

# Survey of herbivore impacts on upland, peatland and woodland designated features in the Strathglass Complex Special Area of Conservation





# COMMISSIONED REPORT

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Commissioned Report No. 115

**Survey of herbivore impacts on upland,  
peatland and woodland designated  
features in the Strathglass Complex  
Special Area of Conservation**

(ROAME No. F02AC202)

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## Survey of herbivore impacts on upland, peatland and woodland designated features in the Strathglass Complex SAC

Commissioned Report No. 115 (ROAME No. F02AC202)

Contractor: **Brendan O’Hanrahan** (Including the results of the survey of North Affric and Forestry Commission Scotland, Fasnakyle, management units carried out by Central Environmental Surveys).

Year of publication: 2005

### Background

This project investigated the current level of herbivore impacts on the Natura interests within the Strathglass Complex SAC covering the hills between Lochs Affric, Mullardoch and Monar (NN 477 753) in the East Highland SNH Area (Highland Council local authority area, Inverness-shire). Where possible, evidence of trends in impact levels were also examined.

The aim of the survey was to establish current levels of impacts attributable to deer browsing and trampling and to consider whether these are likely to lead to the deterioration of the Natura interests. The survey based on random sample points, was stratified by nine upland management units, four of which also contained Caledonian Forest. Current impacts for the upland habitats were assessed against the small-scale field indicators in ‘A Guide to Upland Habitats’ (MacDonald *et al.* 1998) whilst a parallel method was devised for woodlands. The report documents various logistical difficulties with locating the correct habitats at the random locations provided and on the usefulness/timing of application of some of the indicators. Deer were the main herbivores throughout the majority of the site. The results are presented here first by management unit and habitat type and are then repeated in a summary for each habitat across the site as a whole. An overview of the prognosis is then described for each management unit.

### Main findings

The results of the survey indicate that continuation of the current levels of impact on three main features type is likely to lead to the deterioration of these habitats on a relatively widespread basis throughout the SAC, although impact levels do vary between management units. These feature types are:

- Blanket bogs (H7130);
- North Atlantic wet heaths with *Erica tetralix* (H4010) and;
- Caledonian Forest (H91C0).

For blanket bog and wet heath the damaging impacts are most likely a consequence of trampling and for the woodland interests from browsing. Localised concerns which could lead to deterioration of interests were also identified with respect to Alpine and boreal heaths (H4060), European dry heaths (H4030) and flushes. Furthermore it is suggested that Siliceous alpine and boreal grasslands (H6150), dry heath and alpine heath would benefit from reductions in impact levels more widely.

The results of this study will be used to inform discussions relating to local deer management.

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## **Acknowledgements**

The survey was carried out by two teams of surveyors, the northern management units by Brendan O'Hanrahan and his team, the southern management units by Alan Booth's team from Central Environmental Surveys (CES). This report has largely been compiled by Brendan O'Hanrahan. The project was managed initially by Ro Scott (SNH, Deer Advisory Officer) and latterly by Jenny Bryce when she took over this role.

Additional input to the project was provided from Chris Wright (SNH, Area Officer) and Robbie Kernahan (DCS, Deer officer).

All estates are thanked for their assistance in facilitating access for this survey.

May 2005

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NOTE:

The data referred to as being supplied on an accompanying CD have not been reproduced for each copy of the report. However these can be made available on request from SNH Headquarters Library or by contacting Jenny Bryce (jenny.bryce@snh.gov.uk).



## 1 INTRODUCTION

Under the Deer (Scotland) Act of 1996, the Deer Commission for Scotland (DCS) is empowered to take action where deer are damaging the natural heritage. The statutory agencies' approach to this issue is set out in the document "Deer (Scotland) Act & Damage by Wild Deer to Woodland and the Natural Heritage", which is available on request from DCS. In this document, damage to the natural heritage is defined (on p.8) as occurring:

"...when natural and semi-natural habitats are prevented from regenerating to sustain their ground cover and the diversity of plant species; or where local populations of important species (animal or plant) are in decline; or where important earth science features are being eroded by deer."

The Deer (Scotland) Act provides different measures which may be used depending on whether deer "have caused, are causing or are likely to cause damage" and whether or not that damage is considered by the Deer Commission to be serious.

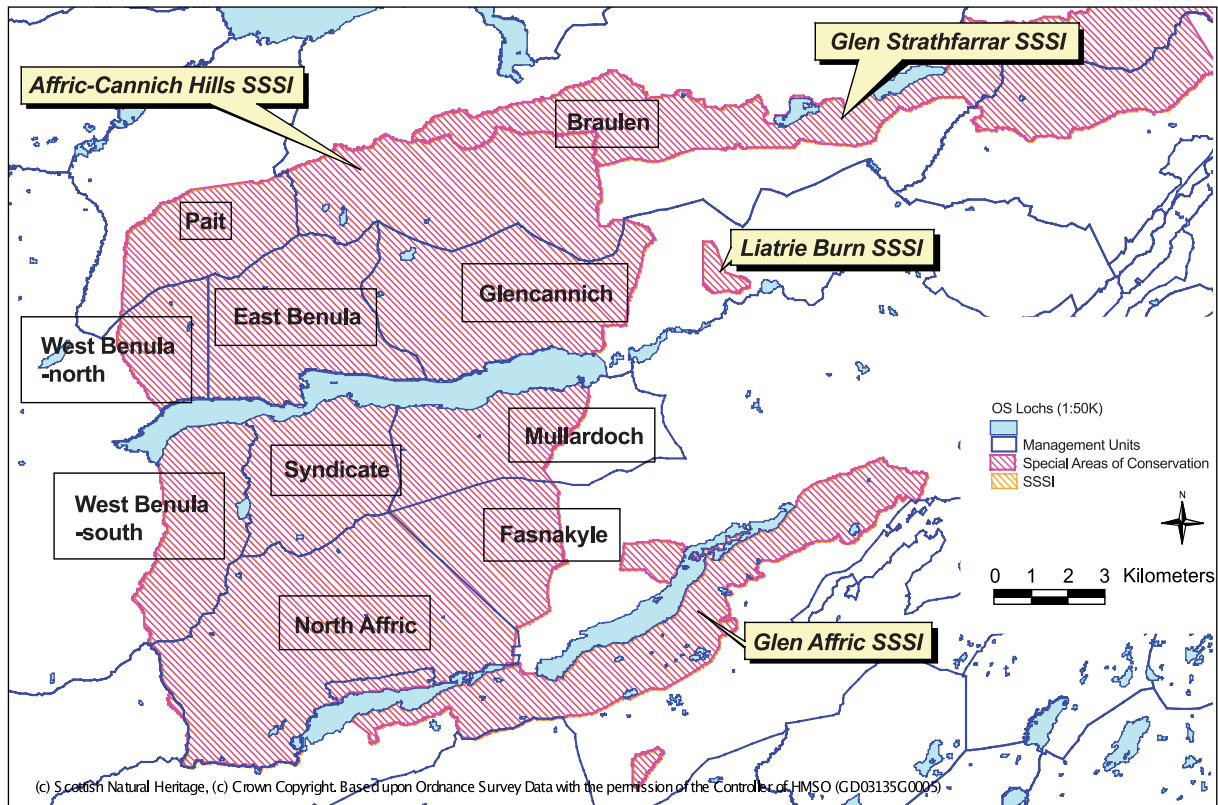
The objective of this survey was to inform SNH, DCS and the land owners of the nature and extent of herbivore impacts within the Strathglass Complex SAC and did not assume that impacts were at damaging levels. In particular the survey sought to:

- i) assess the severity of current grazing and trampling impacts from deer (of any species) on the notified features and the direction of any apparent trends in impact levels;
- ii) determine whether current levels of impact can at present be considered damaging to any of the designated natural heritage features and/or whether trend indicators suggest that such impacts, if continued, are likely to become damaging in the future.

The Strathglass Complex Special Area of Conservation (SAC) is one of the largest SACs in Scotland at c.23,500ha, comprising the following SSSIs: Affric-Cannich Hills, Glen Affric, Liatric Burn and Glen Strathfarrar. The landscape in the SAC is dominated by two parallel east-west ranges of mountains; the southernmost running between Lochs Affric and Mullardoch, while the northern range runs between Lochs Mullardoch and Monar. The southern range includes Carn Eige, the highest mountain north of the Great Glen at 1,183m, while the northernmost of the two Sgurr na Lapaichs within the site is, at 1,150m, the highest peak in the northern half of the site. In the northeast, the site is bounded by Glen Strathfarrar, continuing on to the west as Gleann Innis an Loichel. The Allt Riabhachan and Coire nan Èach, following round to Coire Lungard mark the site's north-western boundaries. The southern boundary extends to the north shore of Loch Affric and the north side of the Allt Gleann Gniomhaidh. The eastern boundary between the east ends of Loch Affric and Loch Mullardoch skirts east of Beinn Eun before descending to the north along Allt Fraoch-choire. North of Loch Mullardoch the line keeps east of Creag Feusag before making a dog-leg to link up with the Allt Innis a' Mhuilt and thence to the southern edge of Glen Strathfarrar, much of which is included almost as far as the junction with Strathglass. However, the Glen Strathfarrar National Nature Reserve (NNR) was not included in this project, in contrast to the Site of Special Scientific Interest (SSSI) of the same name to the west, including Inchvuilt and Coille na Leitire Duibhe.

The site (grid reference NH 185 314) is within the SNH East Highland Area and Highland Council local authority areas.

## Strathglass survey area and management units



This survey was organised according to management units – for upland and peatland features this comprised nine units: Braulen, Pait, Glencannich, East Benula, West Benula, Syndicate (East South Benula) and Mullardoch, North Affric and Forestry Commission Scotland (FCS)-owned Fasnakyle Forest. The latter two were surveyed by Central Environmental Surveys and the results of all the assessments are combined in this report. As the survey methods were not identical, the samples carried out by Central Environmental Surveys are identified in this report and maps by the notation (1), with (2) being those carried out by Brendan O’Hanrahan. Woodland was surveyed in five of the management units, namely North Affric, Fasnakyle (FCS), Mullardoch, Braulen and Glencannich (the latter consisting solely of the Liatric Burn SSSI); all by Brendan O’Hanrahan’s team.

## 2 METHODS

This survey assessed current levels of herbivore impacts on both woodland and upland/peatland habitats. This focussed on Annex I (European Habitats Directive) features in addition to a generic habitat called 'flushes', which was included because it was thought to be likely to provide a good index of herbivore activity.

For the upland and peatland survey, parts of the Affric-Cannich Hills, Glen Affric and Glen Strathfarrar SSSIs were surveyed. For the woodland survey, all of the Liatric Burn SSSI and parts of Glen Affric, Affric-Cannich Hills and Glen Strathfarrar SSSIs were included.

### 2.1 Source of survey methods

For upland and peatland habitats, a protocol amalgamating parts of two published methodologies was drawn up by SNH in discussion with DCS and the land owners and managers. The vegetative condition part of the survey, was taken from the Upland Common Standards Monitoring guidance document (JNCC 2004) and is not detailed in this report. The methods for the habitat impact assessment, which formed the main part of the study, examined the small-scale field indicators from MacDonald *et al.* (1998). The habitat impact assessment consisted of looking at various indices of herbivore impact, some direct, such as trampling and browsing of dwarf shrubs, others more indirect, eg, degree of flowering for cotton-grass species and average vegetation height. It also incorporated a varying number of indicators designed to detect the trend of impacts at each point ie, whether there was any evidence that the level of impact was increasing or decreasing. The samples collected by Central Environmental surveys did not mirror this protocol, instead recording the achievement or failure to achieve condition targets for all the indicators. Hence in the raw data (supplied as a CD) these are described as 'Y' or 'N' rather than as impact classes. However, despite this difference in recording methodology, many of the same browsing and trampling indicators were assessed, hence the information can still be used to draw comparison with the habitat impact assessments carried out for the upland features in the northerly management units.

For the impact assessment part of the survey the feature classes which were the subject of this project corresponded as follows to the field guide habitat types from MacDonald *et al.* (1998).

#### **This survey**

Blanket bogs  
European dry heaths  
North Atlantic wet heaths with *Erica tetralix*  
Siliceous alpine and boreal grasslands  
Alpine and boreal heath  
Tall herb communities  
Sub-Arctic *Salix* spp. scrub  
Siliceous rocky slopes  
Calcareous rocky slopes  
Siliceous scree  
Flushes

#### **MacDonald *et al.* (1998)**

Blanket bog  
Dwarf shrub heath  
Dwarf shrub heath/Blanket bog (see section 2.1.3)  
Wind-clipped heath  
Wind-clipped heath  
Tall herbs  
Scrub  
*No equivalent – refer to JNCC (2004)*  
*No equivalent – refer to JNCC (2004)*  
*No equivalent – refer to JNCC (2004)*  
Flush

For the woodlands, the only aspect of habitat condition assessed was a proxy for age-structure. This involved recording the proportion of trees in different life classes (after Clifford (2003), unpublished) for more or less homogeneous blocks of woodland. The assessment of current impacts was carried out at random waypoints within woodland polygons using a method developed by SNH in parallel to the upland methodology. This included assessment of the level of damage, if any, to regeneration, the degree of browsing on the field layer and the incidence of trampling and dunging. See Appendix 1 for more detailed methodology.

### **2.1.1 Habitats surveyed**

The following Annex I (from the EC Habitats Directive) habitats were the subject of this survey:

#### ***Upland and peatland***

- ***Extensive habitats;***

- Siliceous alpine and boreal grasslands (H6150);
- Alpine and boreal heaths (H4060);
- European dry heaths (H4030);
- North Atlantic wet heaths with *Erica tetralix* (H4010);

- Blanket bogs (H7130);

- ***Scarcer habitats;***

- Siliceous rocky slopes with chasmophytic vegetation (H8220);
- Calcareous rocky slopes with chasmophytic vegetation (H8210);
- Siliceous scree of the montane to snow levels (H6230);
- Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (H6430);
- Sub-Arctic *Salix* spp. scrub (H4080).

#### ***Woodland***

- Caledonian forest (H91C0);
- Bog woodland (H91D0).

#### ***In addition (for upland and peatland)***

- Flushes.

### **2.1.2 Habitat definitions for impact assessment (upland and peatland)**

The habitat definitions in MacDonald *et al.* (1998) are broader than the Annex I habitats. Thus, the wind-clipped heath set of indicators was applicable to both the siliceous alpine and boreal grasslands and alpine heath features. In contrast, there is only one category of impact assessment in MacDonald *et al.* (1998) for flushes, which corresponds to three categories of flushes used in condition assessments: alpine flushes, alkaline fen and springheads, rills and flushes.

Every feature type assessed during this survey had its own table of attributes and targets, although some of the targets were common to several habitats. Flushes were the exception which have been amalgamated for the purposes of this report.

Sample survey forms with more complete texts for the individual targets and indicators are supplied on the CD which accompanies this report.

### **2.1.3 Wet heath anomaly**

One peculiarity is that because the MacDonalld *et al.* (1998) method is based on generic habitat classes, although one impact assessment habitat class could be used for a single feature in almost every case, there was one exception – wet heath, which is covered by either dwarf-shrub heath or blanket bog depending on the floristics of the stand. Thus, the NVC sub-community M15b was normally assessed using the blanket bog impact assessment indicator list (hereafter referred to as ‘boggy wet heath’), whereas M15d was assessed against the dwarf-shrub heath indicators (referred to as ‘heathy wet heath’). M15a and M15c were more often assessed using the blanket bog indicators (being more normally on deep peat), but some drier examples were assigned to ‘heathy wet heath’.

## **2.2 Sampling and field procedure**

### **2.2.1 Generation of waypoints**

Notified features were normally identified from data provided by previous SNH surveys. Annex I habitats were derived from vegetation maps using standard conversions between vegetation codes and feature types. Thus prior to the field survey, a set of random points (or two if woodland was also present) was generated for the five ‘widespread’ upland features within each of the nine management units. Random sample locations were identified by a twelve-figure grid reference, with up to a maximum of 37 points being selected for each feature type present within a management unit.

### **2.2.2 Field procedure**

This survey involved visiting (where possible) each of the sample locations (waypoints), finding the ten-figure grid reference with a hand-held Global Positioning System (GPS) receiver (Garmin etrex and Garmin 12 receivers were used, with accuracies of 5–12m being normal), and checking to see if the vegetation at the point belonged to one of the appropriate vegetation types given for that particular waypoint. Thus, for example, if it was a wet heath point then we would search for the *Scirpus-Erica* wet heath M15 NVC community (Rodwell 1991). Many points were listed in the waypoint lists as being for potentially more than one feature, eg, for both blanket bog and wet heath. If the feature (or features) was absent at the exact location, then it would be sought within a radius of 20m for the extensive upland features (dry heath, wet heath, blanket bog, alpine heath and siliceous and boreal grasslands) or 50m for woodland. A grid reference for this new location was then taken (highlighted in the results spreadsheets). If, however, none of the listed features could be found within this radius, but another of the widespread upland features was present, then this would be assessed instead. In the latter case, the waypoint number is highlighted in the spreadsheet to indicate that it is a ‘new recruit’ to this habitat. No more than one feature was assessed for each waypoint (with the exception of four points on the Syndicate management unit which were each assessed for two habitats because of a misunderstanding – their data have been retained because of the small sample sizes on this unit).

Once the feature had been located, the surveyor would then proceed through the list of targets and indicators in the relevant table for that feature (other than those carried out by CES, in which condition targets were also used to assess current browsing impacts). For the condition assessment part of the exercise if the target was met it was recorded as a 'Y', if not, as an 'N'. There were two parts to the impact assessment: current field indicators and trend indicators. For the former, a point would normally be classed as having either a high, moderate or low level of impact, though sometimes the choice would be between, high/moderate and low. For the trend indicators, the objective was to establish if there were detectable changes in the levels of impacts, perhaps demonstrated by indirect indices such as the relative vigour of species such as *Juncus squarrosus* as compared with *Sphagnum*s. Here the options are either decreasing or increasing, with 'chronic' as a qualifier to indicate that this level of impact has probably been continuing over a long period. The scale of assessment for the extensive habitats was 4m<sup>2</sup>.

Although at least one point was found for each of the extensive habitats within each management unit, some habitats were very poorly represented within particular areas, eg, only one wet heath location was found within the Syndicate management unit and only one dry heath point on Pait ground. Two of the more restricted habitats, tall herbs and *Salix* scrub, were only found in a minority of the nine management units. No locations for calcareous rocky slopes were encountered, probably because it is a very restricted habitat which is unlikely to be picked up at random.

Where reaching waypoints would have involved unacceptable risk to the surveyors the points were either not assessed or, where possible, assessed at a distance using binoculars. Where this was the case, it is noted accordingly in the data spreadsheets.

The impact assessment indicator for dwarf shrub heath referring to *Calluna* and *V. myrtillus* browsing (European dry heaths and 'heathy' wet heath) has different thresholds depending on the vigour and growth rates of the dwarf shrubs. The threshold used in this survey for 'High' impacts on the seven northern management units was 33%, as the dwarf shrubs concerned were judged to have relatively slow rates of growth. However, it is possible that this assumption should have been questioned for some areas, especially Mullardoch, where *Calluna* in particular is often quite vigorous.

### **2.2.3 Less extensive habitats**

Habitats with more restricted distributions were treated in a different way. Those for which some accurate, but limited, survey information was available – *Salix* scrub and tall herbs – were sought at the grid references provided and a subset of points was taken if the habitat was reasonably widespread – if not, each locality was assessed as a single point. An opportunistic approach was also taken with these habitats, ie, if the feature was encountered at additional locations during the course of surveying the extensive features, an assessment would be made at that location and the location recorded. For features where previous survey information was lacking or inadequate – siliceous and calcareous rocky slopes, siliceous scree and flushes – an entirely opportunistic approach was taken, ie, the habitats were assessed whenever encountered up to a target of, eg, 12 points for flushes (fewer for the rocky habitats) per management unit.

