, but it was considered that these were not sufficiently clearly linked to either good or bad management or any botanical characteristics of a field to be usable in a meaningful way. Thus poaching may be bad in that it results in loss of vegetation and invasion by noxious weeds or it may be a useful contribution to maintaining a heterogeneous structure to the vegetation in a field. Similarly, while weeds may be associated with disturbance and over-improvement through use of fertilisers, they may also indicate that significant areas of a field have been left unimproved and, while some patches become weedy, others may become good calcareous grassland.

Species of interest, such as *Helianthemum nummularium*, *Carex lasiocarpa* or *C. aquatilis*, were recorded in a column for notes. This was also used for any observations on the field, e.g., if it appeared

to be in an RSS. Surveyors were also encouraged to give extra information if a field was considered to be particularly species-rich or diverse.

'New' fields were usually indicated on field maps (approximate central grid references were recorded either at the time or later from the maps).

All but one of the five surveyors used paper (waterproof paper where necessary) recording sheets. One surveyor used an Excel version of the recording sheet on a PDA. Sheets contained columns labelled with the commonest vegetation types, one wide column for non-listed types and finally columns for height/structure and general notes.

3.5 'Discarded' and 'dismissed' fields

Because there was a very large number of fields to be surveyed and time was limited, fields which were clearly intensively managed and lacking in both species and community diversity were often either not entered (i.e., seen from outside the fence) or very cursorily checked. In many of these cases, the vegetation type was not recorded – the field being entered as 'discard', although most of these fields were either MG7 or species-poor MG6 (see below for details of NVC types). While it is possible that a few small corners with species-rich vegetation may have been missed in this manner, I am confident that the amounts involved were negligible.

As already noted above, fields which were considered to fall outwith the remit of the project were either not surveyed at all or given the most superficial of checks – these were described as 'dismissed' in the notes column, with reasons given.

3.6 Timing and surveyors

Survey began relatively late in the season due to delays in finalising the project, followed by the necessity to get access information and permission before going on to farmland. Survey started on the 2nd September and went on until 28th October, with the most intensive period being the last week in September until the middle of October.

The late timing meant that some key species of interest, particularly orchids, were no longer evident, but the two main surveyors were happy that NVC communities could still be reliably identified right up until the end of October, as the vast majority of diagnostic species are perennials which were still obvious in the form of leaf rosettes or, in the case of sedges and grasses, distinctive vegetative characters at the end of the season.

Five surveyors were involved in this survey: Ruth Maier (RM), Brendan O'Hanrahan (BOH), Ann Mackay (AM), Graeme Guy (GG) and Sara Emes (SE). The two first-named are the most experienced and between them (excluding 'dismissed' fields) accounted for 1,060 of the 1,340 fields. One or two of the analyses discussed below are restricted to the fields covered by these two surveyors, as these were the most consistent and tended to pick up rather more vegetation types (see Table 8 below). Although the other three surveyors were less experienced, they all have several years experience of using the NVC system. In addition, the two main surveyors spent two days with the other three going over the survey procedure, looking together at examples of the main vegetation types in several different places and ensuring that the more unusual species were familiar to the surveyors.

3.7 Vegetation types and species of interest

3.7.1 Vegetation types

Since the remit of the project referred to species-rich and/or calcareous grassland and fens and/or species-rich wetland vegetation types, the following NVC communities or subcommunities were regarded as the main 'targets' of the survey (please see below in section 4.2 for details of these vegetation types).

Calcareous or at least partially mineral-rich grasslands
CG10a
CG10b
U4c

MG5

Species-rich grasslands (either non-calcareous or less enriched than the first group))
U5c
U1d
These last two were considered to be of interest, but of lesser value compared to the first four grassland types.

Fen and mire types which are either relatively unusual or species-rich
S4
S9
S11 (with & without *Carex aquatilis*)
S27
Carex lasiocarpa-dominated vegetation
M9
M10
M27

The next group of vegetation types was also considered of interest, because they were often reliable indicators of unimproved ground and also because they are probably important in providing cover and breeding sites for invertebrates, birds, amphibians and mammals.

Other vegetation types indicative of unimproved ground or low-intensity management, mainly undrained wetlands (excludes rarer types, woodland and aquatic communities)
a) dry types
U4b
U1a
MG1
H10

b) wet types
MG9
M23a & b
M4
M6 (all subcommunities)
M15 (all subcommunities)
M17 (all subcommunities)
M25 (all subcommunities)
S28

MG10 has been excluded from the latter group because, while often unimproved, it is also common in very damp reseeded (and/or fertilised) fields which have been slightly neglected, allowing *Juncus effusus* to make a recovery.

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3.7.2 Species

The following species were almost always noted if encountered in the field, either because they are relatively unusual in the area or, mainly, because they are closely associated with good-quality grassland (usually calcareous) or wetland vegetation.

Thymus polytrichus
Helianthemum nummularium
Persicaria vivipara
Pilosella officinarum
Galium boreale
Carex lasiocarpa
Carex vesicaria
Carex aquatilis
Cirsium heterophyllum.

If the remains of orchids were seen, this was also usually noted, though since most of the survey was conducted long after the flowering period for this family and species vary in the extent to which they are still visible after fruiting, coupled with the fact that some species are much commoner than others (and therefore of lesser interest), this means that too much weight should not be attached to these data.

Cirsium heterophyllum is slightly different to the other grassland species in that it is not associated with calcareous grassland, but rather is an indicator of ungrazed or very lightly grazed grasslands.

3.8 Data spreadsheet

The main results spreadsheet is attached in the form of an Excel workbook.This is arranged on the basis of the unique 'FIELDID' number of each field. There is also a second spreadsheet which has been merged with the polygon details of the IACS fields – this cannot yet be done with the 'new' fields because their boundaries have not yet been digitised.

Information included in the columns of these spreadsheets includes the proportions of every vegetation type recorded for each field, structural details, often extensive notes, the presence of the notable species listed in 3.7.2 above and whether or not the field was mown.

Many of the species names and other words used in the notes column have been drastically abbreviated to save space – this document provides a key to these abbreviations.

3.9 Subareas

For the purposes of comparison and because different parts of the survey area do differ in their landscape, soil types, proportion of main floodplain, dominant aspects and altitude (and therefore microclimate), the strath has been arbitrarily divided into eight subareas or geographical zones, listed below.