For the purposes of this survey flushes were defined as follows: comprising the NVC communities M10, M11, M12, M31, M32, M33, M37, M38; also species-rich M15a, ie, with at least 3 *Carex* spp., or a good complement of "brown" mosses. 'Heathy' M15a, ie, where it occupies a broader area (rather than a clearly linear, narrow flush), has fewer *Carex* spp. and brown mosses, was assessed as wet heath; very

species-poor, stony flushes which might be regarded as impoverished M15a (what the Averises (Averis & Averis 1998) called M15a(ii)) were not assessed at all (being so species-poor, they would have failed the condition assessments almost every time).

Surveyors entered data in the field onto either standard paper or electronic (for PDA entry) recording forms.

## **2.3 Woodland methods**

### **2.3.1 Waypoints, impact assessment and life-class recording**

The woodland survey method was also based on randomly generated waypoints. In this case 30 points were generated for each management unit as it was assumed they would coincide with woodland blocks mapped as polygons in the Scottish Semi-natural Woodland Inventory (Caledonian Partnership 2001). Only those management units with significant areas of well-developed semi-natural woodland were included in the woodland survey: Braulen, Glencannich (Liatric Burn SSSI), Mullardoch, FCS's Fasnakyle estate and North Affric. This survey was intended to assess the current herbivore impacts on the Annex I habitats Caledonian forest and Bog woodland. In practice, no points were found which clearly qualified as Bog woodland and thus all points were assessed using the indicators for Caledonian forest. Some sample areas did however contain small areas which might have been considered as Bog woodland.

There were two parts to the woodland survey, the first involved mapping the proportion of trees in different life-classes (with Scots pine and broadleaved trees being recorded separately), eg, small seedlings, saplings, pole stage, senescent (definitions of different life-classes are given in Appendix 2) within relatively homogeneous woodland blocks. The Clifford life-class classification was simplified for this survey in that although most of the eight main life-classes are further subdivided, only the 'integers' were used with the exception of class 1, seedlings, where 1.1 and 1.2 were distinguished. The mapping units were nearly always coterminous with the polygons identified by the Scottish Semi-natural Woodland Inventory (Caledonian Partnership 2001). Where blocks could clearly be separated into more than one mappable unit, usually due to the presence of a fence, then additional blocks were noted, although this was very unusual.

The second component of the woodland survey comprised the assessment of current impacts: browsing, trampling and dunging, the extent to which regenerating seedlings seemed to be 'escaping' from the field layer and the presence or absence of damage to trees and seedlings. As for upland features these were assessed and normally given scores of 'H', 'M' or 'L'. For this assessment a sample area of 50m by 50m was used. To attempt to assess the trend of these impacts, the presence of the three 'youngest' life-classes in the sample area was noted as well as the extent to which grazing-sensitive herbs were confined to inaccessible areas. This latter indicator was, however, found difficult to use because the survey was conducted so late in the year.

### **2.3.2 Notes and clarifications for woodland methods**

The indicators relating to seedlings and recording the presence/absence of life-classes were not quantitative, ie, even if there was only one seedling from a particular life-class, it was recorded as being present. Then a recording was made of whether or not the seedling was above the field layer or damaged. If the sample size for seedlings was very low, this is normally (but not always) recorded in the notes section for each waypoint.

Where no regeneration was seen in the sample area, then for the 'regeneration success' indicator an 'H' impact score was awarded. The impact assessment recording forms include a column for 'overall assessment of current impacts'. This is partly a summation of the other columns, but was not derived using the averaging process used for the upland features (see 2.9), and hence comprises a more subjective assessment.

Due to delays relating to progress with the upland fieldwork, amendments to the original assessment methodology and subsequently weather, fieldwork for the woodland survey did not start until December 2004. It is therefore possible that there may have been some underestimation of the presence of broadleaved seedlings.

## **2.4 Data presentation**

NOTE: The data referred to as being supplied on an accompanying CD have not been reproduced for each copy of the report. However these can be made available on request from SNH Headquarters Library or by contacting Jenny Bryce (jenny.bryce@snh.gov.uk). The raw data are supplied electronically as Excel spreadsheets with one worksheet for each feature (on a CD accompanying this report). Each record consists of the waypoint code, date, surveyor, 12-figure grid reference and short letter codes, eg, 'Y' or 'H' for each target or indicator, followed by details of photographs, species of herbivores noted as being present in the area (by signs or direct observation), NVC community and any appropriate notes. For presentation purposes, the column headings for the targets are often severely abbreviated. For full details of the target requirements for the different attributes in the condition assessment, please refer to the Interagency - Upland Habitat Common Standards Monitoring guidance (JNCC, 2004). For full details of the small-scale indicators used for the impact assessment, please refer to MacDonald *et al.* (1998).

## **2.5 Applicability of small-scale field indicators in this survey**

Several of the standard indicators proved not to be applicable or misleading during the course of the project and consequently, were discarded at the analysis stage.

One of the indicators used in MacDonald *et al.* (1998) was omitted from the recording forms almost from the beginning, namely that referring to the presence of spiders' webs (dry heaths and 'heathy' wet heath), as they were found to be rare, even in areas which were shown by all other indicators to have low deer impacts, that their inclusion would have resulted in a misleading contribution to the overall impact score for each waypoint.

The indicator for the firmness of the bog surface (blanket bog and 'boggy' wet heath), although recorded during fieldwork, was discarded for the analysis as it was clear from the beginning that, virtually every single point would have to be described as having a high impact level on this criterion. Hence this indicator was not regarded as providing an accurate reflection of impact levels.

The indicator based on the degree of browsing of *Betula nana* (blanket bog) was also omitted from the analysis as the species was not seen during this survey.

Although the indicator referring to the degree of *Eriophorum* flowering (blanket bog and 'boggy' wet heath) was included in the analysis, it should probably have been given a lower weighting for waypoints surveyed

later in the season. There was a clear seasonal bias to this indicator, with *E. vaginatum* fruiting heads becoming very difficult to spot after June/July and those of *E. angustifolium* having largely disappeared by the end of September. *Eriophorum* flowering may also be subject to other influences, as it often seemed to correlate poorly with other impact indicators.

Similarly, while the *Rubus chamaemorus* indicator (blanket bog and 'boggy' wet heath) was retained for the final analysis, this species rarely flowers this far north in Scotland (O'Hanrahan, *pers. obs.*). The approach taken in the analysis had the effect of neutralising the indicator – following the comments in MacDonald *et al.* (1998). Where no evidence of browsing was noted (which was the case in all of the points surveyed) the point was noted as having neither a high nor a low impact level.

The dwarf-shrub heath indicator referring to the degree of uprooting in recently burnt patches was removed from the final analysis since no burning was noted on any of the management units during this study.

*Calluna* and *V. myrtillus* flowering was not found to be a very reliable indicator of impact levels in this survey. From observations elsewhere eg, Angus, the degree of flowering can often be much more closely linked to the weather in spring and summer than herbivore impacts (O'Hanrahan, *pers. obs.*).

The trend indicator for blanket bog referring to the height and cover of dwarf shrubs relative to graminoids is considered as a useful index of past grazing pressure. However, as implied in MacDonald *et al.* (1998), where *Eriophorum* is vigorous, particularly in *Calluna-Eriophorum* bog (M19), then this may result in a false score of chronic high impact.

The *Carex panicea* indicator for blanket bog is regarded as an indicator of long-term trampling and erosion on drier peat. It was considered that this indicator was not applicable to upland areas such as this one, where exposure is generally less extreme than for example in the Western or Northern Isles, north Sutherland or parts of Wester Ross. Possibly because of the lack of wind-borne marine minerals, *C. panicea* hardly ever becomes common in such situations in the Strathglass area – *Juncus squarrosus* and *Trichophorum* seem to occupy this niche almost exclusively.

## **2.6 Influence of survey timing**

Because of the timing of the survey at least one of the indicators used: the level of browsing on *Calluna vulgaris*, was not assessed at the optimal time of year and it is possible that this impact may therefore have been somewhat underestimated. Certainly, surveys on management units in October, such as on the 'Syndicate' ground, seemed to pick up much more frequent evidence of heather browsing, although this phenomenon is blurred by the fact that the areas with higher deer impacts (as shown by other indicators) tended to have been surveyed later.

The indicator for summer grazing (dry heaths and 'heathy' wet heath) was probably also inappropriate for assessment after September and should perhaps be removed from the analysis for points assessed after that month. As is mentioned above, it also became very difficult to detect *Eriophorum* species flowers or fruits after early September.

Surveyors reported that it was difficult or impossible to assess grazing impacts (for the siliceous alpine and boreal grasslands and alpine heath features) on montane herbs such as *Armeria maritima* and *Silene acaulis*

from October onwards. Similarly, fewer and fewer *Carex* fruiting spikelets remained after mid-October as they had mostly naturally disintegrated. Thus grazing impacts could not be adequately assessed for this indicator for the flushes towards the end of the survey period.

## 2.7 Boundaries of management units

The data relating to the small parcel of ground owned by Carl Lawaetz in the Mullach a' Ghlas-thuill – Allt Taige area on the north side of Loch Mullardoch has for the moment been subsumed within the larger East Benula management unit (of which it was, until recently, a part).

## 2.8 Data analysis

For the purposes of giving an impact score to each waypoint, where the possible field entries are 'H', 'H/M', 'M', 'M/L' and 'L' (very occasionally 'H/L') they have been given weightings to arrive at a numerical 'sum' for each point as follows: 3 for 'H'; 2.5 for 'H/M'; 2 for 'M'; 1.5 for 'M/L' and 1 for 'L'. The total for all of the indicators for each point which were considered applicable and given a 'score' was then calculated and divided by the number of 'scored' indicators. The final impact level for the point was then determined by where this last 'average' figure fell within the following ranges: 0–1.501 for 'Low', 1.502–2.501 for 'Moderate' and above 2.502 for 'High'. The results of these analyses have been presented in the results section for each habitat and ownership unit, but the maps (Appendix 3) illustrate some of the individual browsing and trampling indicators.

As the management units surveyed by Central Environmental Surveys used condition targets for both the condition and current grazing impact indicators, it has not been possible to aggregate them in the same way. The derivation of a current impact class has had to be inferred by reading across from the condition assessment to the appropriate small-scale field indicators in MacDonald *et al.* (1998). In many cases only a subset of the equivalent small-scale field indicators were assessed and these were recorded as passing or failing to meet the condition target. The main indicators used to produce an average impact for each sample carried out by CES are as follows.

<b>Alpine Heath</b>	<ul style="list-style-type: none"> <li>● Where grazing on Arctic-alpine grasses, sedges and rushes is &lt; or &gt; 10%</li> <li>● Grazing on dwarf shrubs is &lt; or &gt; 33%</li> <li>● Extent of disturbed bare ground, locally and/or over the feature as a whole, is &lt; or &gt; 10%</li> </ul>
<b>Siliceous Alpine and Boreal Grassland</b>	<ul style="list-style-type: none"> <li>● Grazing on Arctic-alpine grasses, sedges and rushes is &lt; or &gt; 10%</li> <li>● Grazing on sub-alpine grasses (eg <i>Agrostis</i>, <i>Festuca</i>, subalpine <i>Poa</i> spp.) is &lt; or &gt; 10%</li> <li>● Extent of disturbed bare ground, locally and/or over the feature as a whole, is &lt; or &gt; 10%</li> </ul>
<b>European Dry Heaths</b>	<ul style="list-style-type: none"> <li>● Levels of grazing on mature dwarf shrub is &lt; or &gt; 33%</li> </ul>
<b>North Atlantic Wet Heaths with <i>Erica tetralix</i> and Blanket bog</b>	<ul style="list-style-type: none"> <li>● Presence of an intensely disturbed surface at &lt; or &gt; 10%</li> <li>● Presence of disturbed bare ground at &lt; or &gt; 10%</li> <li>● Drainage due to grazing or trampling &lt; or &gt; 10%</li> <li>● Disturbance to the <i>Sphagnum</i> layer &lt; or &gt; 10%</li> <li>● Levels of grazing on dwarf shrub of any age class is sufficient to fail the sample; 33% for mature heather or 66% for pioneer heather</li> </ul>
<b>Alpine Flush (Calcareous and Acidophilous categories)</b>	<ul style="list-style-type: none"> <li>● Levels of trampling and tracking sufficient to noticeably modify drainage patterns</li> <li>● Disturbed bare ground accounts for &lt; or &gt; 25% of the cover</li> <li>● Disturbance to moss layer with pulling of bryophytes and other plants is &lt; or &gt; 10%</li> <li>● Presence/absence of at least one unbrowsed flowering shoot of each arctic alpine species</li> </ul>

For some impacts, primarily browsing of dwarf shrubs, there is not a direct read across between the condition targets and the small-scale field indicators such that failure to meet the condition target could equate to either moderate or high impact levels. These have been listed as 'moderate or high'. Where there are condition target failures in addition to exceeding dwarf shrub browsing targets, these have been averaged and are recorded as Moderate/High.

For the habitats assessed against the wind-clipped heath small-scale indicators for which assessments are either 'High' or 'Low', the aggregate has a tendency to be flipped towards 'High' by the presence of any additional target failures – this effect is most pronounced in the alpine heath assessments for North Affric.

Photographs that were taken of sample points are supplied on the CD accompanying this report.

## **2.9 Problems with features listed for waypoints**

As can be seen from the low numbers of waypoints confirmed for some habitats in some management units, eg, alpine heath in East Benula and dry heath in West Benula, not all of the extensive habitats were common across the site. In some cases (eg, the alpine heath) this was expected due to the scarcity of the vegetation types concerned recorded in that management unit during the original survey by the Nature Conservancy Council Upland Survey team (NCC 1982, 1983 and 1987). In others, such as the large cluster of points labelled as being dry heath above Coire Moireach on the north side of Beinn Fhionnlaidh, it appears that the extent of the habitat has been misrepresented either in the original survey or through the conversion process to digital files.

Discrepancies between the habitats actually found on the ground and those listed for waypoints led to some habitats being more frequently recorded and assessed, while others were significantly under-recorded. One of the clearest examples of this is on the West Benula management unit, where a large cluster of points in Coire Mhàim was intended to pick up alpine heath which was interpreted (by the digitisation of the Upland Survey results) as being present at about 5% cover in the corrie. However, this habitat probably occupied less than 1% of the area concerned and none of the very few patches present were close to any of the waypoints provided. Consequently virtually all of the waypoints were assessed for the dominant habitat in the corrie: blanket bog. Thus, many more than the target 28 points were assessed for blanket bog on this management unit, but only ten points (all but two on the south side of Loch Mullardoch) were assessed for alpine heath.

Both the remote selection of sample points based on habitat survey and the inclusion of only sample points considered to represent qualifying habitats in the field, had the effect of excluding some areas of the SAC from this survey. Hence this survey has not picked up impacts on non-qualifying habitats, some of which may have undergone the greatest historical changes as a result of herbivore grazing and trampling, for example, the south facing slopes of Mullach a Ghlas-thuill (East Benula) which are now species poor grassland.

### 3 DETAILS OF SURVEY

#### 3.1 Habitats surveyed

Table 1 illustrates the numbers of waypoints surveyed for each habitat in each management unit.

N.B. Waypoints which were 'discarded' because none of the extensive habitats were present within 20m of them have not been included in the lists below.

**Table 1** Number of sample points obtained per management unit

Ownership	Pait	Braulen	East Benula	Glencannich	West Benula	Syndicate (East Benula South)	Mullardoch	North Affric	FCS
Siliceous alpine and boreal grasslands (H6150)	45	15	10	15	21	14	5	17	22
Alpine and boreal heaths (H4060)	7	29	4	32	10	11	21	27	21
European dry heaths (H4030)	32	15	10	20	1	26	37	17	24
North Atlantic wet heaths with <i>Erica tetralix</i> (H4010)	9	29	45	36	24	1	30	17	34
Blanket bogs (H7130)	32	27	27	15	36	29	34	18	28
Siliceous rocky slopes with chasmophytic vegetation (H8220)	1	–	–	10	1	7	2	1	–
Siliceous scree of the montane to snow levels (H6230)	1	4	–	10	3	3	1	4	–
Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (H6430)	–	3	1	1	2	1	–	–	–
Sub-Arctic <i>Salix</i> spp. scrub (H4080)	–	5	2	1	–	–	–	–	–
Flushes	8	12	14	16	8	11	4	12	2
Caledonian Forest (H91C0)	–	27	–	26	–	–	26	15	26

### **3.2 Surveyors**

This monitoring survey was carried out by Brendan O'Hanrahan, Phil James, Alistair Headley, Ruth Maier and Graeme Guy. David Gray, Fraser Milne, Stuart Smith and Pete Matthews carried out the field survey for Central Environmental Surveys.

## 4 RESULTS

The results are presented here first by management unit and habitat type (results section 4) and are then repeated in a summary for each habitat across the site as a whole (Section 5.1) and lastly an overview of the prognosis is given for each management unit (Section 5.2).

Of the intended 1260 waypoints for the extensive upland habitats a total of 979 were assessed – roughly 75%. There were occasionally high discard rates due to waypoints being provided in areas which lacked any of the appropriate habitats – often where grassier vegetation was dominant. Some points were also discarded for health and safety considerations.

The impact classes discussed in the following sections reflect the amalgamation of the various small-scale field indicators. The averaging process by its nature, tends to even out the ‘highs’ and ‘lows’ and hence represents an overall indication of impact levels. However, this amalgamation may disguise some of the detail, for example, in differentiating between browsing and trampling impacts which may not be coincident. Some overall assessments of ‘low’ impacts may disguise the recording of individual indicators as ‘high’. Given that some indicators are more reliable than others and that some of these impacts may in themselves have consequences for the habitats, the aggregated impact class may not always be sufficient to describe the significance of impacts. Hence the maps in Appendix 3 illustrate some of the individual browsing and trampling indicators. In each case, those indicators that are illustrated are those generally thought to be the most reliable indicators of browsing and trampling impacts for the relevant habitat type.

Unless otherwise noted, where deer are referred to below, the species concerned is red deer, *Cervus elaphus*.

### 4.1 Pait (West Monar and Pait)

This is the most north-westerly of the management units, dominated by the An Socach-An Riabhachan ridge.

#### 4.1.1 Siliceous alpine and boreal grasslands (H6150)

Most of the points for this habitat were found either in the large cluster of points in Coire Riabhachain with a few outliers near Fuaran Riabhachain and on the broad slope of Màm Ruisgte leading up towards An Socach. They were usually above 700m a.s.l. The main component of this habitat, namely the *Nardus-Carex* grass-heath (U7) National Vegetation Classification (NVC) community (Rodwell 1992), is widespread on these broad, mainly north-facing slopes. Forty-five points were assessed for this habitat on the Pait management unit – the highest number for the habitat on the entire study area.

No points were assigned to the overall ‘High’ impact level. Just over half of the points assessed were considered to be at ‘Moderate’ levels of impact, mainly due to evidence of dwarf shrub browsing and high densities of deer dung pellets. Deer were by far the commonest herbivore noted during the survey – hares were not seen at all and their dung pellets were only rarely seen. Just below 45% of points were assigned to the ‘Low’ impact level. The points to the west of Coire Riabhachain appeared to have lower impact levels than those in the corrie. This pattern may be expected as deer often seek shelter from the prevailing wind in corries or use them as through-routes. Corries also tend to have slightly lusher vegetation, often being well-irrigated by flushes, than the more exposed ridges. There was an unusually high level of disturbed bare ground recorded, with 13 of the 45 points showing some evidence of this (see Map 4 in Appendix 3).

Both trend indicators tended to be assessed as either chronic high or increasing. However, the indicator based on the cover of fine-leaved grasses is considered by this team of surveyors to be poorly, if at all, linked to herbivore impact levels, especially when the main vegetation type concerned is the *Nardus-Carex* grass-heath, which is naturally grassy. The cover of broad-leaved grass species, which was sometimes recorded by surveyors as being greater than 10%, is probably a more reliable indicator of chronically high or increasing impacts, but it was difficult to detect a pattern for this indicator from the results.

#### **4.1.2 Alpine and boreal heaths (H4060)**

The majority of the very few (seven) points confirmed and assessed for this feature were on the sheltered northwest side of Coire Riabhachain, with two points on the north side of Meall Garbh in the north-eastern part of the management unit and one point on the broad northwest-facing shoulder just west of Coire Gorm Beag. All but one of the points were in vegetation of the *Vaccinium myrtillus-Racomitrium lanuginosum* montane heath (H20) NVC community.

Levels of impact were consistently low, with only one point being assigned to the 'Moderate' impact class. Trends were considered to be either of 'decreasing' impact or stable at a low level.

#### **4.1.3 European dry heaths (H4030)**

The great majority of points for this habitat were on the lower northern slopes of An Riabhachan, straddling Fuaran Riabhachain, supplemented by a small group on the west-facing northeast side of Coire Riabhachain. With only one exception, all of the 32 points for this feature belonged to either the *Alchemilla alpina-Carex pilulifera* sub-community of the *Vaccinium myrtillus-Deschampsia flexuosa* NVC community (H18b) or to the *Vaccinium* sub-community of the *Juncus squarrosus-Festuca ovina* grassland (U6c), both characteristic of the relatively even, moderately steep north-facing slopes of this SAC.

About 80% of the points had impact scores which resulted in their being described as having 'Moderate' levels of herbivore impacts. A significant part of this assessment relates to the low frequency of *Vaccinium myrtillus* flowers and fruits. Hence this assessment may overstate the degree of impact as flowering of *Vaccinium myrtillus* can be a very patchy. Conversely, a high proportion of the points were considered to be displaying evidence of chronic moderate impact. Just under 20% of the points were judged to have low impact levels. None received an overall 'High' impact level rating.

#### **4.1.4 North Atlantic wet heaths with *Erica tetralix* (H4010)**

Of the small sample of wet heath points confirmed for this management unit (just nine) most were, as with the dry heaths above, on the lower slopes of An Riabhachan, with a further three points at the north end of Coire Riabhachain. The points were either from the M15c or M15d sub-communities of the *Scirpus-Erica* wet heath. All of the points on the Pait management unit were assessed using the dwarf shrub heath indicator table.

All had impact scores which caused them to have aggregate impact scores of 'Moderate'. This was mainly due to all but one of the points showing evidence of trampling, as well as varying levels of dwarf shrub browsing.

#### **4.1.5 Blanket bogs (H7130)**

The distribution of blanket bog points forms a fringe along the northern edge of the Pait survey area, occupying a broad band on the south side of the Allt Riabhachain, with a couple of outliers at the mouths of Coire Gorm Mòr and Coire Riabhachain and finally a few scattered on either side of Fuaran Riabhachain. Most of the points were in *Calluna-Eriophorum* bog (M19), usually the drier *Empetrum nigrum* sub-community (M19b), with a few from the Typical sub-community of the *Scirpus-Erica* wet heath (M15b) and two from the *Sphagnum* sub-community of the *Juncus-Festuca* grassland (U6a).

Only one of the 32 blanket bog points on Pait was given an aggregate 'High' impact level, but just over three-quarters were assessed as being of 'Moderate' impact levels. Nineteen percent were assigned to the 'Low' impact class. Those suffering the least impact were in a loose group at the far northern end of the slope separating Coire Gorm Mòr from Coire Riabhachain.

The impacts recorded varied from trampling impacts around water tracks and gullies, conspicuous browsing on *Calluna* and occasionally mechanical disturbance to *Sphagnum* hummocks. There was obviously a lot of deer traffic along the Allt Riabhachain corridor, with gullying there being frequent and locally severe. Some vole signs were noticed at the western end of the Allt Riabhachain glen, but it is unlikely that they have a major impact on the bog habitat.

The trend indicators, as was generally the case on this site, did not deliver a very clear picture, but it seemed that only about a quarter, at most, of points were showing signs of lessening herbivore pressure – based on the vigour and competitiveness of *Juncus squarrosus*.

#### **4.1.6 Siliceous rocky slopes with chasmophytic vegetation (H8220)**

Only one point for this feature was assessed: on the north side of the narrow ridge connecting An Socach with the Bealach Bholla, but the habitat is extremely widespread, especially on the steep north-facing walls of the two main corries on the management unit. The point assessed passed all of the targets in the condition assessment.

#### **4.1.7 Siliceous scree of the montane to snow levels (H6230)**

The single point assessed was on the steep slope descending from the summit of An Socach towards the Bealach Bholla. It did not meet the target referring to disturbance, but this is not surprising as it was directly on the main path. What other scree there was away from the path would certainly have passed. Nothing was seen that would suggest that this habitat was suffering from high impacts from either humans or herbivores.

#### **4.1.8 Flushes**

All of the flushes assessed on the Pait estate were either *Anthelia julacea* (M31) or *Philonoto-Saxifragetum* (M32) springs, and were thus assessed using the springheads, rills and flushes attribute table for condition assessment. The eight points checked were found either near Fuaran Riabhachain, in Coire Riabhachain or on the slopes of Màm Ruisgte in the northwest of the unit.

About two-thirds were found to have 'Moderate' impact levels, the remaining third had 'Low' levels. Few individual indicators were scored as being at a 'High' level, but equally, few flushes showed

consistently 'Low' impact levels. The points near Fuaran Riabhachain may have had slightly higher herbivore impacts than those elsewhere. Impacts included grazing of *Carex* spikelets, disrupted bryophyte carpets and occasional moderate poaching.

## **4.2 Braulen**

This is the least compact of all the management units, stretching from the northeast side of Meall Garbh in the west to Sgurr na Lapaich and then continuing as a narrower swathe into Glen Strathfarrar, ending at Loch Beannacharan in the east and including Creag Dhubh and the north side of Carn nan Gobhar. It also contains the most extensive areas of woodland of any of the management units north of Loch Mullardoch. The north-facing slopes in Glen Strathfarrar are some of the most sheltered on the entire Strathglass Complex SAC.

### **4.2.1 Siliceous alpine and boreal grasslands (H6150)**

Most of the points for this habitat are in the west on either Meall Garbh or Sgurr na Lapaich, with just one outlier on the north side of Carn nan Gobhar. All but two of the points were of the *Nardus-Carex* grass-heath (U7).

Of the 15 points approximately a quarter were at 'Moderate' impact levels, one point on the spur from Meall Garbh was considered to have an overall 'High' impact level and the rest were assessed as having 'Low' impact levels. The principal impacts noted were dwarf shrub browsing, some disturbance of bare ground and relatively high densities of deer dung pellets.

### **4.2.2 Alpine and boreal heaths (H4060)**

Alpine heath has a similar distribution to the montane grasslands above, but with the addition of several points on Creag Dhubh in the east. Most of these are from the *Vaccinium-Racomitrium* montane heath (H20) and *Calluna vulgaris-Racomitrium lanuginosum* heath (H14), but four of the points on the southeast side of Creag Dhubh are from the *Calluna vulgaris-Arctostaphylos alpinus* heath (H17). This reflects the local abundance of alpine bearberry on the western end of the Braulen estate within the Strathglass Complex SAC.

Four of the 29 points were considered to have an aggregate 'Moderate' herbivore impact level, the remainder were all recorded as having aggregate 'Low' impact levels.

### **4.2.3 European dry heaths (H4030)**

Only 15 points were confirmed for this feature on Braulen, perhaps because many of the points provided for this habitat were actually on areas where wet heath was dominant. They were thinly scattered from west to east, with a small group on the lower slopes of Meall Garbh and single points in Coire Gnada, by Coire Buidhe Beag, at the mouth of Garbh-Choire, just above Coille na Lapaich and on Creag Dhubh.

None of the samples was noted as having 'High' impact overall and 40% were recorded as having 'Low' impacts. All of those near the Allt Mheadhoin on the north side of Meall Garbh were assigned to the 'Moderate' impact class, partly because of evidence of browsing on less palatable dwarf shrubs. Deer were the only herbivores present.

One indicator which may be contributing to a slightly spurious increase in the overall impact score recorded is that referring to flowers and fruits of *Calluna* and *V. myrtillus* which was often recorded as 'High', but was not considered to be the most reliable of characters.

#### **4.2.4 North Atlantic wet heaths with *Erica tetralix* (H4010)**

Twenty-nine points were found for this habitat, roughly half from 'heathier' sub-communities – M15c and M15d, while the remainder were all from the 'Typical' M15b sub-community of the *Scirpus-Erica* wet heath. Most of the points were found on moderate slopes below 600m, e.g. below Meall Garbh, the upper slopes of Gleann Innis and Loichel and around Car Mòr and Carn nam Fiacal below Creag Dhubh.

Two of the points down near the River Farrar beside the eastern end of Inchvuilt wood were assessed as having aggregate 'High' impact levels. Just over half of the remainder had 'Moderate' impacts and the remainder (41%), were judged to have 'Low' impacts. The recording of higher levels of impact is consistent with what was anecdotally observed during the survey, i.e., that there was much more evidence of deer traffic in the bottoms of the glens.

#### **4.2.5 Blanket bogs (H7130)**

Most of the 27 blanket bog sample locations were found close to the bottoms of the glens, with one or two exceptions, such as a point high up beside Allt an Èas Bhàin Mhòir north of Loch Mòr, and another at the top of the Fèith Bhàn, the latter at nearly 750m. Points surveyed were from a range of different vegetation types, including *Calluna-Eriophorum* bog (M19), *Scirpus-Eriophorum* bog (M17), the typical sub-community of the *Scirpus-Erica* wet heath (M15b) and even three points from the *Molinia-Potentilla erecta* mire (M25).

Five of the points were regarded as being at an overall 'High' impact level, with three of these being just north of Inchvuilt wood near Loch Lòan t-Samhraidh. Seventy percent of samples had 'Moderate' impact levels and the rest had 'Low' impacts. Conspicuous browsing on *Calluna* and on less palatable dwarf shrubs, such as *Erica tetralix*, were the main impacts recorded. Evidence of trampling was widespread, though rarely severe.

#### **4.2.6 Siliceous scree of the montane to snow levels (H6230)**

The points assessed for siliceous scree on Braulen were on the southeast side of Sgurr na Lapaich, on the steep slopes overlooking Loch Tuill Bhearnach. Each of the four points had vegetation of the *Cryptogramma crispa-Athyrium distentifolium* snowbed (U18). All passed their condition assessment targets.

#### **4.2.7 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (H6430)**

The three points for this habitat assessed were all on ledges on the steep slopes below Sgurr na Lapaich towards Loch Mòr. Each was from a different NVC community, namely from the *Luzula sylvatica-Vaccinium myrtillus* community (U16), *Luzula-Geum* community (U17) and finally from the *Thelypteris-Blechnum* community (U19).

None were noted as having any obvious herbivore impacts, all being more or less inaccessible.

#### **4.2.8 Sub-Arctic *Salix* spp. scrub (H4080)**

Five points for this habitat were monitored during this survey, four of these being on the steep and rocky west-facing slopes of Sgurr na Lapaich while the fourth was on the crags just north of Creag Dhubh. All of these points were of the *Salix lapponum* scrub (W20) vegetation type.

Only the Creag Dhubh point was adjudged to have 'Moderate' impact levels, the others were all considered to have 'Low' impacts. Although most showed some evidence of browsing, the other indicators were generally found to suggest relatively low impacts. However, none of the patches was very large and most 'failed' the target for minimum viable stand area in the condition assessment.

#### **4.2.9 Flushes**

A wide variety of different flushes was found on Braulen, even though only twelve points were assessed. Thus *Carex demissa-Saxifraga aizoides* mire (M11), *Carex saxatilis* mire (M12), *Pinguicula vulgaris-Carex dioica* mire (M10), *Philonotis-Saxifraga* springs (M32) and *Anthelia julacea* springs (M31) were all examined in at least one location.

No flushes were considered to have 'High' impact levels, 25% had 'Moderate' impact levels and the remainder were considered to be subject to only 'Low' levels of impact.

#### **4.2.10 Woodland**

Woodland on the Braulen management unit is distributed between four roughly discrete blocks on the south side of Glen Strathfarrar (extending into Gleann Innis an Loichel in the extreme west), from west to east: Coille na Lapaich (including Giubhas Allt na Lapaich and Giubhas nan Saighead), Inchvuilt wood, Coille na Leitire Duibhe and Coille na Paite. Inchvuilt wood is by far the largest, at around 250ha, while Coille na Leitire Duibhe is also relatively large c.100ha., but the remaining two occupy much narrower bands along the steeper north-facing slopes of the glen. The two latter also have in common that their western 'panhandles' are largely broadleaved woodland from the typical sub-community of the *Quercus petraea-Betula pubescens-Dicranum majus* woodland (W17b). The remainder (and the great majority of the two larger blocks) is dominated by Scots pine *Pinus sylvestris*, from the *Sphagnum capillifolium/quinquenarium-Erica tetralix* sub-community of the *Pinus sylvestris-Hylocomium splendens* woodland (W18d).

The random spread of waypoints resulted in a distribution which did not include any points in the westernmost block – Coille na Lapaich. Twenty-seven points were assessed, while two points were amalgamated and one was discarded. In the remaining woodland blocks, four points (#15, 7, 21 & 1) were recorded as having a 'High' impact score overall. These points were all found in Inchvuilt wood; #15 & 7 in a loose cluster at the eastern end and #21 & 1 close to each other near the middle of this piece of woodland. Two other points had 'Moderate/Heavy' impacts; #29 also in Inchvuilt wood and #24 in Coille na Paite. None of the points mentioned was in a fenced area of woodland, though some of those recorded as displaying 'Low' impact levels were within enclosures. Not surprisingly, all of the points mentioned had no seedling regeneration, with the exception of #24, which only had regeneration on inaccessible rocky ground. In terms of life-classes, most of the points combined either just old trees or old trees with some seedlings and saplings. Only at four sample points were there young trees (class 3) which could be considered to have escaped browsing pressure and hence be contributing to the continuity of the woodland structure. Nine sample points had some regeneration above 1.5m, although all but one of these appeared to be within fences.

## **4.3 East Benula**

### **4.3.1 Siliceous alpine and boreal grasslands (H6150)**

Siliceous alpine and boreal grasslands points were confirmed from the southwest side of Sgurr na Lapaich, from the far eastern and western ends of the Riabhachan ridge, as well as on the Sròn na Frithe spur. Of the ten points, three were from the *Carex-Racomitrium* moss-heath (U10), with the remainder coming from the *Nardus-Carex* grass-heath (U7).

Exactly half of the ten points were considered to be subject to 'Moderate' impact levels and half to 'Low' levels.

### **4.3.2 Alpine and boreal heaths (H4060)**

Only four points were located and confirmed for this habitat on the East Benula management unit. Three of these were on the west-facing side of Sròn na Frithe, while the fourth was over to the east on the steep slopes above An Glas-Tholl.

As with siliceous alpine and boreal grasslands above, half had 'Moderate' impact levels and half had 'Low' levels.

### **4.3.3 European dry heaths (H4030)**

Although no dry heath points were provided, it transpired to be commoner than alpine heath, with ten points being found which complied with the definition of this habitat. The points were scattered thinly along the lower slopes of Coire Brogaichain, Toll na Feurstaig, Coire Socrach and the Garbh-Choire, going west to east. As with Pait to the north, the great majority of the points were in vegetation of the H18 and U6c types.

Nine of the ten points had 'Moderate' aggregate impacts, although this may be partly due to all scoring 'High' for the degree of *Calluna* flowering. Only one of the points was recorded as having heavy browsing, with another five points being recorded as moderate in this respect.

### **4.3.4 North Atlantic wet heaths with *Erica tetralix* (H4010)**

With 45 samples, this had the highest number of points of all the habitats on this management unit. The majority of these were from the Typical *Scirpus-Erica* wet heath sub-community (M15b).

Only one had an aggregate 'High' level of impact, just over half having 'Moderate' levels and the rest, 'Low'. The principal impacts were browsing on *Calluna* and *Vaccinium*. Trampling was most marked in the Coire Socrach-Garbh-choire areas, whereas along the ridge to Meall Bac a' Chùl-dhoire and down to An Màm impacts were generally lower.

### **4.3.5 Blanket bogs (H7130)**

Twenty-seven points were assessed for this habitat on East Benula. They were from a range of different vegetation types, including several which were labelled as being intermediate between the *Calluna-Eriophorum* bog and the *Scirpus-Eriophorum* bog.

No points were considered to be subject to overall 'High' impact levels. Nearly all (89%) had aggregate indicator scores which placed them in the 'Moderate' category, the remainder were considered to be 'Low'. The main impacts noted included browsing on *Calluna* and *Vaccinium myrtillus*, as well as locally conspicuous trampling on bare peat.

#### **4.3.6 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (H6430)**

The single point for this habitat was recorded on the crags between Coire Beag and An Glas-tholl. It was of the *Luzula-Geum* (U17) tall herb ledge community. No obvious impacts were noted.

#### **4.3.7 Sub-Arctic *Salix* spp. scrub (H4080)**

Two points for this feature were noted and surveyed, both in roughly the same area as the tall herb point discussed above. Again the vegetation type was the *Salix lapponum* scrub (W20). One was clearly suffering under a severe insect infestation and this may have been the main reason why it attained a 'Moderate' average impact score. The other point seemed not to be subject to any direct browsing impacts.

#### **4.3.8 Flushes**

A wide range of different flush types was sampled on the East Benula management unit (n=14), ranging from M37 and M38 (*Cratoneuron commutatum* springs) to M31, M32, M11 and M15a.

One was recorded as having a 'High' impact score average, but the majority (86%) had 'Moderate' impact levels, and one had a 'Low' overall score. Moderate levels of poaching and disruption to the bryophytes were the main problems experienced by the flushes monitored on this estate.

### **4.4 Glencannich**

#### **4.4.1 Siliceous alpine and boreal grasslands (H6150)**

This habitat was mainly confirmed from the broader exposed slopes above 5–700m, especially Carn nan Gobhar, but also Leacan Riabhach, Creag Dhubh and the hill north of Creag Feusag. Five points on Leacan Riabhach and three at the top of Coire na Buidheig, which were listed for this feature, turned out to be alpine heath. Of the 15 confirmed locations, just under half were from the *Carex-Racomitrium* moss-heath (U10), with all of the remainder coming from the *Nardus-Carex* grass-heath (U7), except for a single point on Leacan Riabhach, which was in an area of the *Juncus trifidus-Racomitrium lanuginosum* rush-heath (U9).

All but two points, #102 and #110, both on the ridge north of Creag Feusag, were recorded as having an overall 'Low' impact score. These two points, assessed as 'Moderate', were the only points to show significant dwarf shrub browsing. The latter waypoint, just above the saddle with Mullach Tharsuinn, showed obvious trampling damage, perhaps because it lies on a transit route used by deer.

#### **4.4.2 Alpine and boreal heaths (H4060)**

Thirty-two points were found to have vegetation belonging to this Annex I habitat type; more than in any other management unit during this survey. As mentioned above, eight of these were originally listed as being

siliceous alpine and boreal grasslands. The habitat seems therefore to be widely distributed above 700m, with particular concentrations of points around the north end of Mullach na Maoile, on the Leacan Riabhach slope, in an arc around the higher parts of Coire na Buidheig as well as at the east end of the ridge north of Creag Feusag.