N Grantown-Cromdale - Fig 2; although this included several km of the Spey floodplain, there are no significant areas of alluvial soils as the strath narrows perceptibly northeast of Grantown; much of the periphery of this subarea was marginally improved hill grazing on peaty gleys; there was almost no evidence of calcareous enrichment here – indeed, rock outcrops and significant moraines seem scarcer here than to the west.

Carrbridge-Dulnain Bridge-Curr-SW Grantown - Fig 3; most of this subarea was aligned along the east-west axis of the river Dulnain, then following the northern side of the Spey between Curr and Grantown; there are several instances of calcareous outcrops in the area; there are alluvial soils in the Gallovie and Ballintomb areas; moraines are locally prominent, e.g., Mains of Tullochgribban and Clury; there is some higher ground in the Clachbain and Auchterteang areas, though both are at least slightly enriched.

SE Grantown-Corriechullie-Lurg-Clachaig-Dell - Fig 4; this is the most consistently acid and 'upland' of all the subareas – with the exception of some limited evidence of probably morainic enrichment at Iettoch and Knockailan, most of the rest of the area appears to have acid soil; there are locally very extensive areas of rush pasture; this subarea contains the highest ground included in the survey area at Dirdhu; there is only a tiny sliver of strath floodplain – at Achnagonalin.

Deishar-Boat-Drumuillie-Kincardine-Tulloch-Balliefurth - Fig 5; the Deishar-Balliefurth subarea contains a long slice of Spey floodplain, with much alluvial soil and associated moraines (and kames?); rock outcrops are frequent north of the Spey and are at least locally base-rich; the Tulloch township area has been, perhaps somewhat artificially, appended to the main strath area, because it seemed too small to be left as a single subarea and because it shared characteristics with the Docharn-Dochlaggie part of the subarea.

Avielochan-Granish-Pityoulish-Rothiemurchus - Fig 6; this is a relatively narrow slice of Strathspey, although there are alluvial soils in the Rothiemurchus area, the dominant influence here is the swarm of linear moraines and their associated rankers, particularly on the west side of the Spey, contributing a locally quite base-rich influence to the area.

Alvie-Inshriach-Kincraig-Feshie-Insh-Ruthven - Fig 7; the Insh subarea has the highest proportion of wetlands in Badenoch and Strathspey, but also has many moraines, both along the Spey and the Feshie, with local calcareous influence.

Kingussie-Newtonmore-GlenTruim-Breakachy - Fig 8; this, by far the smallest subarea, is relatively similar to the last area, but has more rocky south-facing ground, at least on the northern side of the

strath; there is a small area of brown earth soils just west of Newtonmore; crofting management is also a significant factor here.
Balgowan-Cluny-Catlodge-Laggan-Glenshirra - Fig 9; this is quite a long area, but most of the ground is aligned with the strath of the Spey west of the junction with the Truim; moraines and alluvial soils (with some locally rich wetlands) are prominent here, augmented by frequent rock outcrops on both sides of the strath, a few of which contribute some base-enrichment; the south-facing slopes on the Balgowan, Cluny and Laggan sides are also characteristic of this subarea.

While it should be emphasised that these divisions are arbitrary and that some of the decisions on boundaries were particularly difficult and could be revisited, there are some real differences underlying them, e.g., the SE Grantown-Corriechullie-Lurg area, which has the highest ground included within this survey at Dirdhu and generally has much more acid ground and almost no floodplain compared to other areas. Contrasting with this are subareas such as Avielochan-Rothiemurchus, characterised by an extensive system of moraines and a high proportion of floodplain, or Alvie-Insh-Ruthven, which has one of the highest proportions of fen vegetation.

4 RESULTS

4.1 Summary data

From the original 1,486 fields from the IACS sift (see above), 979 were surveyed, with an additional 50 dismissed, either because they were outwith the National Park boundary or because they were considered to be outwith the remit of the project, being essentially unimproved hill ground. A further 361 'new' fields were surveyed. Thus, the total for the fields which are the main subject of this report is 1340, and unless expressly mentioned, all subsequent references to 'total fields' or 'all fields' are based on this figure.

344 or 26% of all fields were discarded because they were dominated by *Lolium perenne*, were very improved and lacked any apparent corners or margins which might contain more species-rich vegetation.

There were approximately 90 different NVC types (including subcommunities) recorded during the survey – see below for a list and details of the more important types. This includes a few frequently occurring intermediates, but excludes several uncertain or intermediate types which were only recorded once or twice. In addition, there were 15 categories of cover, also listed, which included such things as ruderals, crops, built ground, conifer plantation, bare rock and shingle.

Table 2. No. of fields surveyed by subarea

Subarea	Subarea code	n (from original 1486 IACS fields) ⁂	n (no. of fields actually surveyed in subarea) *
N Grantown-Cromdale	NGC	299	274
Carrbridge-Dulnain Bridge-Curr-SW Grantown	CBDB	217	210
SE Grantown-Corriechullie-Lurg-Clachaig-Dell	LUR	121	71
Deishar-Boat-Drumuillie-Kincardine-Tulloch-Ballliefurth	DEI	217	244
Avielochan-Granish-Pityoulish-Rothiemurchus	AVI	91	122
Alvie-Inshriach-Kincraig-Feshie-Insh-Ruthven	INSH	245	164
Kingussie-Newtonmore-GlenTruim-Breakachy	KIN	143	62
Balgowan-Cluny-Catlodge-Laggan-Glenshirra	BAL	136	193
Totals		1469	1340
Mean no. of fields per Zone		184.625	167.5

⁂ excludes fields from original 1486 outwith National Park
* excludes fields dismissed/excluded after being visited

N.B. The discrepancy between the total of 1469 fields for all eight subareas and the 1486 fields which were sifted from the original list is either partially or completely explained by the presence of several digitising errors in the original GIS shapefile, which meant that some fields were not correctly represented and therefore did not appear in the secondary GIS data sift which was used to obtain the eight areas. It is also possible, however, that a few very small fields were missed during this process, which was corrected by eye.

4.2 Vegetation types recorded

Only those types which were considered to be of particular interest to the survey are described or discussed below; all other types are simply listed, with their full NVC titles where appropriate.

'Target' types

U4c *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland, *Lathyrus montanus-Stachys betonica* subcommunity

This was the principal species-rich grassland type recorded during this survey, and although not as obviously or exclusively calcicolous as CG10, it seemed clear that base-enrichment played a major part in the influences which contributed to the appearance of this vegetation in the strath.