The geographical position of the Strathglass site is reflected in the range of alpine and boreal dwarf shrub vegetation types encountered. Seven different heath types, with examples of both the northwest seaboard and the 'continental' Cairngorms types were found just on this management unit. The commonest vegetation type was the eastern/Central Highland biased *Calluna-Cladonia* heath (H13), which accounts for over a third of the waypoints and was particularly frequent on the north and east sides of Coire na Buidheig and north of Creag Feusag. The characteristically more western *Calluna-Racomitrium* heath (H14) was abundant at eight recorded locations – all of them, as might be expected, on the exposed western sides of either Carn nan Gobhar or the Leacan Riabhach slope. The often *Vaccinium myrtillus*-dominated NVC types *Vaccinium-Racomitrium* heath (H20), *Vaccinium-Rubus* heath (H22) and *Vaccinium-Cladonia* heath (H19) were each represented by three waypoints. *Vaccinium-Deschampsia* heath (H18) and *Calluna-Arctostaphylos alpinus* heath (H17) were restricted to one location each.

All but four of the points assessed had overall 'Low' impact scores, the exceptions falling into the 'Moderate' impact class. There was no general pattern to the distribution of overall impact classes on this estate. Three of the points assessed as 'Moderate' and one other point (#125) had 'High' levels of dwarf shrub browsing. In the case of this indicator, there may have been a very slight pattern towards higher browsing in the Coire na Buidheig and northeast Creag Feusag areas.

#### **4.4.3 European dry heaths (H4030)**

Twenty points were confirmed for this Annex I habitat on Glencannich, although of these only 12 were originally intended for this habitat. A high proportion of the originally dry heath points turned out to be on wet heath, suggesting wet heath was underestimated in the original survey (or subsequent digitisation). With the exception of two outlying points on, respectively, Creag Feusag and the Leacan Riabhach area, all the other points for this habitat are either contained within or very close to the general catchment of the Allt Mullardoch. Thirteen of these are on the eastern side of the glen. Just over half of the points were attributed to the *Calluna vulgaris-Erica cinerea* heath (H10), with the remainder being mainly from the *Calluna vulgaris-Vaccinium myrtillus* heath (H12); principally distributed on the higher steeper slopes of Coire Dubh and Coire na Buidheig.

Eight of the confirmed locations for this habitat received an overall 'Moderate' impact score, with the rest adjudged to be at a 'Low' level. Apart from the fact that three of the four points in the Mullach na Maoile area reached the higher of the two impact classes, there was no discernible geographical pattern to the distribution of impact scores. It was also difficult to extract any consistent pattern from the indicators which contributed to the 'Moderate' scores. Two points had high levels of dwarf shrub browsing, one had extensive trampled ground and one had a significant amount of stem breakage due to herbivores. Two points were recorded as having *Calluna* growth-forms associated with chronically high levels of browsing – #23 and #83, located respectively on Mullach na Maoile and Leacan Riabhach.

#### **4.4.4 North Atlantic wet heaths with *Erica tetralix* (H4010)**

There were eleven waypoints assessed under the dwarf shrub heath set of indicators, with the exception of two points on the southern slopes of Mullach na Maoile. All the 'heathy' wet heath points were located some distance from Loch Mullardoch, e.g., in the Glas Toll between Carn nan Gobhar and the Leacan Riabhach slope or in Coire Dubh. Most of these points were from the *Cladonia* sub-community (M15c). In contrast, the great majority of the 25 points assessed as 'boggy' wet heath were within a kilometre of the loch shore, especially below Mullach na Maoile: these being mainly from the Typical sub-community (M15b). There was also a cluster of 'boggy' wet heath points in the Coire Eoghainn area between Creag Feusag and Mullach Tarsuinn.

Two points at opposite ends of the management unit – one right at the back of Coire Beag and the other close to Allt Coire Eoghainn achieved 'High' overall impact scores. Neither point had any ericoids present, although dead *Calluna* was noted at the Coire Eoghainn point (#30). It was not clear whether the heather had been killed by large herbivores or, perhaps, by heather beetle. In the case of #34 in Coire Beag, all trampling-related indicators were recorded as having 'High' impact levels. A further four points (#24, 44, 65 and 78) at the southern end of Mullach na Maoile showed relatively high overall impact scores. It was also noticeable that seven of the eleven 'boggy' wet heath points in the stretch between the Allt Taige and the Allt Mullardoch had over 75% graminoid cover, principally *Molinia*, with *Trichophorum* locally prominent. In the case of three of these, there was little or no live *Calluna* present.

However, nine of the 'boggy' wet heath points had 'Low' aggregate impact scores; scattered apparently at random across the study area, apart from a group of four in the southwest corner towards the Allt Taige. Again, there was a slight westerly bias to the distribution of the four 'heathy' wet heath points with 'Low' overall impact scores, with three of these being in the Mullach na Maoile-Allt Taige area.

#### **4.4.5 Blanket bogs (H7130)**

Most of the fifteen locations confirmed for blanket bog are west of the main line followed by the Allt Mullardoch, with the greatest concentrations in the Coire an t-Sith and Glas Toll-Leacan Riabhach areas. There were also singleton points on Mullach na Maoile, Bealach an Tuill Ghaineamhaich, Coire Dubh and the top of Coire Eoghainn. The two principal blanket bog vegetation types assessed were the *Scirpus-Eriophorum* bog (M17) and the more upland *Calluna-Eriophorum* bog (M19), with slightly more points belonging to the former. There was also one point from the *Sphagnum* sub-community of the *Juncus-Festuca* grassland (U6a).

Over half of the waypoints originally generated for the blanket bog habitat turned out to be wet heath (though many were generated for both habitats).

The waypoints were split roughly equally between 'Low' and 'Moderate' overall impact scores. As with other habitats, the points east of the Allt Mullardoch showed some of the higher impact scores. However, the only two points (#2 and 64) which were recorded as having high-to-moderate dwarf shrub browsing were west of the Allt Taige. No waypoints were noted as having more than moderate trampling impacts.

The trend indicators which provided meaningful results: the proportion of grass species, the ratio of graminoid to dwarf shrub height and the abundance and growth of *Juncus squarrosus*, all tended to either show chronically low impacts or decreasing impact tendencies.

#### **4.4.6 Siliceous rocky slopes with chasmophytic vegetation (H8220)**

Ten points were opportunistically sampled for this Annex I habitat. Five were on Creag Feusag, two on the steep slopes southeast of Carn nan Gobhar and three along the northeast-facing slopes of Creag a' Chaorainn-Leacan Riabhach. None showed any signs of grazing or trampling pressure.

#### **4.4.7 Siliceous scree of the montane to snow levels (H6230)**

There were also ten points for siliceous scree, seven of which were on Carn nan Gobhar, one below Creag a' Chaorainn and two on Creag Dhubh. There were no signs of any herbivore impacts at any of the points.

#### **4.4.8 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (H6430)**

There was only one tall herb ledge found in this area during the survey – at the southeast corner of Creag a' Chaorainn. The vegetation there was from the *Luzula sylvatica-Vaccinium myrtillus* tall herb community (U16). No herbivore impacts were noted.

#### **4.4.9 Sub-Arctic *Salix* spp. scrub (H4080)**

One stand of *Salix lapponum* scrub (W20) was found adjacent to the tall herb vegetation on Creag a' Chaorainn just mentioned. Apart from some minor evidence of browsing on the shrubs, there did not seem to be any significant impacts affecting this small stand.

#### **4.4.10 Flushes**

Sixteen flushes were found and assessed by surveyors while *en route* to supplied waypoints. Half of these were on or around Creag Feusag. Ten of these were from the *Philonotis-Saxifraga* spring (M32), two each from the *Carex panicea* sub-community of the *Scirpus-Erica* wet heath (M15a) and *Sphagnum fallax* lawns (M2) and just one from the *Anthelia julacea* spring (M31). The M2 lawns do not, strictly speaking, come under the agreed definition of the flush 'habitat', but, are included here for information.

Slightly over half of the points were assessed overall as having 'Moderate' impact scores, the rest being 'Low'. Apart, perhaps, from #8 and #13, which showed some evidence of significant grazing pressure, and #9 which was heavily poached, none of the flush points seemed to be experiencing significant levels of impacts.

The non-native willow herb *Epilobium brunnescens* was noted at two locations, both in the east near Creag Feusag.

#### **4.4.11 Woodland (Liatric Burn SSSI)**

On the Glencannich management unit all of the woodland was contained within the Liatric Burn SSSI. This area of woodland is dominated by Scots pine *Pinus sylvestris*, most of which belongs to the *Sphagnum capillifolium/quinquifarium-Erica tetralix* sub-community of the *Pinus sylvestris-Hylocomium splendens* woodland (W18d), with some areas of *Betula pubescens* woodland, mainly from the Typical sub-community of the *Quercus petraea-Betula pubescens-Dicranum majus* woodland (W17b).

Of the 30 points provided, 26 were assessed and four were discarded. Two points received an overall 'High' impact score, seven a 'Moderate/High' impact and a further five sample locations were judged to be subject to 'Moderate' impact levels. The six points with the highest impact scores (#7, 10, 14, 20, 23 & 24) were all at the north end of the site; all outwith exclosures and all with no evidence of seedling regeneration (Appendix 3). The northern part of the wood consists largely of life-classes four and older with only a few samples recording any young trees. Young trees and regeneration were, however, evident in the southern fenced part, where current herbivore impact levels were mostly recorded as 'none'.

## **4.5 West Benula**

### **4.5.1 Siliceous alpine and boreal grasslands (H6150)**

There were 21 points confirmed for this feature, with a relatively high level of discards due to either inaccessibility (six) or because the feature was not present (ten). Most of the points discarded due to the wrong habitat were on relatively planar slopes either above An Nead on the north side of Loch Mullardoch or on the western side of the Stob Coire Lochan-Màm Sodhail ridge, where vegetation was generally dominated by *Juncus-Festuca* grassland (U6) or the *Racomitrium* sub-community of the *Nardus stricta-Galium saxatile* grassland (U5e). Eight extra points for this feature were picked up from the Coire Moireach area on the north side of Beinn Fhionnlaidh; points originally generated for dry heath.

Apart from the Coire Moireach points, there were also locations for this feature in the Meall a' Chaisg and Beinn Fhionnlaidh-Stob Coire Lochan areas as well as the slopes and ridge southwest of Màm Sodhail. The great majority of the points with this feature were from the *Nardus-Carex* grass-heath (U7) with a couple of points each from the *Carex-Racomitrium* moss-heath (U10) and the *Juncus-Racomitrium* rush-heath (U9).

Seven of the 21 points had overall 'Moderate' impact scores, the rest having 'Low' impacts. Five of the 'Moderate' overall impact points were in the area between Coire Moireach and the Leapaichean Falaich on the northwest side of Beinn Fhionnlaidh. The other two, were on Meall a' Chaisg and in the high corrie nestling below Meall a' Chaisg and An Socach. Points #10 and #130 at Beinn Fhionnlaidh seemed to have the highest levels of grazing, although all the points in this area were reported as having conspicuous signs of trampling.

### **4.5.2 Alpine and boreal heaths (H4060)**

The great majority of random points provided for this habitat turned out to be other habitats, especially those in Coire Mhàim, which were largely blanket bog. Thus, only ten points were confirmed for this feature, eight of which were south of Loch Mullardoch. All but one of the locations were of the *Vaccinium-Racomitrium* heath (H20) NVC vegetation type, the exception being from the *Vaccinium-Rubus* heath (H22).

Eight of the points received 'Low' overall impact scores and the remaining two had a 'Moderate' average score. Seven of the points showed 'High' scores for dwarf shrub browsing, including all of the points from the Coire Moireach-Beinn Fhionnlaidh area. One point – #19 at the very south end of this part of the study area was reported with a 'High' level of grazing on *Carex bigelowii* and/or fine-leaved grasses.

#### **4.5.3 European dry heaths (H4030)**

None of the points generated for this habitat were actually sampled for this feature. Nearly all of the generated points were in the Coire Moireach area on Beinn Fhionnlaidh, which had been recorded on the Upland Survey maps as having *Vaccinium-Deschampsia* heath (H18). On visiting this area, it transpired that the only Annex I habitats present were alpine heath and siliceous alpine and boreal grasslands.

The only point sampled was originally assigned to another habitat and was probably a rather borderline example of the feature, being an almost alpine version of *Vaccinium-Deschampsia* heath (H18) at the corner between Coire Mhàim and An Nead on the north side of Loch Mullardoch. All except one of the indicators (the exception being the unreliable indicator based on the degree of flowering and fruiting of *V. myrtillus*) were recorded as being 'Low' or 'Moderate/Low'.

With such a tiny sample size, it appears that this habitat is indeed very scarce on this management unit.

#### **4.5.4 North Atlantic wet heaths with *Erica tetralix* (H4010)**

Sixteen 'heathy' wet heath and eight 'boggy' wet heath points were confirmed on this management unit. Five of the latter were around the Dorus a' Choilich area on the northwest side of Beinn Fhionnlaidh, all the rest of the points from both categories were on the north side of Loch Mullardoch. There was a large cluster of 'heathy' wet heath points in the intermediate step of Coire Mhàim and a smaller cluster of 'boggy' wet heath points at the foot of Leathad Choinneach at the loch shore. The 'heathy' wet heath points are mainly M15d, with some M15c locations. The 'boggy' wet heath points are a mixture of these two sub-communities, joined by a few points of M15b.

All of the 'boggy' wet heath points had overall 'Moderate' impact scores. From the 'heathy' wet heath points, #97 and #92 below Meall a' Chaisg both had 'High' overall impact scores due to almost uniformly high scores for both trampling and dwarf shrub browsing. The remainder of the heathy points had overall 'Moderate' scores, with just under half showing 'High' scores for dwarf shrub browsing. Trampling appeared to be less of an issue than browsing, the reverse of the pattern more frequently encountered in the area generally. Three of the 'boggy' points between An Nead and Coire Lungard had high levels of dwarf shrub browsing. Point #8 by Creag na Ciste had significant trampling impacts.

#### **4.5.5 Blanket bogs (H7130)**

Blanket bog was very common and widely distributed on this management unit. There was an especially large concentration of waypoints that were assigned to this habitat in Coire Mhàim (many of which had been generated for alpine heath). Other groupings of points were along Gleann a' Choilich, in a loose line on the western side of Allt Coir' an Lochan and also on the moderate slopes between Coire Lungard and An Nead. In total there were 36 points for this feature, the highest number for any of the management units. On this management unit (and particularly in Coire Mhàim) about a third of the points were not considered to currently support blanket bog vegetation, but almost certainly had done in the past and were considered capable of doing so again. The vegetation in such cases varied mainly between the *Sphagnum* sub-community of the *Juncus-Festuca* grassland (U6a) and the *Vaccinium myrtillus* sub-community of *Scirpus-Erica* wet heath (M15d). Most of the remainder of the points were from the *Scirpus-Eriophorum* bog (M17), the majority of these from the *Juncus squarrosus-Rhytidiadelphus loreus* sub-community (M17c). There were

also three points from the *Vaccinium vitis-idaea-Hylocomium splendens* sub-community of the *Calluna-Eriophorum* bog (M19c), as well as several points where bare peat occupied most of the immediate assessment locations.

The overall impact scores were distributed as follows: five 'High', 29 'Moderate' and two 'Low'. Three of the points with 'High' overall scores were in the bottom of Coire Mhàim, one was on the next 'intermediate' level and the last was beside Allt Coir' an Lochan on the south side of the loch. Including all of these, 21 of the waypoints had evidence of heavy trampling near pools or water tracks. *Calluna* or *V. myrtillus* were totally absent from five of the points and where they were present, high to moderate levels of browsing were noted on 14 occasions. The only two points with 'Low' overall scores were not far from the mouth of Abhainn a' Choilich. Despite the frequency with which some evidence of trampling was noted, eleven points had good cover and depth of *Sphagnum* and/or *Cladonia*. Hence at least a third of the points could still be considered to be on intact bog.

The vigour of *Juncus squarrosus* was the only trend indicator to show a reliable pattern, particularly where adjoining *Sphagnum* or other potential competitors. Nineteen of the points showed at least some evidence that *J. squarrosus* was becoming overgrown by other plants indicating a decrease in impacts.

#### **4.5.6 Siliceous rocky slopes with chasmophytic vegetation (H8220)**

One point on crags above Coire Lochan was assessed – there were no signs of herbivore access or impact.

#### **4.5.7 Siliceous scree of the montane to snow levels (H6230)**

Three points were assessed on the flank of the top southwest of Màm Sodhail – there were no signs of herbivore impacts.

#### **4.5.8 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (H6430)**

Two locations on the crags above Coire Lochan were assessed (with binoculars). Due to the distance and the lateness of the season it was difficult to see a great deal, apart from the fact that both areas seemed to be of *Luzula-Vaccinium* vegetation (U16), but were almost certainly inaccessible, so should have been spared any attentions from deer or other herbivores.

#### **4.5.9 Flushes**

There were eight flush points picked up in total, of which seven were on the north side of Loch Mullardoch. The southern point was west of the top southwest of Màm Sodhail and was from the *Philonotis-Saxifraga* spring (M32). Two points were in the high corrie below Meall a' Chaisg, two on the higher slopes of the same mountain (but to the west) and the remaining three were in the Creag na Ciste-An Nead area. There were three other points from the M32 spring, one from the *Anthelia julacea* spring (M31) and the three lowest points were from the *Carex panicea* sub-community of the *Scirpus-Erica* wet heath (M15a).

Two points had 'Low' overall impact scores while the rest had 'Moderate'. Points #F3, #F4 and #F8 were all at the high end of the scales for impacts, mainly due to severe poaching and disruption to the bryophyte

carpet. However, one complicating factor may have been that there had been repeated bouts of heavy rain just prior to survey and there was some evidence that there had been scouring of flushes due to heavy runoff which had swept away parts of *Sphagnum* cushions in several places. In general none of the points showed any significant signs of grazing.

#### **4.6 Syndicate (East Benula South) (labelled Cozac in datasheets provided)**

##### **4.6.1 Siliceous alpine and boreal grasslands (H6150)**

There were 14 points confirmed for this feature, with a relatively high level of discards due to either inaccessibility (four) or because the feature was not present (three). With two exceptions, the points found along the Stob a' Choire Dhomhain and Carn Eige ridge were all from the *Carex-Racomitrium* moss-heath (U10) or *Juncus-Racomitrium* rush-heath (U9). The remaining points, all in Coire Domhain, were from the *Nardus-Carex* grass-heath (U7).

Only three points had an overall 'Moderate' impact score, the rest being 'Low'. However, nearly half of the points had 'High' levels of dwarf shrub browsing. This should, however, be considered in conjunction with the fact that none of the locations had 'High' scores for grazing on fine-leaved grasses and *Carex bigelowii*. Significant grazing impacts were noted on the slopes above #49, including locally intensive uprooting of grass tillers.

##### **4.6.2 Alpine and boreal heaths (H4060)**

Eleven points were confirmed for this habitat, all either in Coire Domhain or on the high, steep ground enclosing it to east and west. There were small clusters of points on the western side of Creag Dhubh and near Bealach na h-Eige. Of these points, the majority were from the *Calluna-Racomitrium* heath (H14) (sometimes in a variant close to *Calluna-Cladonia* heath (H13)), with three being from the *Racomitrium lanuginosum* sub-community of the *Calluna-Erica* heath (H10b) and a single point from the *Vaccinium-Racomitrium* heath (H20).

Point #107 received a 'High' overall impact score, while four points had a 'Moderate' overall score. The remainder received an overall 'Low' score. There was perhaps a tendency for the points closest to the entrance to the corrie to be subject to higher impacts. Point #113 was reported as experiencing 'High' levels of grazing on both dwarf shrubs and fine-leaved grasses, while another four and three points respectively also had one of these indicators recorded as 'High'. A conspicuous density of hoof prints was recorded for most of the points on the east side of the corrie and also towards the Creag na h-Eige.

##### **4.6.3 European dry heaths (H4030)**

As with the alpine heath above, all of the points confirmed for this habitat were in the Coire Domhain area, though in this case closer to the main axis of the corrie and below the crags separating the upper from the lower half of the corrie. Just under half of the locations found here were of the *Vaccinium-Rubus* NVC heath type (H22), with a similar number coming from the *Calluna-Vaccinium* heath (H12) and one or two points each from the *Vaccinium-Deschampsia* heath (H18) and the *V. myrtillus* sub-community of the *Juncus-Festuca* grassland (U6c).

All but three of the 26 points had overall 'Moderate' impact scores, the rest being 'Low'. Point #87 in the southeast of the area had a 'High' overall status, having 'High' scores for dwarf shrub browsing, the type of shoots removed, trampling and the density of dung pellets. Twelve and six points recorded 'High' scores for trampling and browsing respectively suggesting trampling is generally more of an issue than browsing. This may indicate that the corrie is largely used for shelter or in transit to other areas.

#### **4.6.4 North Atlantic wet heaths with *Erica tetralix* (H4010)**

No points were generated for this feature on the 'Syndicate' management unit, but one point was found near Allt Coir' an Lochan. It was from the *Vaccinium myrtillus* sub-community of *Scirpus-Erica* wet heath (M15d). Although it had an overall 'Moderate' impact score, both trampling and dwarf shrub browsing indicators showed relatively high impact levels.

#### **4.6.5 Blanket bogs (H7130)**

The blanket bog points on this management unit (n=29) were mostly scattered in the northern half, with the greatest proportion of them found on the western side of Allt a' Choire Dhomhain, especially near or above Coire Buidhe. There was also a loose group on the gentle and often highly eroded slopes between Allt Coir' an Lochan and the base of the Stob a' Choire Domhain-Creag na h-Eige ridge.

Most of the points were in vegetation belonging to either the *Calluna-Eriophorum* bog (M19) or the *Scirpus-Eriophorum* bog (M17), six of these being from the *Drosera rotundifolia-Sphagnum* sub-community (M17a). One other point was identified as being from the closely related *Sphagnum magellanicum-Andromeda polifolia* sub-community of the *Erica tetralix-Sphagnum papillosum* bog (M18a). Three points came from the often secondary vegetation type U6a – the *Sphagnum* sub-community of the *Juncus-Festuca* grassland.

Seven points received a 'Low' overall impact score, 21 were calculated to be at a 'Moderate' overall impact level and a single point received an overall 'High' score. The latter was #34 at the very top of Coire Buidhe, where trampling and dwarf shrub browsing indicators were unanimously 'High'. Eighteen points were recorded with high to moderate levels of dwarf shrub browsing. Ten points had 'High' scores for the abundance of hoof prints in bare peat. *Sphagnum* or *Cladonia* were extensive and abundant at 13 of the point locations, whereas only three points were reported as having absent or very patchy quantities of these groups.

#### **4.6.6 Siliceous rocky slopes with chasmophytic vegetation (H8220)**

There were no signs of herbivore access or impacts at the seven points assessed. One point was on crags just east of Allt Coir' an Lochan while the rest were on crags scattered through the Coire Domhain area.

#### **4.6.7 Siliceous scree of the montane to snow levels (H6230)**

Three points on Bealach na h-Eige and just above it to the north were assessed. There were no signs of herbivore impacts.

#### **4.6.8 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (H6430)**

One small patch on crags east of the waterfall on Allt Coir' an Lochan was assessed with binoculars. Due to the distance and the lateness of the season, it was difficult to see a great deal, apart from the fact

that the area was of the *Luzula-Vaccinium* vegetation (U16). However, the crag was more or less inaccessible, so should have been spared any attentions from deer or other herbivores.

#### **4.6.9 Flushes**

Eleven points were found and assessed on this management unit. Nine of the points were from the *Philonotis-Saxifraga* spring (M32) and one each from M15a and from the *Carex demissa – Saxifraga aizoides* (M11). Apart from two points each in the East Allt Coir' an Lochan and upper Coire Buidhe areas, the remainder of the points were scattered through the Coire Domhain area.

Two of the points at the outer end of Coire Domhain (one strictly speaking in Coire Buidhe) had 'High' overall impact scores, mainly due to poaching and disruption to bryophytes, though the Coire Buidhe point was also heavily grazed. The points on the steep east side of Coire Domhain below Tom a' Chòinich also had relatively high scores (though with a 'Moderate' average), but much of this was due to very few indicators being available to assess and the skewing effects of the vegetation height indicator, which is not considered to be very reliable in November. Two points (both on the western side of the Creag na h-Eige ridge) had overall 'Low' impact scores, the other points were 'Moderate' overall. Apart from #F7, most of the other points showed only moderate levels of poaching and generally low to insignificant levels of grazing.

### **4.7 Mullardoch**

#### **4.7.1 Siliceous alpine and boreal grasslands (H6150)**

Only five points were confirmed for this feature on the Mullardoch management unit, partly because most of the waypoints generated were for both alpine heath and this habitat, but only met the description of alpine heath. All of the points were either on Toll Creagach or the ridge extending to the west. Four of the points were attributable to the *Juncus-Racomitrium* rush-heath (U9), with the remaining point belonging to the *Nardus-Carex* grass-heath (U7).

Rather surprisingly, considering the otherwise generally low level of impacts on this estate, two points (#77 and #78) about a kilometre apart, had very clear signs of heavy grazing impacts and hence received 'High' overall impact scores. This was also despite the fact that there were few signs of deer in the vicinity. Uniformly 'Low' scores were recorded for the other three points for all indicators.

#### **4.7.2 Alpine and boreal heaths (H4060)**

Twenty-one points were found and confirmed for this feature on the Mullardoch management unit. They were scattered quite widely across the higher ground of this area, with concentrations around Toll Creagach, the top of the eastern Creag Dhubh and towards the top of Toll na h-Imrich.

The diversity of alpine and boreal vegetation types noted here was almost as great as on the Glencannich management unit, with only one fewer NVC community being recorded from this area. The commonest vegetation type was *Vaccinium-Cladonia* heath (H19) with six locations. The *Calluna-Cladonia* heath (H13) and *Calluna-Racomitrium* heath (H14) each had four points. *Vaccinium-Racomitrium* heath (H20), *Vaccinium-Rubus* heath (H22) and *Calluna-Arctostaphylos alpinus* heath (H17) were each represented by two or three waypoints.

The low degree of impact experienced by most of the habitat on the Mullardoch estate is probably best illustrated by the fact that only one point had 'High' scores for browsing and grazing (#16), all of the others being recorded with 'Low' levels for grazing impacts. There was some very local evidence of trampling, which contributed to three of the points attaining 'Moderate' overall impact scores (the rest being 'Low'), and this seems to be consistent with the Bealach between Toll Creagach and the crags by Doire Tana being an important transit route for deer. Similar levels of trampling were recorded from the Fasnakyle ground on the other side of the march. In general, it would seem that alpine heath on this estate is not subject to levels of herbivore impact which would endanger the integrity of the habitat.

#### **4.7.3 European dry heaths (H4030)**

Dry heath was widely distributed below the 550m contour on this estate. Thirty seven points were confirmed, more than for any of the other management units. Twenty-five of these were from the *Calluna-Sphagnum-Vaccinium* heath (H21), with several other points attributable to the *Vaccinium-Rubus* heath (H22) and the *Calluna-Vaccinium* heath (H12). One point came from the *Calluna-Erica* heath (H10).

The level of impact here was uniformly low. Only one point had a 'Moderate' score for dwarf shrub browsing. Point #54 in the Fraoch-choire was recorded as having a 'High' degree of trampled ground, but all other points were assessed as having 'Moderate/Low' trampling impacts. The *Calluna* on this management unit is very often over 60cm high which may deter herbivore browsing.

#### **4.7.4 North Atlantic wet heaths with *Erica tetralix* (H4010)**

There were 20 points from the 'heathy' wet heath and 10 from the 'boggy' wet heath category. All but one of the latter and most of the former were in the Allt Lùb nam Meann area. All of the 'heathy' wet heath points were from the *Cladonia* sub-community of *Scirpus-Erica* wet heath (M15c), as were half of the 'boggy' wet heath points. The remainder from the latter category were from the Typical sub-community (M15b).

A total of 12 points had a 'Moderate' overall impact score. The remainder were assessed at overall 'Low' impact levels. Only two points had more than the minimum score for dwarf shrub browsing and some of the 'Moderate' scores for 'boggy' wet heath seem to be largely due to the absence of *Eriophorum* fruiting heads. There was some conspicuous damage from heather beetle in the northeast of the Allt Lùb nam Meann cluster.

#### **4.7.5 Blanket bogs (H7130)**

There were 34 confirmed points for blanket bog on the Mullardoch management unit. With the exception of one point at the lower end of the Fraoch-choire, all the other points were either in the area stretching up from Allt Lùb nam Meann to Allt Toll na h-Imrich or between the western Creag Dhubh and the loch shore. About 20 were from the *Calluna-Eriophorum* bog, especially from the *Empetrum nigrum nigrum* sub-community (M19b) or the *Vaccinium vitis-idaea-Hylocomium splendens* sub-community (M19c). Eleven points were from the *Scirpus-Eriophorum* bog (M17), particularly the *Juncus-Rhytidiadelphus* sub-community (M17c).

Seven points had 'Moderate' overall impact scores, while the remainder had 'Low' overall scores. Although not severe, both #106 and #128 showed evidence of some trampling. This aside, there did not appear to be any signs of major herbivore impact on this habitat. No point received more than a 'Low' assessment for dwarf shrub browsing.

#### **4.7.6 Siliceous rocky slopes with chasmophytic vegetation (H8220)**

Two points were assessed, one on crags above the Fraoch-choire and one below Toll Creagach. There were no signs of herbivore access or impact at either.

#### **4.7.7 Siliceous scree of the montane to snow levels (H6230)**

Only one point on the northeast shoulder of Toll Creagach was assessed. There were no signs of herbivore impacts.

#### **4.7.8 Flushes**

Just four points were found and assessed on this management unit. One was just below Bealach Toll Easa while the other three were on the north and northeast sides of Toll Creagach. Two of the points were from the *Philonotis-Saxifraga* spring (M32) and two from the *Anthelia julacea* spring (M31).

#F2 and #F3 both showed some signs of poaching, but only the former reached an overall 'Moderate' impact score, the rest having 'Low' average impact scores. #F1 and #F4 showed virtually no signs of herbivore impact.

#### **4.7.9 Woodland**

This area of woodland is dominated by Scots pine *Pinus sylvestris*, most of which belongs to the *Pinus sylvestris-Hylocomium splendens* woodland (W18), with some areas of *Betula pubescens* woodland, mainly from the Typical sub-community of the *Quercus petraea-Betula pubescens-Dicranum majus* woodland (W17b).

Twenty-six points from the original 30 were assessed – four were discarded because they overlapped with other points. No points received an overall 'High' impact score, 35% of the sample locations were judged to be subject to 'Moderate' or 'Moderate/Low' impact levels, with the remainder (65%) having 'Low' impacts. There was no clear pattern to the distribution of those points with higher scores for individual impact indicators. It is possible that the proportion of 'Moderate' scores may somewhat exaggerate the level of impact as the absence of seedlings in some areas may be due to the height of the *Calluna* canopy rather than to herbivore pressure.

The tall field layer of *Calluna* and lush carpet of mosses beneath, which is a widespread feature within the estate, may be reducing the potential for regeneration. Within the single enclosure, Scots pine regeneration occurred beyond the boundaries of the existing stands, whilst broadleaf regeneration, mainly Rowan *Sorbus aucuparia* occurred beneath the canopy. In terms of life-classes, pine was either present only as class four and older or in combination with class one (small saplings). Only one point recorded large saplings, however, most samples recorded the presence of pre-reproductive broadleaved regeneration, most of which was below heather height.

### **4.8 North Affric**

#### **4.8.1 Siliceous alpine and boreal grasslands (H6150)**

The montane communities on the ridges are chiefly of the *Carex-Racomitrium* community (U10) and *Juncus-Racomitrium* community (U9). The *Nardus-Carex* snowbed (U7) community is somewhat fragmentary at lower

altitudes in mosaics with alpine and boreal heaths, but becomes more continuous and extensive at higher altitudes.

Twenty four percent of samples assessed for siliceous and alpine boreal grassland failed to meet the targets for current grazing on indicator species of grasses and sedges. Levels of grazing on certain grasses, ie, *Festuca* and *Agrostis* species were generally lower than that on the indicator species. Trampling impacts on this habitat were generally light and overall impacts were assessed as 'Low' in 94% of samples.

#### **4.8.2 Alpine and boreal heaths (H4060)**

At the lowest limits of montane influence there are fragmentary stands of *Calluna-Racomitrium* (H14) and *Vaccinium-Racomitrium* (H20) heaths. These are mostly confined to small knolls located between tracts of blanket mire or wet heath. Some stands of *Vaccinium-Deschampsia* heath (H18c) rich in *Vaccinium uliginosum* may also be regarded as a form of alpine heath. These occur as fragmentary stands in this kind of location, which are found mostly higher in the floors of the corries. Further up and in more exposed locations, there are frequent expanses of *Calluna-Cladonia* heath (H13) and *Calluna-Arctostaphylos alpinus* heath (H17) and more rarely *Vaccinium myrtillus-Cladonia arbuscula* heath (H19). In a few places there are limited expanses of *Calluna-Juniperus* heath (H15) in more exposed locations.

There was no indication of poor condition of alpine and boreal heaths on the basis of the composition of the vegetation sampled. All plots passed on cover of dwarf shrubs, lichens, bryophytes and indicator species. The principal indicator resulting in plots failing to meet condition targets was grazing. This was most pronounced in relation to dwarf shrubs where 70% had more than a third of heather shoots browsed. However, there were also modest failure rates for grazing on grasses and sedges, both palatable species and those that are indicator species for the habitat. Disturbance from trampling appeared to be a much less significant impact on alpine heath in this management unit than grazing.

#### **4.8.3 European dry heaths (H4030)**

The dry heath is mostly *Calluna-Erica* heath (H10), again a western type, with small tracts of *Calluna-Vaccinium-Sphagnum* heath (H21) continuing the oceanic trend. On a few slopes some *Vaccinium myrtillus-Rubus chamaemorus* heath (H22) is found, chiefly around the margins of boulder fields and siliceous scree.

A significant proportion of the plots were in poor condition with a reduction in cover of key species, including dwarf shrubs. Thirty five percent of samples failed to meet the criteria for cover and diversity. The effects of browsing during the current season was visible on dwarf shrubs, resulting in 24% of plots being classed as having 'Moderate' impact levels. Grazing pressure on dry heath was highest in the corries, mostly noticeable in Corrie Coulavie, but also in Corrie Leachavie and Gleann nam Fiadh.

#### **4.8.4 North Atlantic wet heaths with *Erica tetralix* (H4010)**

North Affric management unit occupies moderate slopes overwhelmingly dominated by forms of *Trichophorum-Erica* wet heath (M15), much of it *Molinia*-dominated or otherwise rich in *Molinia*.

The principal cause of failing to meet the condition criteria in the wet heath samples was the dominance of *Molinia*, most often combined with loss or reduction of key species. Although there was no sign of recent to

intermediate-term burning, the habitat structure gives the general appearance of a heath that has become *Molinia*-dominated through loss of heather following burning in the past. Extended winter grazing may, however, also have contributed to or been responsible for this in the past.

Current grazing appeared to be generally light in this habitat, possibly because in many samples, *Erica tetralix* is the dominant or only dwarf shrub with any significant cover. There was a single sample where browsing of dwarf shrubs was >33%. Although affecting relatively few points, higher impacts occurred mainly on the lower slopes in the glens and corries. There was also a single point with significant disturbance due to poaching and tracking by deer.

#### **4.8.5 Blanket bogs (H7130)**

The blanket bog is western-oceanic, with wetter tracts having a high cyperaceous cover typical of *Trichophorum-Eriophorum* bog (M17), and drier peats giving way to the *Calluna-Eriophorum* bog (M19). Hag systems are common, and occur even on gently sloping ground.

All samples passed on the condition indicators. Eleven percent of samples were classed as an aggregate 'Moderate' impact level largely due to grazing impacts. As for wet heath, browsing may have been ameliorated by the predominance of *Erica tetralix*. The distribution of grazing pressure was patchy, although there was generally little evidence of grazing in the interior of extensive hag systems.

In some places, especially in the corries, erosion appeared to be exacerbated by tracking by deer. This influence was present in most areas of blanket mire, but only occasionally was it severe enough to fail the condition targets. In these locations trampling impacts have contributed to the classification of overall impacts as 'Moderate'.

#### **4.8.6 Siliceous rocky slopes with chasmophytic vegetation (H8220)**

Only one sample was recorded for this habitat, which met all the condition targets.

#### **4.8.7 Siliceous scree of the montane to snow levels (H6230)**

Four samples were recorded for this habitat, which is not sufficient to draw an accurate assessment of the feature, however, there were no specific problems relating to any aspect of habitat condition raised by this current survey.

#### **4.8.8 Flushes**

Calcareous upland communities are very limited in extent and distribution on this management unit, but do occur, often near outcrops of calcareous rocks or calcareous scree. Corrie Leachavie in particular has some open swards of *Festuca-Agrostis-Alchemilla* grassland (CG11) and associated high-altitude *Carex-Pinguicula* mire (M10), as well as *Saxifraga-Carex* mire (M11). *Carex saxatilis* mire (M12) also occurs near Màm Sodhail. The most frequent and varied of the upland flushes are the acidophilous types, of which the *Carex curta-Sphagnum russowii* mire (M7) and *Anthelia-Sphagnum* mire (M31) are most often found.

The 12 samples assessed were in generally good condition as regards the non-specialist suites of indicator species, but most of the calcareous flushes failed on the presence of specialist species. Only one sample

had *Tofieldia pusilla*. About a quarter of plots showed current grazing levels high enough to fail the plot. This was noted exclusively in the acid flushes. Acid flushes exhibited predominantly 'Moderate' impacts, with a smaller number having no or 'Low' impacts, while the calcareous flushes were almost all 'Low' impact locations. Almost half of the flushes displayed poaching and tracking on the bare surface, which probably results from deer using the drainage tracks as routes through the hills. As with grazing, most of those affected were acid flushes, contributing to the aggregate assessments as 'Moderate'. One plot exhibited encroachment of *Agrostis stolonifera*, which may indicate long-term decline of the habitat in that particular location.

#### **4.8.9 Woodland**

This area of woodland is dominated by Scots pine *Pinus sylvestris*, most of which belongs to the *Pinus sylvestris-Hylocomium splendens* woodland (W18), with some areas of *Betula pubescens* woodland, mainly from the Typical sub-community of the *Quercus petraea-Betula pubescens-Dicranum majus* woodland (W17b). Much of the woodland is rather open, forming a mosaic with bog, and both dry and wet heath, with just scattered older trees and variable amounts of regeneration.

Just under half of the 15 points assessed received an average 'High/Moderate' impact score, five points were adjudged to have a 'High' average impact score and the remaining points (20%) received a 'Low' or 'Moderate/Low' overall impact score. All of the 'High/Moderate' points were unfenced and showed high impact levels of damage to regeneration. There was also much local trampling. Not surprisingly, those points in the fragmentary woodland at the west end of Loch Affric showed relatively high levels of browsing and two of the points with 'High' overall impact scores were situated here.

#### **4.9 FCS (Fasnakyle)**

##### **4.9.1 Siliceous alpine and boreal grasslands (H6150)**

*Nardus-Carex* snowbed (U7) is abundant at high altitude and occurs more patchily in sheltered locations on lower slopes, and the *Carex-Racomitrium* community (U10) and *Juncus-Racomitrium* community (U9) is abundant on the ridges.