Although no quadrats were taken this vegetation was generally observed to be dominated by *Agrostis capillaris*, *Anthoxanthum odoratum*, *Festuca ovina*, *Trifolium repens*, *Prunella vulgaris*, *Plantago lanceolata* and *Galium verum*, usually accompanied by at least some of *Rhinanthus minor*, *Danthonia decumbens*, *Luzula campestris*, *Achillea millefolium*, *Campanula rotundifolia*, *Lathyrus linifolius*, *Viola riviniana*, *Lotus corniculatus* and *Succisa pratensis*.

CG10a *Festuca ovina-Agrostis capillaris-Thymus praecox* grassland, *Trifolium repens-Luzula campestris* subcommunity.

This – the most typically calcicolous grassland type found in the north of Scotland – was normally dominated by a similar mix of grass species to U4c above, though with *Festuca rubra* sometimes prominent, *Danthonia* slightly commoner and *Briza media* very occasional. Whereas *Thymus polytrichus* was normally absent from U4c, it was one of the diagnostic species for this type (though in some areas, particularly around Laggan, often absent), as was the more local *Helianthemum nummularium*. *Linum catharticum*, *Euphrasia* sp., *Carex pulicaris* and the very unusual (at this lower altitude) *Persicaria vivipara* were all apparently more closely associated with CG10a than U4c.

CG10b *Festuca ovina-Agrostis capillaris-Thymus praecox* grassland, *Carex pulicaris-Carex panicea* subcommunity.

This was similar to the last , but tended to have a much higher cover of sedges such as *Carex panicea*, *Carex flacca* and *Carex pulicaris*.

MG5 *Cynosurus cristatus-Centaurea nigra* grassland
MG5b *Cynosurus cristatus-Centaurea nigra* grassland, *Galium verum* subcommunity

MG5 is the classic hay-meadow community, although with traditional hay-meadow management now increasingly unusual in Badenoch and Strathspey, as in much of the rest of Scotland, most of the stands encountered during this survey were actually associated either with very lightly-grazed (or mown) riverbanks, unimproved banks at the edge of fields or, less frequently, with shingle banks. The *Cynosurus-Centaurea* community is generally dominated by variable mixtures of grasses such as *Agrostis capillaris*, *Cynosurus cristatus*, *Anthoxanthum odoratum*, *Dactylis glomeratus* and *Festuca rubra*, joined by forbs which include the conspicuous *Centaurea nigra*, often with *Lotus comiculatus*, *Plantago lanceolata* and, at least in MG5b, *Galium verum* and *Achillea millefolium*.

MG5b is generally the version of this community most closely associated with calcareous soils and is accordingly the most species-rich subcommunity, with an average of 26 species per quadrat from the NVC samples (Rodwell 1992). Because many of the characteristic species of this community (including orchids such as *Platanthera* sp., at least in northern Scotland, see Milnes & Eardley (1994)) have wilted or become inconspicuous by late September-October, most of the MG5 stands were not identified to subcommunity.

This vegetation type was fairly widespread across the fields surveyed, with particular concentrations at Balliefurth, Ouchnoire-Balvattan (between Curr and Drumuillie), Tullochgrue (Rothiemurchus), Laggan and Blargie. Only two fields were recorded as being dominated by MG5, and therefore possibly having been hay meadows – one at Invertruim and a much smaller field at Balgowan, opposite Tighbeg, which might just have been an abandoned strip.

U5c *Nardus stricta-Galium saxatile* grassland, *Carex panicea-Viola riviniana* subcommunity

This is a more acid and usually slightly damp community, with the standard *Nardus* grassland being irrigated by at least some base-rich runoff, leading to the appearance of species such as *Carex panicea*, *Viola riviniana*, *Festuca rubra*, *Plantago lanceolata*, *Calliergonella cuspidata* and *Selaginella*, with occasional *Carex pulicaris*. U5c was quite widespread, being reported from 61 fields (c. 5% of the total).

U1a *Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland, *Comicularia aculeata-Cladonia arbuscula* subcommunity
U1d *Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland, *Anthoxanthum odoratum-Lotus comiculatus* subcommunity

These two subcommunities are characteristic of often quite disturbed, relatively acid and summer-parched soils. Although mostly dominated by grasses, such as *Festuca ovina*, *Agrostis capillaris*, *Anthoxanthum odoratum* and *Holcus lanatus* (the latter two being commoner in U1d), this kind of

vegetation may end up being dominated by either rosette perennials like *Pilosella*, *Plantago lanceolata*, *Hypochoeris radicata* and *Senecio jacobea*, or, on heathier ground, by lichens, principally *Cladonia* species such as *C. arbuscula*, *C. portentosa* and *C. furcata* (the U1a subcommunity). In the study area, this kind of vegetation was often associated with better-drained (even sandy) morainic hummocks, particularly where rabbit numbers were high. It was apparently commonest in and around the Granish-Avielochan-Boat of Garten area as well as along the Kingussie-Laggan corridor. There were also examples at Delliefure and Lethendry in the Grantown-Cromdale area.

M9 *Carex rostrata-Calliergon cuspidatum/giganteum* mire.
The *Carex-Calliergon* mire is generally either a topogenous (e.g., basin or valley mires) or soligenous mire. There is usually some calcareous influence evident here. It was uncommon during this survey, only being reported from Achnahatnich (Rothiemurchus), Inshriach and Invertromie (between Insh and Kingussie). This is usually quite species-rich, with an average of 25 species per sample in the quadrats assigned to this community by the NVC (Rodwell 1991).

M10 *Carex dioica-Pinguicula vulgaris* mire.

This is an often strongly calcicolous and species-rich flush type, dominated by small sedges – principally *Carex viridula oedocarpa* and *C. panicea*, often joined by *C. nigra*, *C. hostiana* and *C. echinata*. *Eleocharis quinqueflora* and *Schoenus nigricans* are also frequent in particular variants of this vegetation type. A mixture of so-called brown mosses, e.g., *Scorpidium scorpioides*, *Campylium stellatum* and *Drepanocladus revolvens* often characterise the bryophyte component of these flushes, with *Sphagnum denticulatum* normally present. Forbs like *Pinguicula vulgaris*, *Narthecium* and *Euphrasia* sp. are usually present. The nationally scarce orchid *Hammarbya paludosa* is frequently associated with this NVC type. As with the last community, this also has an average of 25 species per quadrat from the NVC samples (Rodwell 1991).

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This community was reported from several areas across the strath, including Dalvey in the far northeast, the Neavuie- Balnuick-Finlarig-Glenbeg area (almost certainly associated with the metacarbonate outcrops in that area), Lethendryvuole west of Carrbridge, Achnahatnich (also possibly associated with base-rich outcrops nearby), Dochlaggie and, in the Laggan-Balgowan area, Blargie, Sherrabeg, Gaskbeg and Crubenbeg.

M27 *Filipendula ulmaria-Angelica sylvestris* mire.

The *Filipendula-Angelica* mire is a colourful assemblage of tall herbs, which is characteristic of relatively rich waterlogged soils where grazing is either very light or absent. Because of the conspicuous dominance of *Filipendula*, it is often not especially species-rich, but as it is associated with essentially undisturbed areas of wetland, it would seem to have some intrinsic value.

Its distribution from this survey showed one obvious cluster in the Laggan-Balgowan area, with examples at Drumgask, Catlodge, Breakachy and Creagdhubh. In the north there was another cluster in the Cottarton-Rothiemoon area (due to the rich moraines here?), with good examples also at Auchnafearn (north of Grantown), Starindeye (Cromdale), Port and, particularly impressive and extensive, at Rhuarden on the west side of the town of Grantown.

S4 *Phragmites australis* swamp and reed-beds.

This vegetation type is usually overwhelmingly dominated by *Phragmites*. It was rare during this survey, only being found at three locations: Tomachrochar (between Boat and Nethy Bridge), north of Loch Alvie and near the village of Insh.

S9 *Carex rostrata* swamp.

The *Carex rostrata* swamp was commonest between Nethy Bridge and Insh, though fairly widely scattered elsewhere as well, with the exception of the North Grantown-Cromdale area, where it was absent apart from one large field at Auchnafearn. This is also a species-poor vegetation type.

S11 *Carex vesicaria* swamp.
Cxaq S11 – a version of S11 which is either largely or completely dominated by *Carex aquatilis*.

These are usually slightly more mesotrophic fen or swamp types than S9. The majority of the stands recorded were dominated by *Carex aquatilis*, with *Carex vesicaria* being significantly less common.

The distribution of this vegetation type showed some obvious concentrations, with the Laggan-Balgowan area, the Alvie-Insh area and the Ballintomb to Boat stretch of the Spey floodplain all supporting at least nine fields with this vegetation. Dalvey, Achnahannet (Carrbridge-Dulnain Bridge) and Easter Duthil also had examples of this fen type.

S27 *Carex rostrata-Potentilla palustris* tall-herb fen.

This is a fen type where dicotyledons play almost as prominent a role as sedges, with at least some of *Potentilla palustris, Lychnis flos-cuculi, Angelica sylvestris, Lythrum salicaria* and *Menyanthes* normally being present.

It was fairly widespread through the study area, though completely absent from the North Grantown-Cromdale and Southeast Grantown-Lurg subareas and very scarce in the Carrbridge-Dulnain Bridge subarea. In contrast to this, it was common in the Laggan-Balgowan subarea as well as between Alvie and Loch an Eilein.

***Carex lasiocarpa* vegetation** (although the NVC (Rodwell 1995) suggests putting vegetation which is completely dominated by *C. lasiocarpa* in either S4 or M9 (see above), I feel that this is a sufficiently frequently occurring and distinctive type to merit its own swamp type).

The *Carex lasiocarpa* swamp/fen had a markedly disjunct north-south distribution, with two examples in the far southwest (at Cluny and Strath Mashie) and four-five in the north – Dochlaggie, Easter Duthil and near Burnside (south of Cromdale).

Unimproved types
U4b *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland, *Holcus lanatus-Trifolium repens* subcommunity

Although this vegetation type is not always unimproved, probably over 80% of the examples seen during this survey were either completely unimproved or had not been improved for several decades. The fields were effectively maintained by long term grazing, usually by sheep, with occasional hay cuts being taken.

The general appearance of this community was of a rather 'unkempt', often tussocky sward, with relatively few forbs, though *Trifolium repens* and *Ranunculus acris* were common, sometimes accompanied by *Prunella vulgaris* and/or *Achillea millefolium*. This kind of grassland is typical of areas which have mesotrophic soils, bordering on more acid grasslands. On the other hand, there were examples which showed features transitional to MG6, suggesting that they had been reseeded.

One of the interesting features of the most unimproved (and therefore effectively an index of this character) examples of this kind of grassland was the occurrence of often quite rich fungal assemblages on these fields; these were often, though not exclusively, dominated by members of the *Hygrocybe* (waxcap) genus. Some of the best fields were at Tomachrochar, Balnallan and Wester Rynaballoch (southeast of Cromdale), Rysaurie-Lochgorm (west of road to Lochindorb), Upper Delliefure (northwest of Cromdale), Lyngarrie (east end of Abernethy forest), Lettoch (south of Nethy Bridge), Tom Lethendry, East Croftmore, Biallaidbeg (just west of Newtonmore), Shanvall and Glentruim, Coull Hill (north of Insh), Inveruglass (south of Insh) and Tolvah (Glen Feshie). While an association between U4c and fungal assemblages was also occasionally observed, 87% of those fields where significant quantities of fungi were noted had U4b.

This was the commonest vegetation type recorded during the survey, with just over 40% of all fields having at least some U4b. It therefore appears to be the dominant grassland on permanent pasture in lowland Badenoch and Strathspey.

MG1 *Arrhenatherum elatius* grassland

This is the classic rank grassland community, being abundant on uncut and ungrazed banks, edges and riverbanks. It is usually completely dominated by tall grasses – mainly *Arrhenatherum elatius* and *Dactylis glomeratus*, though there are variants where species such as *Galium verum*, *Achillea millefolium*, *Centaurea nigra* and, more unusually, at least in this area, *Filipendula* are prominent. Between 10-15% of all fields had at least some MG1.

MG9 *Holcus lanatus-Deschampsia cespitosa* grassland

This is a vegetation type characteristic of damp ungrazed or lightly grazed fields and often tends to consist of little more than *Deschampsia cespitosa*, *Holcus lanatus* and *Juncus effusus*. A few stands were, however, slightly more species-rich, with species such as *Lychnis flos-cuculi* appearing. The community also probably has value because it is a relatively undisturbed habitat.