Higher levels of *Festuca* spp. in some plots were sufficient to fail the condition samples and can sometimes be associated with long-term grazing impacts. However, on the basis of observations in the Cairngorms and the Torridons this is not considered to be a reliable indicator (O'Hanrahan 2005, unpublished). The pattern of current grazing on indicator species of grasses and sedges was similar to that in North Affric along the tops of the ridges. Twenty three percent of plots failed the target relating to grazing of forbs and fine-leaved grasses.

##### **4.9.2 Alpine and boreal heaths (H4060)**

Alpine heaths in this unit comprise *Calluna-Racomitrium* heath (H14), *Vaccinium-Racomitrium* (H20) heath, *Vaccinium-Deschampsia* heath (H18c), often with *Vaccinium uliginosum*, *Calluna vulgaris-Cladonia arbuscula* heath (H13) and *Calluna-Arctostaphylos alpinus* heath (H17).

There was no indication of poor condition on the basis of the composition of the vegetation sampled. The main current impact resulting in samples being recorded as 'High' impact (10%) was grazing. This was most pronounced in relation to dwarf shrub, although many of the samples showed similar failure rates for

grazing on grasses and sedges, both palatable species and those that are indicator species for the habitat. A cluster of samples at the bealach to the east of Toll Creagach failed both browsing and trampling targets. The overall impact was, however, significantly less than on similar habitats in the North Affric Estate.

#### **4.9.3 European dry heaths (H4030)**

Dry heath is of limited occurrence and is found mostly in small pockets of steeper sloping ground among larger tracts of wet heath around Ben Eun. Cover of dwarf shrubs is generally good, with only one plot failing to meet the target of 75% cover. Species-rich types of dry heath were not recorded on this management unit. Current grazing on dwarf shrub in the dry heath habitat was relatively slight with three samples failing to meet the targets. Trampling indicators were 'light' throughout.

#### **4.9.4 North Atlantic wet heaths with *Erica tetralix* (H4010)**

The wet heath is a north-western oceanic type, principally forms of *Trichophorum-Erica* wet heath (M15), mainly *Molinia*-dominated. However, there are tracts of *Calluna-Erica* heath (H10) and *Calluna vulgaris-Vaccinium myrtillus-Sphagnum capillifolium* heath (H21).

In contrast to the adjacent North Affric Estate, failure of condition targets due to *Molinia* dominance was significantly less frequent, but did occur in four samples. However, wet heath did show significant levels of current grazing impacts, with 35% of samples (n=10) being assessed as having more than 33% of shoots browsed. This was most marked on the lower ground in Gleann nam Fiadh between Beinn Eun and Am Meallan. Higher altitude points on and around Am Meallan and the march with North Affric appeared to be experiencing much less grazing pressure. Possibly a higher proportion of the habitat on moderate to steep slopes is derived by modification of stands of *Sphagnum*-rich dry heath (H21). *Calluna* cover is therefore quite high in some stands and hence grazing impacts are probably more marked than on grassier stands. There was a low condition failure (n=2) rate due to the ground being excessively disturbed by poaching and tracking, most likely by deer. These trampling impacts made the principal contribution to the assessment of 'Moderate' impacts (6% of samples) on this management unit.

#### **4.9.5 Blanket bogs (H7130)**

The blanket mire is western-oceanic, with wetter tracts of *Trichophorum-Eriophorum* bog (M17), and *Calluna-Eriophorum* bog (M19) on drier ground. The blanket mire is patchy and is mostly found as small expanses of several hectares in mosaics with wet heath on gently sloping to level ground on the shoulders of hills and in corries. There are scattered hag systems on the lower slopes of Am Meallan, and a few hags elsewhere. The habitat is typically species-poor, which may be a result of longer-term impacts. Twelve percent (n=4) of samples failed the condition targets due to an insufficiently diverse representation of indicator species.

The most significant current impact on blanket bogs was grazing, which was high on this management unit. Unlike the North Affric Estate, this management unit has no very extensive areas of continuous blanket mire, therefore it may be that the existing stands are much more accessible to deer. Tracking was present in most areas of blanket mire, but only occasionally was it severe enough to fail the condition targets. However, these impacts have been used to distinguish between aggregate 'Moderate' (11%) and 'Low' impacts (89%). There is a significant cover of *Calluna*, much of which appeared to be severely affected by heather beetle, *Lochmaea suturalis*.

#### **4.9.6 Flushes**

Only two samples of *Philonotis fontana-Saxifraga stellaris* spring (M32) were assessed. One sample passed on all criteria and the other failed on: the level of cover of indicator species, a high cover of disturbed bare ground, both at the sample point and over the extent of the feature visible from the sample point and on the presence of high levels of *Agrostis stolonifera*. The latter assessment tends to indicate that this is an area of flush that is in long-term decline.

#### **4.9.7 Woodland**

Twenty-six points were assessed, all on the north side of Loch Affric. This area of woodland is dominated by Scots pine *Pinus sylvestris*, most of which belongs to the *Pinus sylvestris-Hylocomium splendens* woodland (W18), with some areas of *Betula pubescens* woodland, mainly from the Typical sub-community of the *Quercus petraea-Betula pubescens-Dicranum majus* woodland (W17b).

Thirteen of the points assessed received a 'High' overall impact score (50%), two were 'Moderate' and 11 received a 'Low' or 'Moderate/Low' overall score. Only one sample lacked any form of regeneration from either broadleaves or pine. The browsing levels in the unfenced western half of the area are almost all 'High'. Only three points had regeneration above 1.5m.

## 5 OVERVIEW BY HABITAT, MANAGEMENT UNIT AND HERBIVORE SPECIES

### 5.1 Habitats

#### 5.1.1 Siliceous alpine and boreal grasslands (H6150)

**Table 2** Siliceous alpine and boreal grasslands results – all management units

Average	n	% of points with 'HIGH' impact levels	% of points with 'MODERATE' impact levels	% of points with 'LOW' impact levels
Pait	45	0	56	44
Braulen	15	7	27	67
E Benula	10	0	50	50
Glencannich	15	0	13	87
W Benula	21	0	33	67
Syndicate	14	0	21	79
Mullardoch	5	40	0	60
North Affric	17	0	6	94
FCS	22	0	18	82

This is the dominant habitat on most exposed ridges throughout the site, normally represented by the *Nardus-Carex* grass-heath (U7) and the *Carex-Racomitrium* moss-heath (U10), with the former being especially abundant over large areas of the Pait deer forest.

It was rarely subject to severe herbivore impacts, but occasionally 'High' impacts were recorded, such as on Braulen and Mullardoch. However, sample sizes for these units were quite small, so it may be premature to conclude that these habitats are in danger. Trampling impacts on this habitat were most evident on the northern slopes of An Riabhachan in the Pait management unit. Grazing seemed to be most marked on or near the Toll Creagach-Tom a' Chòinich ridge, particularly on the Fasnakyle side.

One of the problems with interpreting the results for waypoints from this and the next feature is that the number of indicators (from the 'wind-clipped heath' set) actually producing results was often rather low – the alpine cushion-herb indicator could only be used about 20% of the time and terracing was relatively rare. The broad-leaved grass indicator was also inapplicable for over half of the points checked. This led to a situation where many points were assessed on the basis of only five indicators, two of which referred to dung pellet densities.

### 5.1.2 Alpine and boreal heaths (H4060)

**Table 3** Alpine and boreal heaths results – all management units

Average	n	% of points with 'HIGH' impact levels	% of points with 'MODERATE' impact levels	% of points with 'LOW' impact levels
Pait	7	0	14	86
Braulen	29	0	14	86
E Benula	4	0	50	50
Glencannich	32	0	13	88
W Benula	10	0	20	80
Syndicate	11	9	36	55
Mullardoch	21	0	14	86
North Affric	27	7	63	30
FCS	21	10	33	57

This was the rarest of the extensive habitats across the site, with two of the management units having fewer than ten points each.

It was also the habitat that was apparently subject to the least herbivore impact, with only one point being recorded as having a 'High' average impact score in the northern sites, and a clear majority in all but two cases with 'Low' impacts. The map for alpine heath in Map 5, Appendix 3 illustrating performance against dwarf shrub browsing targets, highlights that all management units reported at least some higher impacts against this individual target. However, this was rare on Mullardoch and occurred at around 15% of points for Braulen and Glencannich. Trampling impacts, on the other hand, were more localised – for example, around the bealach between Toll Creagach and Doire Tana (Mullardoch and FCS ground) and in Coire Domhain (Syndicate).

The higher levels of herbivore impacts in the southern sites is based on a smaller number of indicators, converted from the condition assessment system. It is probably slightly biased by the absence of the hare dung indicator from the analysis of these data points, as this indicator was 'Low' for every single point checked on the northern management units during this survey (where hare dung pellets were present).

The generally low level of impacts probably reflects the fact that these vegetation types are often dominated by species such as *Empetrum nigrum* which are of low palatability. They are also often found on very exposed ridges or steep rocky slopes which would not be especially attractive to deer browsing.

### 5.1.3 European dry heaths (H4030)

**Table 4** European dry heaths results – all management units

Average	n	% of points with 'HIGH' impact levels	% of points with 'MODERATE' impact levels	% of points with 'LOW' impact levels
Pait	32	0	81	19
Braulen	15	0	60	40
E Benula	10	0	90	10
Glencannich	20	0	40	60
W Benula	1	0	0	100
Syndicate	26	0	88	12
Mullardoch	37	0	0	100
North Affric	17	0	24	76
FCS	24	0	13	87

Dry heath is a common habitat across the Strathglass Complex SAC, being especially frequent on the lower, steeper slopes on for example, the north side of An Riabhachan and the slopes on the Mullardoch management unit between the woodland and about 600m. Probably a slight majority of it is from the *Calluna vulgaris-Erica cinerea* (H10) community, but there are also large areas of the *Vaccinium myrtillus-Deschampsia flexuosa* heath (H18), especially in the northern half of the site. *Calluna* is often quite rare in these drier areas. The more oceanic *Calluna-Vaccinium-Sphagnum* heath H21 is locally frequent, especially on Mullardoch estate and near burns.

Perhaps surprisingly, no points were recorded with aggregate 'High' impact scores, but several management units such as Pait, East Benula and the Syndicate ground were recorded with large majorities displaying 'Moderate' impacts. The maps for dwarf shrub browsing in Appendix 3 (Map 7) illustrate the pattern of moderate and high levels for this indicator. Trampling indicators found evidence of high level impacts for the presence of disturbed bare ground around Coire Domhain (Syndicate) and An Riabhachan (Pait). Mullardoch is clearly a separate case, with the *Calluna*-dominated dry heaths there apparently in very good condition and subject to little or no impact. This may partly be due to the height of many of the *Calluna* stands, especially lower down, rendering them unattractive to browsers. Glencannich, with the exception of some localised browsing, also appeared to be relatively free of damaging impacts.

In the two southern management units, obvious browsing pressure seemed to be relatively unusual, with the exception of a small cluster of points at the base of the southern spur from Tom a' Chòinich, and no points failed the disturbance targets. Areas with apparently consistently high to moderate browsing levels in the north were the base of An Riabhachan and Coire Domhain, which corresponds well with the pattern for trampling impacts.

**5.1.4 North Atlantic wet heaths with *Erica tetralix* (H4010)**

**Table 5** Wet heaths results – all management units

<b>Average</b>	<b>n</b>	<b>% of points with 'HIGH' impact levels</b>	<b>% of points with 'MODERATE' impact levels</b>	<b>% of points with 'LOW' impact levels</b>
Pait	9	0	100	0
Braulen	29	7	52	41
E Benula	45	2	58	40
Glencannich	36	6	58	36
W Benula	24	8	92	0
Syndicate	1	0	100	0
Mullardoch	30	0	40	60
North Affric	17	0	0	100
FCS	34	0	6	94

This habitat is very widespread across the site, particularly on gentle-moderate slopes below 600m. The habitat was especially dominant on much of the East Benula, North Affric, FCS and Braulen management units. Yet it was virtually absent from Pait and the Syndicate ground.

Although relatively few points were considered to have clearly 'High' levels of impact, the majority in all but one of the management units (Mullardoch) was recorded as having an average impact 'Moderate' level. This may be partly related to a lot of the points being on softer peat and therefore more likely to be affected by deer trampling if near any of the main thoroughfares. Notable clusters for browsing impacts are along the south facing slopes of Loch Mullardoch in Coire Lungard, An Garbh-choire and around Mullach na Maoile and on the FCS unit between Am Meallan and Beinn Eun. In addition, heavy trampling impacts on wet heath are evident on the northern edge of the Pait ground and again in the corries to the north of Loch Mullardoch.

It was noticeable that where the field layer was dominated by a high cover of graminoids, such as on East Benula in the Meall Bac a' Chùl-dhoire-An Màm area and in the lower part of Gleann nam Fiadh on Fasnakyle, trampling was a relatively insignificant impact. This may reflect the ability of tough, resilient grasses like *Molinia* to absorb a lot more mechanical damage than a comparable area of wet heath where eg, *Trichophorum* and *Calluna* are dominant.

### 5.1.5 Blanket bogs (H7130)

**Table 6** Blanket bogs results – all management units

Average	n	% of points with 'HIGH' impact levels	% of points with 'MODERATE' impact levels	% of points with 'LOW' impact levels
Pait	32	3	78	19
Braulen	27	19	70	11
E Benula	27	0	89	11
Glencannich	15	0	47	53
W Benula	36	14	81	6
Syndicate	29	3	72	24
Mullardoch	34	0	21	79
North Affric	18	0	11	89
FCS	28	0	11	89

The majority of blanket bog on the Strathglass Complex SAC is of either the *Scirpus cespitosus-Eriophorum vaginatum* (M17) or the *Calluna vulgaris-Eriophorum vaginatum* blanket mire (M19) NVC vegetation types (Rodwell 1991). Blanket bog is mainly located in the northern, western and south-western parts of the site, in addition to the larger corries such as Coire Domhain, Coire Riabhachain and Coire an Lochain.

Much of the greatest impact seems to be concentrated in the west, where there are several busy routes for deer traffic such as Coire Lungard, along the Allt Riabhachain and through Gleann a' Choilich. The larger corries also seem to suffer in some places, eg, on the Syndicate ground as well as Pait and East Benula. However, by the criteria used during this survey, relatively few points are described as having aggregate 'High' impact levels. Indeed, the eastern estates or management units: Braulen, Glencannich and Mullardoch, seem to have only localised areas with any significant impact.

The separate maps of browsing and trampling impacts, however, provide more detail on individual indicators. High to moderate levels of dwarf shrub browsing were widespread, being particularly marked in much of Pait, East Benula and the Syndicate management units, but also frequent on parts of Braulen, West Benula and Fasnakyle. North Affric, Glencannich and Mullardoch (in descending order) have few or no problems with dwarf shrub browsing. Some of the corries mentioned above recorded high trampling impacts on *Sphagnum* mosses (Map 12, Appendix 3) and generally such impacts are highest on East Benula, West Benula and the Syndicate areas, with significant local concentrations on Braulen, Pait, Glencannich and even Mullardoch (Lùb nam Meann area). In contrast, the two southern management units seem to be subject to only the most localised trampling impacts.

### 5.1.6 Calcareous rocky slopes with chasmophytic vegetation (H8210)

No points were found for this feature.

### 5.1.7 Siliceous rocky slopes with chasmophytic vegetation (H8220)

**Table 7** Siliceous rocky slopes results – all management units

<b>Average</b>	<b>n</b>	<b>% of points meeting condition targets</b>
Pait	1	100
Braulen	0	–
E Benula	0	–
Glencannich	10	100
W Benula	1	100
Syndicate	7	100
Mullardoch	2	100
North Affric	1	100
FCS	0	–

None of the points surveyed showed any signs of herbivore impact.

### 5.1.8 Siliceous scree of the montane to snow levels (H6230)

**Table 8** Siliceous scree results – all management units

<b>Average</b>	<b>n</b>	<b>% of points meeting condition targets</b>
Pait	1	86
Braulen	4	100
E Benula	0	–
Glencannich	10	100
W Benula	3	100
Syndicate	3	100
Mullardoch	1	100
North Affric	4	100
FCS	0	–

None of the points surveyed showed any signs of herbivore impact. The only target missed was for disturbed bare ground at a location coinciding with a path on narrow ridge.

### 5.1.9 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels (H6430)

**Table 9** Tall herbs – results for all management units

Average	n	% of points with 'HIGH' impact levels	% of points with 'MODERATE' impact levels	% of points with 'LOW' impact levels
Pait	0	–	–	–
Braulen	3	0	0	100
E Benula	1	0	0	100
Glencannich	1	0	0	100
W Benula	2	0	0	100
Syndicate	1	0	0	100
Mullardoch	0	–	–	–
North Affric	0	–	–	–
FCS	0	–	–	–

All of the tall herb ledges surveyed were recorded as having low impacts, perhaps because these communities are largely confined to inaccessible locations.

### 5.1.10 Sub-Arctic *Salix* spp. scrub (H4080)

**Table 10** *Salix* scrub results – all management units

Average	n	% of points with 'HIGH' impact levels	% of points with 'MODERATE' impact levels	% of points with 'LOW' impact levels
Pait	0	–	–	–
Braulen	5	0	20	80
E Benula	2	0	50	50
Glencannich	1	0	0	100
W Benula	0	–	–	–
Syndicate	0	–	–	–
Mullardoch	0	–	–	–
North Affric	0	–	–	–
FCS	0	–	–	–

Although all of the *Salix* scrub patches were quite small, relatively little direct herbivore impact was noted (with the exception of the insect infestation recorded on the stand in East Benula and some evidence of slight browsing on Braulen).

### 5.1.11 Flushes

**Table 11** Flushes results – all management units

Average	n	% of points with 'HIGH' impact levels	% of points with 'MODERATE' impact levels	% of points with 'LOW' impact levels
Pait	8	0	63	38
Braulen	12	0	25	75
E Benula	14	7	86	7
Glencannich	16	0	56	44
W Benula	8	0	75	25
Syndicate	11	18	64	18
Mullardoch	4	0	25	75
North Affric	12	0	17	83
FCS	2	0	50	50

Most of the points on management units apart from Braulen and Mullardoch were recorded as having a 'Moderate' aggregate impact score. About a fifth of flush points on the Syndicate ground had a 'High' overall impact score, as did one point on East Benula. However, there were relatively few examples of flushes badly damaged by poaching, which is the main impact associated with large herbivores for this habitat. Those impacts that were noted were mainly in the Coire Lungard-Màm Ruisgte area as well as a scattering across both the East Benula and Syndicate management units. In North Affric, four points had evidence of at least some poaching, although due to the different methodology and therefore differing thresholds, it is difficult to compare directly with similar impacts in the seven northern management units. The conversion of the condition assessment results to overall impact scores for the North Affric and FCS areas above, may understate the degree of impact some of these flushes are experiencing, particularly in terms of disturbance.

The picture for grazing pressure on flushes was less clear, with moderate or high levels of grazing being reported from a few points in each of Pait, East Benula, West Benula, the Syndicate ground, North Affric and Glencannich.

The sample sizes for Mullardoch and the FCS ground were both very small, so no serious conclusions can be drawn about the state of flush habitats on these management units.

### 5.1.12 Upland assemblage

All of the constituent habitats were present in sufficient quantity for the upland assemblage feature to be considered in favourable condition. There was no discernible loss in area for any of these habitats (although it would be impossible to be sure about this because of the anomalies identified when comparing the current vegetation pattern with the original vegetation surveys).

### 5.1.13 Caledonian Forest

**Table 12** Caledonian Forest results – all management units

Average	n	% of points with 'HIGH' impact levels	% of points with 'HIGH'/'MODERATE' impact levels	% of points with 'MODERATE' impact levels	% of points with 'LOW'/'MODERATE' impact levels	% of points with 'LOW' impact levels
Braulen	27	15	7	11	7	59
Glencannich	26	8	27	19	8	38
Mullardoch	26	0	0	15	19	65
North Affric	15	33	47	0	7	13
FCS	26	50	0	8	8	33

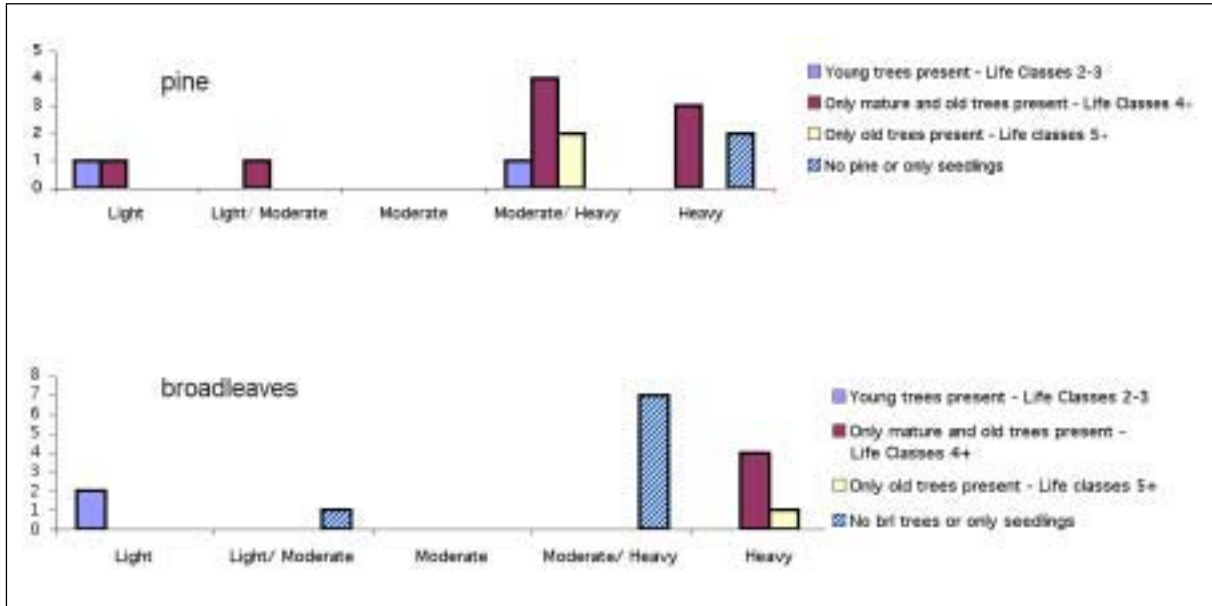
All woodland blocks appeared to have the potential for regeneration in the form of canopy gaps and woodland edge, seed sources and suitable substrates. In one unit (Mullardoch) competition from the surrounding vegetation may have posed a limitation on new regeneration, but regeneration was present, often below heather height. Most woodland blocks are dominated by mature and old trees with a gap in the life-structure where some young trees might have been expected. Although small seedlings were relatively widespread, few appeared to have reached a height where they would be considered to have escaped from browsing pressure. As may be expected, there was a clear distinction between the current impact levels in enclosed (Liatric, FCS, parts of Braulen) and unenclosed blocks. Figures 1–5 illustrate the aggregate classes for current impacts in woodland samples (x-axis, with numbers of samples on the y-axis) grouped according to a classification of the life-classes present at that location. These figures provide an indication of the potential significance of the current levels of impact in terms of the continuity of woodland structure at those locations. The classifications are as follows:

- Young trees present – (juvenile non-reproductive and young reproductive, classes 2 and 3)
- Only mature and old trees present – (mature reproductive and older, class 4 and above)
- Only old trees present (over-mature and older, class 5 and above)
- Or no trees of that type (either pine or broadleaves) at that location or only seedlings.

Seedlings (life-classes 1.1 and 1.2) have not been included in the interpretation of young trees as they are considered to be vulnerable to browsing and hence are not guaranteed to form a cohort of young trees.

Figures 1–5 Current impacts on woodland: numbers of sample points classified by life-class types.

**Figure 1** North Affric – 15 samples



**Figure 2** FCS – 26 samples



Figure 3 Mullardoch – 26 samples

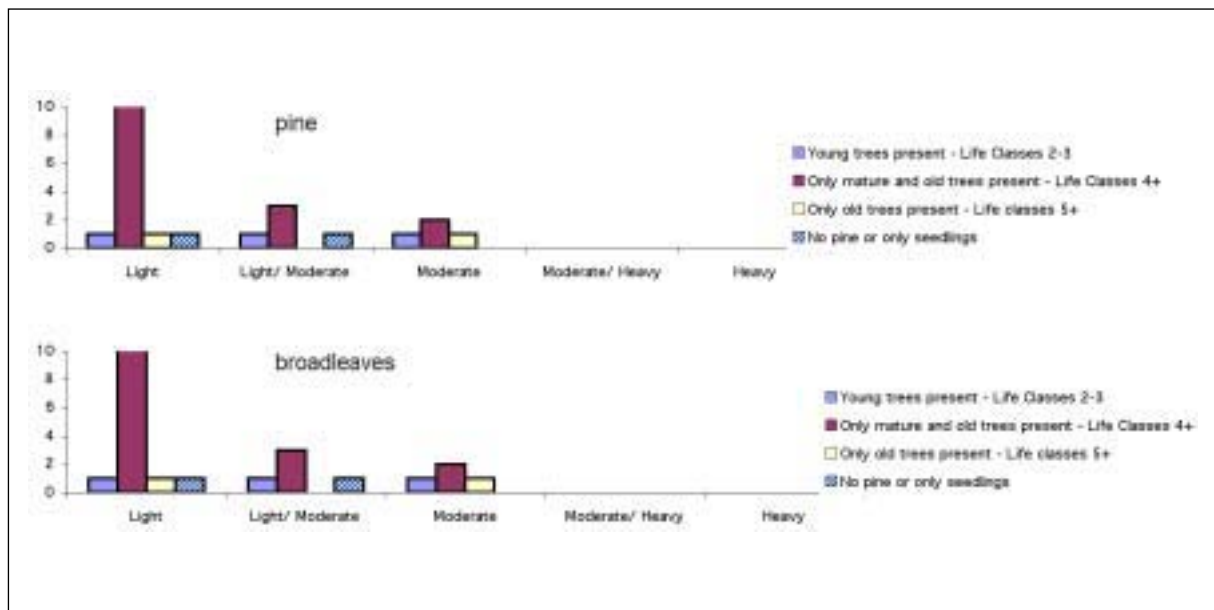
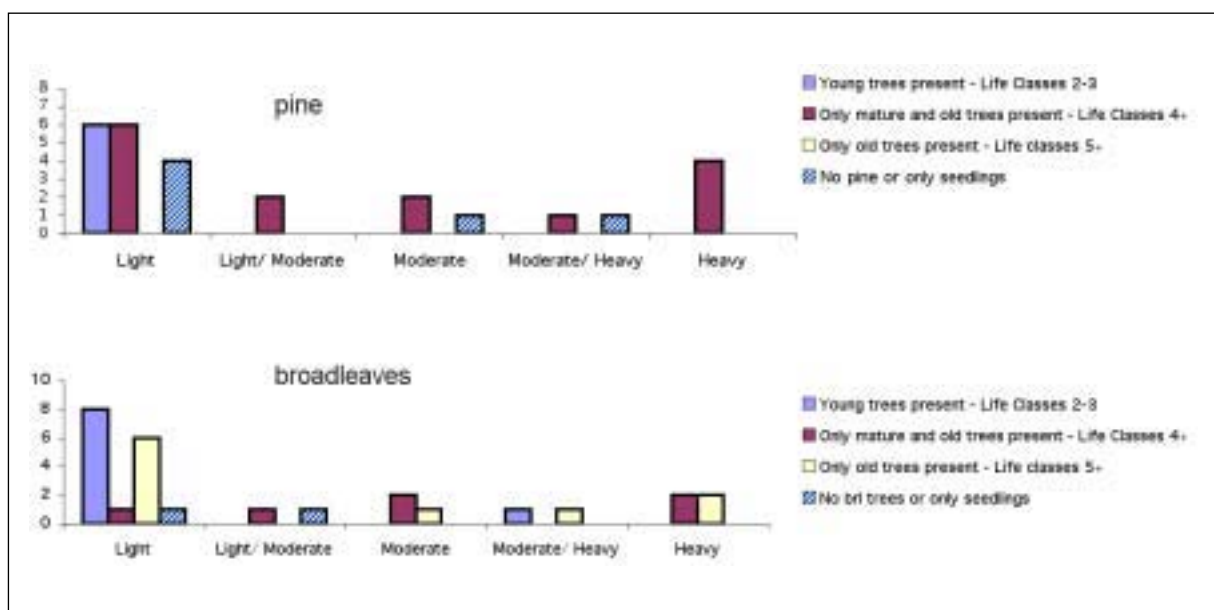
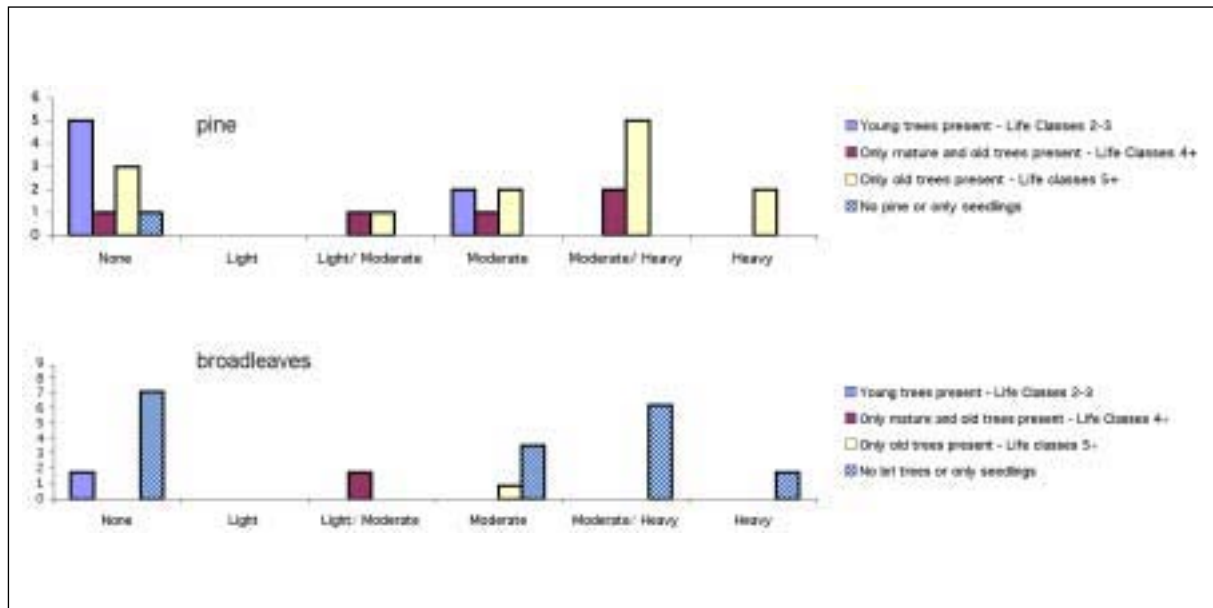


Figure 4 Braulen – 27 samples



**Figure 5** Glencannich (Liatric Burn SSSI) – 26 samples



## 5.2 Overview for each management unit

### 5.2.1 Pait

On this management unit most of the significant impacts seemed to stem from deer in transit, particularly in Coire Riabhachain and along the Allt Riabhachain corridor, where haggling was frequent. Wet heath, dry heath (in north-east) and blanket bog are probably the habitats most at risk from mechanical damage from deer on the move or congregating in the main corrie. Although the overall balance of impacts at individual points was rarely severe, all habitats except alpine heath are clearly under some pressure.

The continuation of even moderate trampling impacts on wet heath and blanket bog may lead to further erosion and loss of habitat area. Although dry heath is probably more resilient than these habitats, where it is on steeper ground, loss of habitat area is also possible if 'Moderate' to 'High' impacts are sustained for longer periods. The prognosis for the alpine habitats is more optimistic, although a reduction in trampling levels for siliceous alpine and boreal grasslands is certainly desirable. It is perhaps worrying that, almost alone of the management units on the site, there was little or no evidence of an improvement in the trampling regime in the core areas of Coire Riabhachain and below An Riabhachan.

Heather beetle was not reported from any of the points on this management unit.

### 5.2.2 Braulen

The alpine habitats here seem to be in reasonable condition, but there are local problems with each of the remaining habitats, eg, blanket bog in the bottoms of the glens (especially near Inchvuilt) and in Garbhchoire. There is evidence of trampling damage in dry heath at the northeast end of the Riabhachan ridge by the march with Pait and browsing levels are frequently moderate in this habitat. Wet heath is subject to a mixture of browsing and trampling pressure near Meall Garbh and below Inchvuilt wood.

The life-class profile of the woodlands within Braulen is dominated by older trees, with little evidence of established regeneration outwith enclosures, other than at a few samples in Coillie an Ath. Seedlings were present in other samples, but current browsing levels appear to be keeping them in check. The life-class (Map 17, Appendix 3) map illustrates the distribution of stands with only old trees or old trees and seedlings, which are unlikely to be able to sustain current impact levels.

In virtually every case where there was a discernible trend (about eight of the 27 points) in terms of blanket bog impacts, this was towards decreasing impacts, mostly visible through a reduction in vigour of *J. squarrosus*. An even greater proportion of 'boggy' wet heath points (c.55%) showed the same trend.

On flatter areas with wet heath and blanket bog moderate to high trampling impacts may lead to further erosion and loss of habitat area. The prognosis for the alpine habitats and dry heath here is more optimistic, although a reduction in trampling levels for siliceous alpine and boreal grasslands is certainly desirable and the dry heath in the far west of the management unit is vulnerable to even the slightest increase in trampling impacts.

Heather beetle was not reported from any of the points on this management unit.

### **5.2.3 East Benula**

Alpine heath is very rare on this estate, but is subject to some browsing pressure in the Coire na Brogaichain area as is the slightly more widespread dry heath. Siliceous alpine and boreal grasslands appear not to be suffering from detrimental impacts at the moment. Wet heath in the Coire na Brogaichain-Coire Mhàim area is clearly exposed to pressure from both browsing and trampling. Possibly the habitat with the most significant impacts on this management unit is blanket bog, where nearly two thirds of all points are subject to significant browsing, while significant trampling impacts were reported for just under half.

The almost dwarf shrub-less areas in the zone c.500–750m wide in from the loch-shore are probably the product of previous management, particularly sheep grazing. See discussion on Glencannich below.

At just under half of the blanket bog points there was a trend towards decreasing impacts, mostly visible through a reduction in vigour of *J. squarrosus*. This was slightly balanced, however, by six points which, if anything, showed that *J. squarrosus* was more than retaining its vigour and local dominance. There was no particular pattern to be gleaned from this indicator for 'boggy' wet heath.

The continuation of even 'Moderate' impacts for trampling indicators such as that relating to disturbance of *Sphagnum* would be of concern as this would lead to a decline in the quality of the habitat in the short term and, through exposure of bare peat, possible loss of habitat area in the future. This applies to blanket bog and the 'boggier' stands of wet heath. The Coire Brogaichain area in general probably cannot tolerate sustained levels of 'High' to 'Moderate' trampling (and browsing, though with deer this tends to act more slowly) in any of the heath or bog features found in the area.

Old heather beetle infestation was conspicuous east of Mullach a' Ghlas-thuill.

#### **5.2.4 Glencannich**

Alpine habitats were generally in good condition, but there were some browsing and trampling impacts on the ridge west of Mullach Tharsuinn. Trampling was very rare on dry heath here, but there was some local browsing pressure. Areas of wet heath were often subject to at least moderate browsing and trampling impacts and damage to *Sphagnum* was particularly marked in the Glas Toll area. Blanket bog was, however, generally less affected by such impacts, with the exception of a cluster of points on Carl Lawaetz's ground on and around Mullach a' Ghlas-thuill. Two of the flushes were under a combination of grazing and poaching pressure, but the rest seemed to be subject to no more than occasional moderate impacts.

It was noticeable that several of those wet heath points where graminoids had over 75% cover and *Calluna* had either completely or almost completely disappeared had 'Low' overall impact scores. This may support the view that much of the apparent disappearance of wet and dry heath here has not been a recent phenomenon, but has been caused by previously high levels of grazing.

About half of the blanket bog and 'boggy' wet heath points showed at least some evidence in terms of declining vigour of *J. squarrosus* and, to a lesser extent, the height and cover of graminoids versus dwarf shrubs. Only three points showed a stable impact level which could be described as chronically high.

The continuation of sustained 'Moderate' to 'High' trampling (and, to a lesser extent, browsing) impacts in the Glas Toll and south Mullach na Maoile areas, as well, perhaps, as on the ridge west of Mullach Tharsuinn, could lead to long-term and irreversible damage to blanket bog, wet heath and, perhaps, alpine heath.

Current impact levels in Liatrie Burn SSSI are clearly split, with regeneration and no browsing impacts in the southern fenced area and no regeneration and heavy impacts in the unfenced northern half. The life-class profile indicates a predominance of old trees and a lack of younger life-classes and the apparent scarcity of the broadleaved component.

Old heather beetle damage was common, at least in the glen of the Allt Mullardoch and may have been implicated in the death of *Calluna* south of Mullach na Maoile.

#### **5.2.5 West Benula**

Like Pait to the north, this management unit is strongly influenced by its position straddling two major highways for deer in Coire Lungard and Gleann a' Choilich. It also contains much of the very sheltered Coire Mhàim and it is perhaps not surprising that habitats with waypoints located in or near these areas are exposed to locally very high impacts.

About half of the siliceous alpine and boreal grasslands points were being heavily browsed, though there did not appear to be a trampling problem. There was a similar picture with alpine heath. All of the Coire Moireach (Beinn Fhionnlaidh) cluster showed evidence of significant browsing. Browsing impacts on wet heath was particularly marked in the upper reaches of Coire Mhàim. Very few blanket bog points were free of significant herbivore impacts and in the Allt Choir' an Lochan and upper Coire Mhàim areas there was widespread evidence of damaging impacts. Poaching in flushes was also common, though conspicuous signs of grazing less so.

However, one positive factor was the relatively high number of points in the Coire Mhàim area which showed a decreasing impact trend as illustrated by the declining vigour of *J. squarrosus*.

Heather beetle was not reported from any of the points on this management unit.

### **5.2.6 Syndicate**

Siliceous alpine and boreal grassland samples were usually free of noticeable impacts. Although only one of the alpine heath points seemed to be subject to clearly damaging impacts, most were subject to some mixture of trampling and grazing and there appears to be some significant pressure on this habitat in the Coire Domhain area. Dry heath in the Coire Domhain area, especially in the east, had widespread signs of impacts, particularly from trampling. The pattern with blanket bog was more complicated with some points, especially in the far northeast relatively untouched, but both browsing and trampling impacts were widespread.

Some of the apparent impacts picked up during the survey, such as the low abundance of *Sphagnum* or *Cladonia* or the greater height and cover of graminoids compared to dwarf shrubs may be due to old grazing, particularly by sheep. The stalker (Angus Hughes) commented that there had been sheep there until 20–30 years ago (belonging to a previous stalker). This is borne out by what seem to be remnant sheep scars on the slopes below Bealach na h-Eige.

There were only very slight signs of a relaxation of trampling pressure in terms of a decline in *J. squarrosus* vigour and the graminoid versus dwarf shrub cover and height ratios. Thus, although much of the damage in the Coir' an Lochan area may be due to higher historical densities of sheep and deer, the extent of bare peat has now reached a point where even 'Moderate' levels of trampling could continue the trend towards loss of physical habitat area, certainly for blanket bog and also potentially for alpine heath and dry heath on the eastern side of Coire Domhain.

Old heather beetle damage was reported from an area on the east side of Coire Buidhe.