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M4 *Carex rostrata-Sphagnum recurvum* mire.

This is a fairly acid soligenous mire type, dominated by *C. rostrata* and *Sphagnum* – normally *S. fallax*. It is not normally particularly species-rich.

M6 *Carex echinata-Sphagnum recurvum/auriculatum* mire.
M6a *Carex echinata-Sphagnum recurvum/auriculatum* mire, *Carex echinata* subcommunity.
M6b *Carex echinata-Sphagnum recurvum/auriculatum* mire, *Carex nigra-Nardus stricta* subcommunity
M6c *Carex echinata-Sphagnum recurvum/auriculatum* mire, *Juncus effusus* subcommunity
M6d *Carex echinata-Sphagnum recurvum/auriculatum* mire, *Juncus acutiflorus* subcommunity

The various M6 types were widespread across the survey area and, although this is a very common vegetation type across the north and west of Britain, it is usually indicative of at least locally non-intensive management, and stands can be moderately species-rich (cf. a stand reported in Lochaber which had 45 species (Milnes & Eardley 1994)). M6a, M6b and M6c were the commonest types encountered, each being present in roughly 7% of all fields surveyed.

M15 *Scirpus cespitosus-Erica tetralix* wet heath.
M15a *Scirpus cespitosus-Erica tetralix* wet heath, *Carex panicea* subcommunity.
M15b *Scirpus cespitosus-Erica tetralix* wet heath, Typical subcommunity
M15c *Scirpus cespitosus-Erica tetralix* wet heath, *Cladonia* subcommunity

M15 is the commonest wet heath type in Britain (although its scarcer eastern counterpart was also occasionally recorded during this survey) and tends to be indicative of low levels of agricultural management, at least when encountered at lower altitudes. Many of the examples found were rather borderline in terms of their 'qualification' for inclusion in this survey, as this is much more a hill vegetation type.

M15a can be quite species-rich, frequently providing a niche for some of the more damp-loving orchids, e.g., *Dactylorhiza* spp. and *Pseudorchis albida*. It often occurs in a form which resembles a rather impoverished version of M10 (see above).

M17 *Scirpus cespitosus-Eriophorum vaginatum* blanket bog.
M17a *Scirpus cespitosus-Eriophorum vaginatum* blanket bog, *Drosera rotundifolia-Sphagnum* subcommunity.

Again, this is essentially a community of the uplands proper, though it was occasionally reported from more oligotrophic hollows and troughs in fields that were either lightly managed or neglected. It can be moderately species-rich - the NVC (Rodwell 1991) reporting that an average sample had 20 species - and some lowland examples in this area can support quite a colourful assemblage of forbs, e.g., *Succisa pratensis*, *Pedicularis sylvatica*, *Dactylorhiza maculata ericetorum* and *Pinguicula vulgaris*.

M23a *Juncus effusus/acutiflorus-Galium palustre* rush pasture, *Juncus acutiflorus* subcommunity.
M23b *Juncus effusus/acutiflorus-Galium palustre* rush pasture, *Juncus effusus* subcommunity.

Particularly the M23a subcommunity can be quite species-rich, often including such forbs as *Galium palustre*, *Lotus uliginosus*, *Succisa pratensis*, *Angelica sylvestris*, *Epilobium palustre*, *Cardamine pratensis*, *Lychnis flos-cuculi*, *Hydrocotyle vulgaris* and *Viola palustris*. M23 a was reported from c. 7% of all fields, while M23b was significantly commoner – occurring in just over 20% of all fields.

These are effectively slightly drier relatives of M6, but also indicate either unimproved areas or very light management.

M25a *Molinia caerulea-Potentilla erecta* mire, *Erica tetralix* subcommunity.
M25b *Molinia caerulea-Potentilla erecta* mire, *Anthoxanthum odoratum* subcommunity.
M25c *Molinia caerulea-Potentilla erecta* mire, *Angelica sylvestris* subcommunity.

These *Molinia*-dominated vegetation types are often relatively species-rich in Badenoch and Strathspey, though M25c – the most species-rich type – was not recorded very often. Overall, this community occurred in just over 15% of all fields.

S28 *Phalaris arundinacea* tall-herb fen.

This species-poor, but unimproved, vegetation type was commonest on unmanaged riverbanks.

H10 *Calluna vulgaris-Erica cinerea* heath.
H10a *Calluna vulgaris-Erica cinerea* heath, Typical subcommunity.
H10b *Calluna vulgaris-Erica cinerea* heath, *Racomitrium lanuginosum* subcommunity.
H10c *Calluna vulgaris-Erica cinerea* heath, *Festuca ovina-Anthoxanthum odoratum* subcommunity
H10d *Calluna vulgaris-Erica cinerea* heath, *Thymus praecox-Carex pulicaris* subcommunity
H10c/d – intermediate between the two subcommunities.
H10LR – a lichen-rich version of the *Calluna-Erica* community which is not described by the standard NVC.

These western heaths were reported from just under 5% of the fields surveyed. H10d is often associated with base-rich soils or outcrops and may grade into calcicolous grasslands such as CG10. The lichen-rich variant is not properly covered by the NVC and seemed to be associated with areas (such as the large field just northwest of Boat of Garten) where there was little stock grazing but where rabbits were abundant.

Other types recorded
MG6 *Lolium perenne-Cynosurus cristatus* grassland
MG6/U4b – vegetation intermediate between these two types.
MG7 *Lolium perenne* leys and related grasslands
MG10 *Holcus lanatus-Juncus effusus* rush pasture
U2 *Deschampsia flexuosa* grassland
U4 (not b or c) *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland
U4a *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland, Typical subcommunity
U4e *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland, *Vaccinium myrtillus-Deschampsia flexuosa* subcommunity
U5 *Nardus stricta-Galium saxatile* grassland.
U5a *Nardus stricta-Galium saxatile* grassland, species-poor subcommunity.
U5b *Nardus stricta-Galium saxatile* grassland, *Agrostis canina-Polytrichum commune* subcommunity.
U6 *Juncus squarrosus-Festuca ovina* grassland
U6a *Juncus squarrosus-Festuca ovina* grassland *Sphagnum* spp. subcommunity
U20 *Pteridium aquilinum-Galium saxatile* community (bracken).
W3 *Salix pentandra-Carex rostrata* woodland.
W4*Betula pubescens-Molinia caerulea* woodland.
W7 *Alnus glutinosa-Fraxinus excelsior-Lysimachia nemorum* woodland.
W11 *Quercus petraea-Betula pubescens-Oxalis acetosella* woodland.

W17 *Quercus petraea-Betula pubescens-Dicranus majus* woodland
W18 *Pinus sylvestris-Hylocomium splendens* woodland.
W19 *Juniperus communis* ssp. *communis-Oxalis acetosella woodland.*
W23 *Ulex europaeus-Rubus fruticosus* scrub.
W24 *Rubus fruticosus-Holcus lanatus* underscrub.
M1 *Sphagnum auriculatum* bog pool community.
M2 *Sphagnum cuspidatum/recurvum* bog pool community.
M3 *Eriophorum angustifolium* bog pool community.
M5 *Carex rostrata-Sphagnum squarrosum* mire.
M16 *Erica tetralix-Sphagnum compactum* wet heath.
M18 *Erica tetralix-Sphagnum papillosum* bog.
M19 *Calluna vulgaris-Eriophorum vaginatum* blanket bog.
M28 *Filipendula ulmaria-Iris pseudacorus*
M29 *Hypericum elodes-Potamogeton polygonifolius* soakway.
M37 *Cratoneuron commutatum-Festuca rubra* spring.
H12 *Calluna vulgaris-Vaccinium myrtillus* heath.
H12b *Calluna vulgaris-Vaccinium myrtillus* heath, *Vaccinium vitis-idaea –Cladonia impexa* subcommunity.
H12c *Calluna vulgaris-Vaccinium myrtillus* heath, *Galium saxatile-Festuca ovina* subcommunity
H16 *Calluna vulgaris-Arctostaphylos uva-ursi* heath.
S3 *Carex paniculata* swamp.
S8 *Scirpus lacustris* ssp. *lacustris* swamp.
S10 *Equisetum fluviatile* swamp.
S19 *Eleocharis palustris* swamp.
S22 *Glyceria fluitans* water-margin vegetation.
A24 *Juncus bulbosus* aquatic community.
MG1/ruderals
MG1/MG6 – vegetation intermediate between these two types.
MG11 *Agrostis stolonifera-Potentilla anserina* grassland
Ruderals – this comprises a wide range of vegetation of open ground, usually dominated by ruderal species such as, *Cirsium arvense*, *Cirsium vulgare*, *Urtica dioica*, *Rumex* spp., etc.
Crop – various arable crops, but principally kale or other *Brassica* spp., barley or wheat.

Unvegetated ground or generic cover descriptions

OW – open water.
RW – running water.
Bog
Heath.
Bog woodland
Made ground – any ground concreted or otherwise with a man-made surface.
Garden.
Scattered/planted trees.
PCW – conifer plantation.
Shingle – often an important location for CG10a, see above.
Bare rock.
Farmyard.
Herb-rich mix – where a proprietary seed mix had been spread on an area, often as part of an RSS.

4.3 Vegetation diversity

Table 3. Variation in no. of vegetation types by subarea

Subarea	Mean no. of vegetation types per field	n (no. of fields surveyed in subarea) *
N Grantown-Cromdale	4.24	274
Carrbridge-Dulnain Bridge-Curr-SW Grantown	4.00	210
SE Grantown-Corriechullie-Lurg-Clachaig-Dell	4.06	71
Deishar-Boat-Drumuillie-Kincardine-Tulloch-Balliefurth	4.34	244
Avielochan-Granish-Pityoulish-Rothiemurchus	4.67	122
Alvie-Inshriach-Kincraig-Feshie-Insh-Ruthven	4.04	164
Kingussie-Newtonmore-GlenTruim-Breakachy	5.34	62
Balgowan-Cluny-Catlodge-Laggan-Glenshirra	4.33	193
Total survey area	4.29	1340

* excludes fields dismissed/excluded after being visited.

Perhaps surprisingly, with the exception of the Kingussie-Newtonmore subarea (which had the smallest sample size), there did not appear to be major variation in the diversity of vegetation across the different areas of the strath.

4.4 Geographical patterns in distribution of vegetation types and species of interest.

As can be seen in the table below, the area around Aviemore tended to have the highest proportion of fields with calcareous or species-rich grassland types, followed by Insh, Deishar, Laggan-Balgowan and Kingussie, whereas Lurg-SE Grantown and North Grantown-Cromdale had the least.

Balgowan-Laggan had frequent patches of good fen, as did Kingussie and, to a lesser extent, the large Insh subarea. The absence of S27 from much of the northernmost subareas may be partly due to BOH overlooking this type.

Helianthemum nummularium was almost confined to the Deishar and adjacent subareas, whereas *Thymus polytrichus* was commonest between Grantown and Aviemore, while apparently absent from the area northeast of Grantown and, with the exception of Glen Feshie, the area between Aviemore and Newtonmore.

Carex aquatilis, a sedge which in Britain is only local outside Scotland (Jermy *et al* 1982) and was confirmed in only 139 10 km squares in Britain between 1987 and 1999 - and therefore close to being nationally scarce - proved to be locally quite common, particularly in the Deishar, Carrbridge, Balgowan-Laggan and Insh areas, though completely absent from the SE Grantown-Lurg subarea.

Table 4. Occurrence of four key vegetation types by subarea

		NGC	CBDB	LUR	DEI	AVI	INSH	KIN	BAL
U4c	No. of fields	68	63	12	87	56	58	22	47
	% of all fields in zone	24.82	30.14	16.90	35.51	45.90	35.37	34.92	24.61
CG10a	No. of fields	7	19	5	23	15	23	8	19
	% of total fields	2.55	9.09	7.04	9.39	12.30	14.11	12.70	9.95
M27	No. of fields	5	2	0	8	1	2	1	7
	% of total fields	1.82	0.96	0.00	4.27	0.82	1.23	1.59	4.66
S27	No. of fields	0	2	0	12	5	15	11	26
	% of total fields	0.00	0.95	0.00	4.90	4.10	9.20	17.46	14.61
n (fields)		274	210	71	244	122	164	62	193

Table 5. Occurrence of several key species or taxonomic groups across Badenoch and Strathspey

Species (or similar) of interest	*Thymus poly-trichus*	*Helianth-emum nummu-larium*	*Pilosella officin-arum*	*Cirsium hetero-phyllum*	*C. lasio-carpa*	*C. vesi-caria*	*C. aqua-tilis*	orch-ids	fungi
No. of fields in which recorded	55	20	21	23	6	6	30	19	71
% of total fields	4.10	1.49	1.57	1.72	0.45	0.45	2.24	1.42	9.17

n (fields) = 1340, except for fungi, where n = 774, as noting of fungi-rich fields only began after the first few days of survey and since there is some question as to whether SE, GG and AM may have forgotten to note such fields.

4.5 Vegetation structure

The structural categories used were quite basic and were purely subjective. Nonetheless it is clear that there was a large proportion of fields (50-70%, see Table 6 below) where there was at least some marked heterogeneity in the vegetation structure. 35% of all fields with structural data were, however, recorded as being short, and therefore most of these fields are likely to be of limited interest for biodiversity. This must be qualified by the fact that some of the best calcareous grassland is quite short and that, since most surveyors tended to classify the field by its dominant structural type, this significantly understates the frequency of small patches of more heterogeneous vegetation.

Although there has not yet been time to analyse this, it is likely from our observations, that the relatively high proportion of fields (c. 20%) with tall vegetation will be significantly less than the actual proportion by area that is made up in the survey area by vegetation of this kind. There are two reasons for this: a) because many of the fields which are dominated by tall vegetation are e.g., long, narrow strips along burns or rivers or small areas of wetland which have been fenced off, and b) in many of the fields where 'tall' has been recorded as a component, this would only refer to narrow strips along the edges of the field, or unimproved corners with impeded drainage, etc.

Table 6. Overview of fields with structural data

No. of fields with no structure data (or unclear)	177
No. of fields with usable structure data	1163
Proportion of all fields surveyed with usable structure data (%)	86.8
Of which only one class noted per field	1007
Fields where > one category recorded	156

Table 7. Frequency of different structural categories

Structure category	no. of fields where sole category	no. of fields with this category	proportion of fields with this category (%), n = 1163
Short	323	410	35.25
Short heterogeneous	200	261	22.44
Heterogeneous	237	327	28.12
Tall ¥	197	255	21.93
Woodland	4	39	4.35
Crop	1	14	1.20

¥ 'Tall' includes 129 fields which were simply recorded as being 'ungrazed' – it is probable that the great majority of these would fit into the 'tall' class as well.

N.B. Table excludes fields recorded as 'G' – 'normal grazed', as this was not used by all surveyors – 51 fields were recorded for this class alone.

It is also important to remember that the proportions will overlap, since some fields (see table 6 above) had more than one structure category recorded.

4.6 Areas of vegetation types of interest

As yet, it is only possible to provide areas and area proportions for the 'old' fields which are already present as polygons in the GIS used for this report. This will lead to an underestimation of the areas of the more interesting communities, because of their greater frequency in the 'new' fields – as shown below in Table 9.

Vegetation type	Area (ha) total area = 5585 ha	Proportion of total area (%) ('old' fields)
U4c	184	3.29
CG10a	43	0.77
M27	3.9	0.07
S27	10	0.18

As can be seen from these figures, the areas involved are not particularly large, showing that many of the occurrences of these types – especially the calcicolous grasslands – are in the form of small strips and corners at the edges of otherwise more intensively managed or grazed fields.

4.7 Extent of unimproved ground

When all of the vegetation types of interest are combined with the unimproved types (see section 3.7.1 above) then 74% of all fields in the survey contained at least some unimproved ground. When just the 'old' fields are looked at, there is an aggregate of 2,310 ha comprising species-rich grasslands, wetlands and unimproved vegetation types. This is equivalent to just over 40% of the total area represented by the 'old' fields (fields registered as either permanent pasture or rough grazing for IACS purposes).

This is clearly a very substantial and important resource, whose importance transcends botanical terms of reference, providing as it does suitable habitat for a very wide range of organisms, many of more than local interest, e.g., the Northern Brown Argus *Aricia artaxerxes*, the Pearl-bordered Fritillary *Boloria euphrosyne*, the fly *Dorycera graminum*, the mason bee *Osmia inermis*, black grouse *Tetrao tetrix* and the waxcaps *Hygrocybe ovina* & *H. ingrata* (Rotheray & Horsfield 2006, Holden 2006). It is also a very important breeding ground for lapwing *Vanellus vanellus*, redshank *Tringa totanus*, skylarks *Alauda arvensis*, curlew *Numenius arquata* and snipe *Gallinago gallinago*. Although none of these species is especially rare, the RSPB-coordinated Strathspey Breeding Farmland Wader Survey in 2000, which looked at 9,000 ha of farmland, all outwith SSSIs, concluded that the area was the most important mainland breeding site in Britain and Ireland for lapwing, redshank, curlew and snipe (RSPB 2000).

4.8 Surveyor variation

There were clear differences in the number of vegetation types recorded by surveyors (Table 8), with the two most experienced surveyors noting more than the others. These data have not, however, been disentangled from the geographical biases associated with individual surveyors, e.g., RM surveyed mainly in the Tulloch, Alvie-Insh and Laggan areas, while SE did most of her surveys in what were probably naturally less diverse areas – Lynchurn, Lynemore and Tombain. AM's results are also skewed by an unusually large number of 'new' fields which were discards – a more experienced surveyor would not have expected to find vegetation of interest in these fields and they would not have been included in the survey.

Table 8. *Variation in no. of vegetation types per field recorded by surveyors*

	RM	BOH	GG	AM	SE
Mean per field	4.54	4.85	4.93	2.40	2.98
n (fields) =	624	409	96	126	58

4.9 'Old' and 'new' fields

As can be seen in Table 9 below, the 'new' fields clearly had a higher frequency of the more interesting and species-rich types – both for calcicolous grassland and fen and other wetter types. This would be even more pronounced if the Gartenbeg-Lynchurn fields – which were almost all discards – were removed from the 'new' total.

Table 9. Comparison of frequency of species-rich vegetation types between 'old' and 'new' fields

		U4c	CG10a	CG10b	M4	M10	M27	S9	S11	Cxaq S11	S27	Cxla	
Old	No. of fields with vegetation type	270	70	12	20	20	20	37	5	20	39	4	n = 979
	% of fields with vegetation type	27.58	7.15	1.23	2.04	2.04	2.04	4.78	0.51	2.04	4.98	0.41	
New	No. of fields with vegetation type	142	49	4	14	5	6	27	3	16	30	3	n = 361
	% of fields with vegetation type	39.34	14.57	1.11	4.88	1.39	1.66	7.48	0.83	4.43	8.31	0.83	

5 CONTEXT

For several reasons, it is difficult to compare the results of this survey effectively with other surveys on grasslands (and wetlands). The main difference is that this survey looked at all fields within its search area, whereas all of the other surveys consulted (in, e.g., Lochaber, Skye, Fife, Ayrshire and the Borders) concentrated on areas regarded as good – often seeking potential SSSIs. Several of the other surveys (e.g., Orange (1987) and Milnes and Eardley (1994)) also tended to focus on hay meadows rather than on all species-rich grasslands, though they usually ended up describing at least some drier, calcicolous grasslands. Other surveys, such as Bachell & Wright (1983), tended to focus on the floristics, taking large numbers of quadrats. Since no quadrats were taken for this survey at all, it is difficult to make very meaningful comparisons with such surveys.

Differences in local vegetation and environmental conditions also made it difficult to compare this work with, e.g., Smith's (1999) work on grasslands in the Borders, where U4c and CG10 are either absent or not covered, while CG7 (and CG2, though this was rarer) appears to be much more important.

The only survey where similar vegetation seems to have been covered or encountered to any extent appears to be Orange's work on Skye (and other parts of SNH's West Highland Area), where he reports vegetation which he generally describes as MG5c, but which seems to be at least superficially similar to the U4c which was so ubiquitous in Badenoch and Strathspey.

On the other hand, relatively superficial perusal of reports from the Borders, Fife, Ayrshire and parts of the western Highlands, combined with conversations with Mike Smedley, who has a very thorough knowledge of the grasslands of the northeast of Scotland, suggests that the extent of at least moderately species-rich, unimproved grasslands is significant in the Badenoch and Strathspey area and may be unique. There may not be any more high-quality grasslands here than elsewhere, but the frequency and area of the good or moderately interesting grasslands here appears to be unusual. Other areas may have better surviving hay meadows, but it is possible that the combination of the widespread presence of at least moderately mineral-enriched soil, very extensive moraine systems (providing dry and often warm locations) lower rainfall than much of the rest of Scotland (thereby reducing at least some of the potential for leaching of minerals) and, last but not least, a generally relatively low-intensity style of agricultural management, often bolstered by a high rate of participation in agri-environment schemes have combined to create the conditions for an important resource of species-rich grassland in Badenoch and Strathspey.

I have not yet been able to make any systematic appraisal of the purely wetland element of the inbye of Badenoch and Strathspey, though again it appears that there is little or no work which has taken this broad area approach. Possibly comparable areas are the extensive and often very species-rich *Juncus* and *Molinia*-dominated pastures and wetlands of Knapdale and Lorn, as well as similar areas which are scattered through Lochaber (with Ardnamurchan, Skye and perhaps Lochalsh), the latter having been partially covered by some mainly grassland-focused surveys over the last 20 years (Orange 1987, Milnes & Martin 1993, Milnes & Eardley 1994).

6 DISCUSSION

6.1 Timing of the survey and other issues

The timing of the survey, with most of the surveying being done in mid-late autumn, clearly led to many of the more interesting flowering plants which are found on inbye farmland in the area being missed.

Reviewing the results of this survey, it also strikes me as possible that the MG5 *Cynosurus-Centaurea* grassland was under-recorded, partly because it appears less distinctive in the autumn, but also because vegetation which lacked *Centaurea nigra* tended to be assigned to other communities, especially U4c, whereas, while distinctive, *Centaurea nigra* is only shown as having a constancy of 60-80% in MG5a and MG5b (Rodwell 1992). It is also possible that there were quite a lot of stands which were intermediate between MG5 and U4c. Another interpretation may be that many of the stands which are now U4c were previously managed as hay meadows and would have been 'standard' MG5, but since they have been rather more intensively grazed (though normally not yet heavily grazed), often by sheep, and used more for silage, some of the more palatable grasses (e.g., *Festuca rubra*) and forbs have declined, leading to a transition to the shorter, but still species-rich, U4c swards. More evidence is needed before this can be regarded as anything more than speculation.

On the other hand, a superficial examination of Orange's (1987) report from Skye, Ardnamurchan, Sunart and Lochaber shows that he assigned vegetation analogous to that described as U4c by this survey to MG5c. To place these U4c stands properly in a wider Scottish context, it would probably therefore be useful to obtain some quadrat data if there is to be an extension of this project.

6.2 Key points

The most important areas within the strath are clearly those along the Spey axis, benefiting from the frequency of often calcareous or at least slightly mineral-rich morainic material and, on seasonally flooded areas, locally extensive areas of often almost untouched wetlands.

The relatively poor floristic results for the N Grantown and SE Grantown-Lurg in particular, should not obscure the fact that these areas do however contain some very extensive areas of unimproved species-poor wetland, e.g., in the Lurg-Clachaig area, which are almost certainly important for several breeding bird species, such as snipe.

Surveyors were often concerned by how often potentially species-rich areas had been fenced off and 'forgotten' as part of either ESA or RSS schemes, resulting in the development of relatively species-poor *Arrhenatherum elatius* and/or *Dactylis glomeratus*-dominated rank grassland. While there is provision for seeking permission/derogation for limited grazing on these areas, it seems to be relatively bureaucratic and the general supposition that no grazing would be good for these areas of potentially herb-rich grassland is, in most cases, mistaken. This was a particularly common phenomenon along river banks.

Some of the best areas observed, e.g., Gaskbeg near Laggan or Tomachrochar between Boat and Nethy Bridge for calcareous grassland and Ballinlaggan between Carrbridge and Dulnain Bridge for fen vegetation, were all grazed, sometimes for several months of the year.

While no data directly related to fields were available to us, the impression we received was that fertilisation, spreading of herbicides and ploughing were more significantly damaging to the chances of species-rich grassland thriving than grazing.

One of the discoveries of the survey (at least to the surveyors) was the extent to which corners and margins of cropped or otherwise intensely improved fields could shelter significant areas of high-quality vegetation, whether calcareous grassland or wetland. One minor example of this was at Docharn, north of Boat of Garten, where fields that are in rotation have between a third and a fifth of their area left untouched, occupied by scattered birch, dry (south-facing on thin soil) grassland and scattered rock outcrops. These untouched areas supported extensive patches of good quality calcareous grassland, with *Helianthemum nummularium* locally common.

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