### **5.2.7 Mullardoch**

With the exception of the slightly puzzling proportion of siliceous alpine and boreal grassland points which had overall 'High' impact scores and some significant trampling of blanket bog and, to a lesser extent, wet heath in the Lùb nam Meann area, the upland habitats of interest to this survey on this estate were only rarely subject to significant herbivore impacts.

The only area for minor concern on this estate would be the shallow corrie west of Lùb nam Meann, where sustained trampling pressure could potentially lead to a further slow loss of habitat area for blanket bog and, perhaps, wet heath.

The level of current woodland impacts also indicates a lower pressure than on other unenclosed woodlands in the SAC, but regeneration in most cases has yet to escape from browsing pressure. The life-class profile again indicates that there are areas with only old life-classes or old trees and seedlings which have yet to establish, therefore the continuity of these woods remains to be secured.

Old heather beetle damage was widespread in the Lùb nam Meann area.

### **5.2.8 North Affric**

Siliceous alpine and boreal grasslands seemed to be relatively free of herbivore impact, but alpine heath was frequently heavily browsed (though only very rarely trampled). Dry heath was usually in good condition and wet heath seemed to be almost completely free of potentially damaging impacts. Blanket bog was subject to some locally conspicuous browsing, but did not seem to be suffering from trampling damage.

Current impacts in the unenclosed pinewoods in North Affric were assessed as Moderate or Heavy. The life-class profile of these woods is almost exclusively composed of either only old trees, or old trees and seedlings with no younger life-classes being recruited to maintain the continuity of these woods.

### **5.2.9 Fasnakyle (FCS)**

Both alpine heath and siliceous alpine and boreal grasslands were under some pressure from deer near the Toll Creagach-Doire Tana Bealach. Significant browsing and trampling impacts seemed to be absent from dry heath areas on this estate, but wet heath often showed signs of browsing (though not trampling) pressure. There was also some relatively widespread evidence of browsing impacts on blanket bog, though trampling damage was rare.

Continued trampling of alpine heath areas on the south side of the bealach east of Toll Creagach could lead to a slow loss of habitat if sustained at current levels.

The woodlands share the patterns of the other woods within the SAC with evidence of regeneration of both pine and broadleaves in the fenced eastern section, but high levels of browsing and no established regeneration elsewhere. Again these woods demonstrate a distinct gap in the life-class profile.

## **5.3 Individual herbivore species**

### **5.3.1 Red Deer**

Deer (only red deer *Cervus elaphus* were seen during the survey) were by far the most common herbivore in the SAC.

### **5.3.2 Sheep**

Sheep were confined to the western end of the Glencannich area and did not seem to use the area very intensively, largely keeping to the east of Creag Feusag, at least during the period of this survey.

### **5.3.3 Cattle**

A small herd of cattle (c.30 beasts?) was occasionally observed along the southern edge of the Glencannich management unit and occasionally strays further inland along the glen of the Allt Mullardoch.

### **5.3.4 Feral goats**

A loose group of feral goats was seen occasionally at the eastern end of the East Benula estate, particularly near Mullach a' Ghlas-thuill. From conversations with Donald Fraser and Carl Lawaetz, it seems they do

sometimes wander onto the northern side of the watershed and quite far to the west. It seems likely that they have only a very local impact, apart perhaps from preventing birch or rowan from colonising suitable sites in their core area.

#### **5.3.5 Mountain hares**

Although relatively widespread, mountain hares *Lepus timidus* were scarce and very few individuals were seen. It seems unlikely that hares have a significant impact on the designated features on this site.

#### **5.3.6 Heather beetle**

As noted for the appropriate management units above, heather beetle outbreaks have in the past resulted in conspicuous damage to a few areas, notably near the Allt Mullardoch and the Creag Feusag area on Glencannich and by Lùb nam Meann on the Mullardoch estate.

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## Appendix 1 Herbivore impact assessment methods for woodland features

The following assessments were made at each of the random sample locations. As for the open habitats, the assessments were grouped into indicators of condition, current impacts and impact trends. The footnotes provide an explanation of the different impact classes for each indicator.

Designated feature	Habitat category for assessment	Type of indicator	Indicators to be used
Caledonian Forest	Woodland	Condition (Across extent)	<ul style="list-style-type: none"> <li>● Life-class distribution across whole woodland block<sup>1</sup>.</li> </ul>
		Current impacts (using 50m by 50m plot)	<ul style="list-style-type: none"> <li>● Browsing impacts<sup>2</sup></li> <li>● Presence of regeneration<sup>3</sup></li> <li>● Damage to trees and regeneration<sup>4</sup></li> <li>● Trampling/dunging<sup>5</sup></li> </ul> Overall assessment of current impacts <sup>6</sup>
		Impact trends (using 50m by 50m plot and sampling inaccessible locations <i>en route</i> where possible).	<ul style="list-style-type: none"> <li>● Life-class distribution (classes seedling to young reproductive only) at sample<sup>7</sup></li> <li>● Presence and location of grazing sensitive species<sup>8</sup></li> </ul> Assessment of impact trends – maintained, decreasing, increasing, unknown. <sup>9</sup>

<sup>1</sup> Whilst travelling to the sample point record the life-classes of pine and broadleaves present in the woodland block according to the life classes developed by Tim Clifford for Glen Feshie (unpublished, 2003). Other than for seedlings, these need only be to integers.

<sup>2</sup> Browsing Impacts should be assessed as H, M or L using a combination of current impacts on the shrub layer and impacts on the ground layers. See table 1.

<sup>3</sup> Prior to assessing the presence of regeneration at each sample, an assessment should be made of the potential for regeneration, considering, the availability of suitable substrates, light, seed sources and competition from other vegetation. Where there is assessed to be the potential for regeneration, it should be scored as being 1) below the level of the surrounding vegetation, 2) above the surrounding vegetation or 3) above 1.5m see table 2.

<sup>4</sup> What proportion of saplings show browsing damage, fraying or bark stripping? <1/3, >1/3 or >2/3.

<sup>5</sup> Trampling and dunging should be scored as H, M or L. See table 3.

<sup>6</sup> The indicators under current impacts should be amalgamated to produce an overall weighting of H, M or L.

<sup>7</sup> Life-classes should also be recorded in each 50m by 50m sample area to give an indication of the trends of browsing impacts. The focus should be on classes 1–3: seedlings/juvenile non-reproductive/and young reproductive. For example, the presence of young reproductive trees, but absence of seedlings and saplings (juvenile non-reproductive) suggests that browsing pressure has increased.

<sup>8</sup> The species composition of stands that are both accessible to browsing and inaccessible should be compared where possible. Where grazing sensitive species are restricted to inaccessible locations (Y/N/NA as all accessible), the species and location should be noted.

<sup>9</sup> Using the two indicators, where possible, indicate the direction of the browsing impacts.

**Appendix 1** (continued)

**Table 1 Browsing impacts**

Heavy	Browsing induced topiary effect (as distinct from weather induced) on any shrubs that may be present. Browse line on mature trees. Ground vegetation <10cm tall, mostly grasses and mosses. All herbs (tormentil, heath bedstraw, wood anemone, wood sorrel) obviously heavily cropped, non-flowering. Only <i>Luzula</i> is likely to be abundant.
Moderate	Patchy shrubs showing evidence of pruning or a browse line. Ground vegetation to 30cm, as a mixture of grasses, herbs or heaths. Localised close-cropped lawns where there is a concentration of grazing. Some herbs partially cropped or ungrazed, sparsely flowering.
Light or none	Well developed shrub layer without obvious browse line. Lush ground vegetation, where shrub layer is not too dense (ie 30–50% cover), dominated by grazing sensitive species. Many herbs only partially cropped or ungrazed. Some species abundant and flowering.

**Table 2 Assessing regeneration where there is the potential**

1	Tree seedlings not above ground vegetation height.
2	Tree saplings projecting above ground vegetation in a few areas.
3	Saplings escaped from browsing pressure (above 1.5m).

**Table 3 Trampling and dunging**

Heavy	Abundant dung from grazing animals, evidence of tracks and poaching.
Medium	Patches of bare soil rare and small, scattered dung present.
Light	Few signs of trampling, dung.

## Appendix 2 Definitions of Caledonian Forest life-classes used from Clifford (unpublished, 2003)

\*the equivalent life-class definitions were used for broadleaved species

Scots Pine life stage:	Tree sub-class:	Descriptor:	Stand type and conditions:	Biodiversity characteristics:	Stand process:
1. Seeding	1.1 Small seedling	All seedlings <b>at or below the predominant field layer veg'n height</b> , Includes newly germinated seedlings of the year	Fragmented canopy, gaps & woodland stand edges	Generally high biodiversity in sheltered canopy gaps with increased woodland edge habitat, particularly birds and Lepidoptera. Biodiversity generally reduced on exposed woodland edges.	Stand initiation/ regeneration
	1.2 Large seedling	Seedlings above field layer veg'n height, <b>up to 1m tall; usually conical form</b>	Fragmented canopy, gaps & woodland stand edges		
2. Juvenile non-reproductive	2.1 Small sapling	Young trees <b>1–3m height</b> ; not yet producing <b>significant</b> quantities of seed, <b>(usually conical form)</b>	Both dense drifts & scattered individuals in canopy gaps & at stand edges		
3. Young reproductive	3.1 Large sapling	Young trees <b>3–5m in height</b> usually coning/seed producing <b>usually conical form</b> <b>DBH usually &lt;7cm</b>	Either in dense patches but with branches of established trees not yet fully interlocking, or as small patches or scattered individuals		
	3.2 Pole stage	Seed/cone producing young trees <b>usually over 5m in height</b> where canopy has closed; <b>usually conical canopy form</b> <b>DBH range usually 7–30cm</b>	Often dense stands & patches with fully interlocking branches [thicket], <b>but</b> also lone trees & small groups in canopy gaps & at stand edges	1. Low light levels, declining biodiversity; 2. Some deadwood formation through self thinning	Stem exclusion
4. Mature reproductive	4.1 Mature	Seed/cone-producing trees <b>usually over 5m height &amp; 30cm DBH<sup>1</sup></b> not falling into the preceding or following classes; <b>crown usually spreading rather than conical and at its maximum development</b>  May be <b>canopy die-back up to 10%</b> due to competition for light	1. Scattered open-crowned individuals [often poor form] <b>or</b> 2. closer grown stands of first progeny [better form] around "pioneer trees"	1. Some deadwood habitat provided on standing tree and forest floor from windthrown branches; 2. Canopy provides nesting & feeding sites for birds & invertebrates; 3. Sap-runs developing; 4. Mosses, lichens on bark (but greater development of bryophytes on overmature trees)	Dynamic equilibrium
5. Over-mature	5.1 Early canopy decline	Trees <b>usually over 5m</b> height, with spreading canopy; <b>Canopy 10–20% dead</b> with reduced coning/seed production [Any reduction likely to be proportional to crown size]	Usually more open conditions, where wind has begun to de-limb trees	1. Increase in standing and fallen deadwood; 2. Torn branches & broken limbs; 3. rot-holes developing on tree & saprophytic fungi fruiting 4. Crown dieback → increased light to bole → more opportunities for epiphytes!	Canopy breakup
	5.2 Mid-canopy decline	Trees <b>usually over 5m</b> height, with spreading canopy; <b>Canopy 20–50% dead</b> with consequent further reduction in coning/seed production			

Appendix 2 (continued)

Scots Pine Life Stage:	Tree sub-class:	Descriptor:	Stand type and conditions:	Biodiversity characteristics:	Stand process:
6. Senescent post-reproductive	6.1 Heavy canopy decline	Trees <b>usually over 5m</b> height, with spreading canopy much ravaged by wind & pathogens; <b>Canopy 50–99% dead</b> with markedly reduced coning./seed production proportional to loss of canopy	Often [but not always] very open stand with large canopy gaps, with or without recent regeneration	As above sub-class with significant increase in standing deadwood habitat on each tree	<b>Canopy breakup</b>
7. Dead	7.1 Standing dead	Three classes as broad indicators of time elapsed since death: 1. Some needles & all bark still on tree [recent dead] 2. >20% bark still on tree, surface of bole hard 3. <20% bark still on tree, surface of bole soft [long dead]	Often degrading fragmented stands of large old trees with significant windthrow; <b>but:</b> includes smaller specimens resulting from competitive exclusion in dense stands <b>and:</b> Steep scree slopes with a mobile substrate where trees have been uprooted	Bio-diversity likely to be high for recently dead trees [bark still on tree] with larger stem diameters, which are more typical of fragmented open stands. Epixylic lichens an important feature of pinewood biodiversity, restricted to decorticate trees. Overall lichen diversity appears to be much higher for dead pines than live ones!	<b>Death, decay and nutrient cycling</b>
	7.2 Fallen dead	Three classes as broad indicators of time elapsed since death: 1. Some needles & most [>80%] bark still on tree [recent dead] 2. <80% & >20% bark still on tree, surface of bole hard, even though heartwood may be soft and rotting. 3. <20% bark still on tree, surface of bole usually soft [long dead]			
	7.3 Stumps with no fallen trunk/bole evident	Two classes as broad indicators of past woodland history and management: 1. Stumps from past logging operations [clean cut surface] but in varying stages of decay depending on when cut 2. Torn stumps resulting from wind "snap" where trunk has either been removed for firewood or completely decayed	Various but typical of open stands of old wide-crowned trees. Where straightest large specimens have been removed for timber		

NOTES:

1. Maturity is defined as the point at which growth starts to slow down significantly. FC Yield class models can provide an approximate guide to minimum DBH at the age of Maximum mean annual volume increment [MAI], the point at which growth begins to slow down. Naturally regenerated Scots pine trees [as opposed to planted ones] are unlikely to exceed Yield class 8, and at this yield class SP is considered to have reached maturity at approximately 30cm DBH. [see Life Stage Class 4.1]. However, this estimate cannot be reliably applied to trees in conditions of environmental stress such as exposure and poor drainage, where maturity may be reached at much smaller size [DBH].

## **Appendix 3 Individual browsing and trampling indicators for each habitat type**

### **Map 1 Browsing indicators – all habitats**

This map illustrates the results of the single indicators selected to illustrate browsing impacts for each of the extensive habitat types.

These include the proportion of shoots browsed of dwarf shrubs for:

Alpine heath

Wet heath

Dry heath and

Blanket bog

And of grasses and sedges for Siliceous boreal grassland and flushes.

And browsing of tall herbs and willow species respectively.

See individual habitat maps for fuller description of small-scale field indicators represented by the impact classes illustrated.



## **Map 2** Trampling indicators – all habitats

This map illustrates the results of the single indicators selected to illustrate trampling impacts for each of the extensive habitat types.

These include the proportion of disturbed bare ground for:

Alpine heath

Wet heath

Dry heath

Siliceous boreal grassland and

Willow scrub

And for Blanket bog and flushes – the proportion of *Sphagnum* moss hummocks and lawns which are broken by hoof prints.

See individual habitat maps for fuller description of small-scale field indicators represented by the impact classes illustrated.



**Map 3**      Browsing indicators – Siliceous boreal grassland

***Siliceous boreal grassland (1)***

Less than 10% of live leaves and/or flowers of any of *Alchemilla alpina*, *Carex bigelowii*, *Deschampsia flexuosa*, *Festuca ovina*, *Festuca vivipara*, *Juncus trifidus*, *Nardus stricta*, *Sibbaldia procumbens*, *Thymus polytrichus*, with any evidence of grazing;

**Y**

More than 10%.

**N**

***Siliceous boreal grassland (2)***

Signs of grazing on the leaves of *Carex bigelowii*, *Juncus trifidus* or fine leaved grasses such as *Deschampsia flexuosa*, *Festuca ovina* and *Festuca vivipara*.

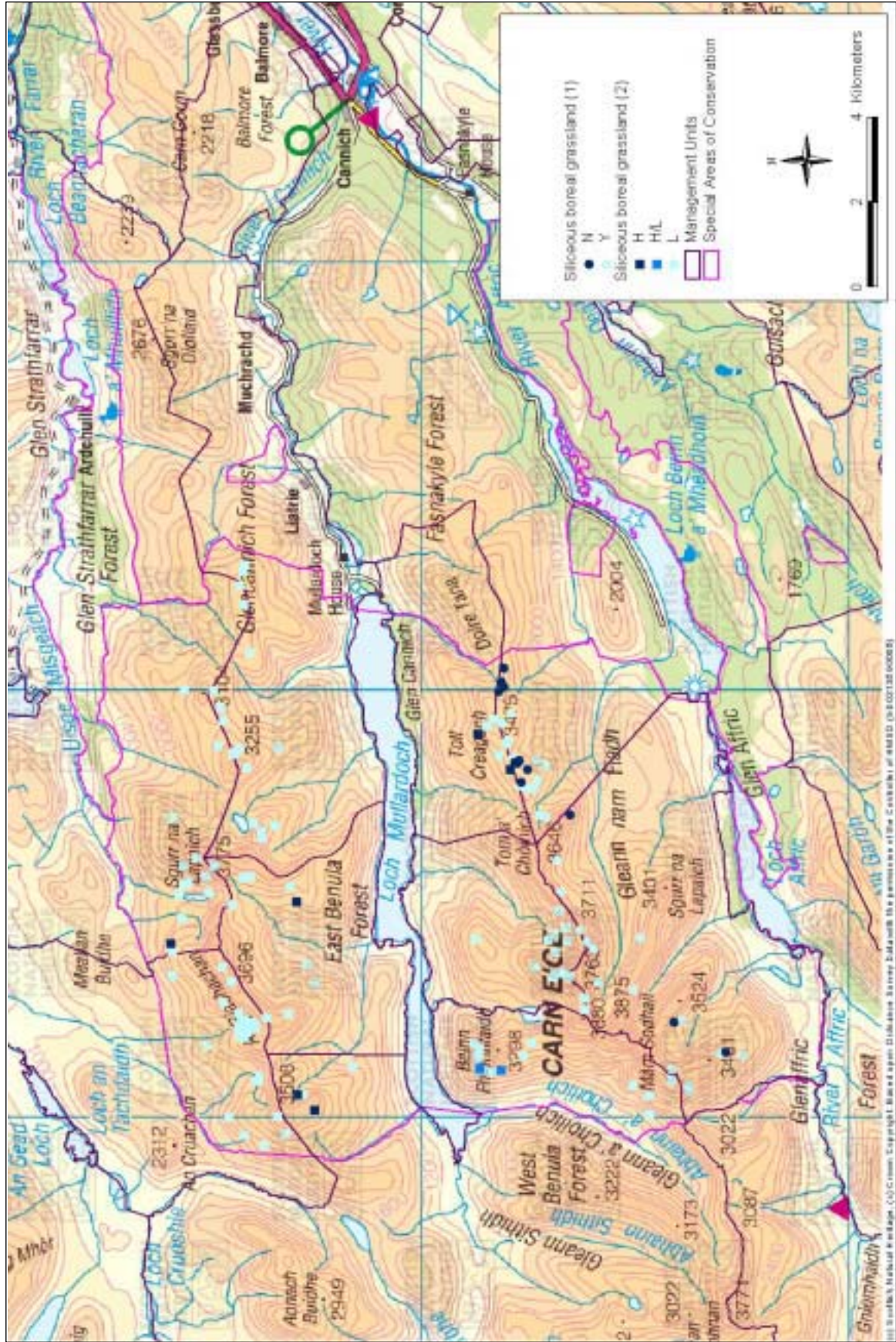
Easily observable. >10% of green leaves.

**H**

Very little or no signs of grazing. <10% of green leaves grazed.

**L**

**Map 3** Browsing indicators: Siliceous boreal grassland – proportion of alpine species browsed



**Map 4** Trampling indicators – Siliceous boreal grassland

***Siliceous boreal grassland (1)***

Less than 10% of the ground cover is disturbed bare ground. **Y**

More than 10% of the ground cover is disturbed bare ground. **N**

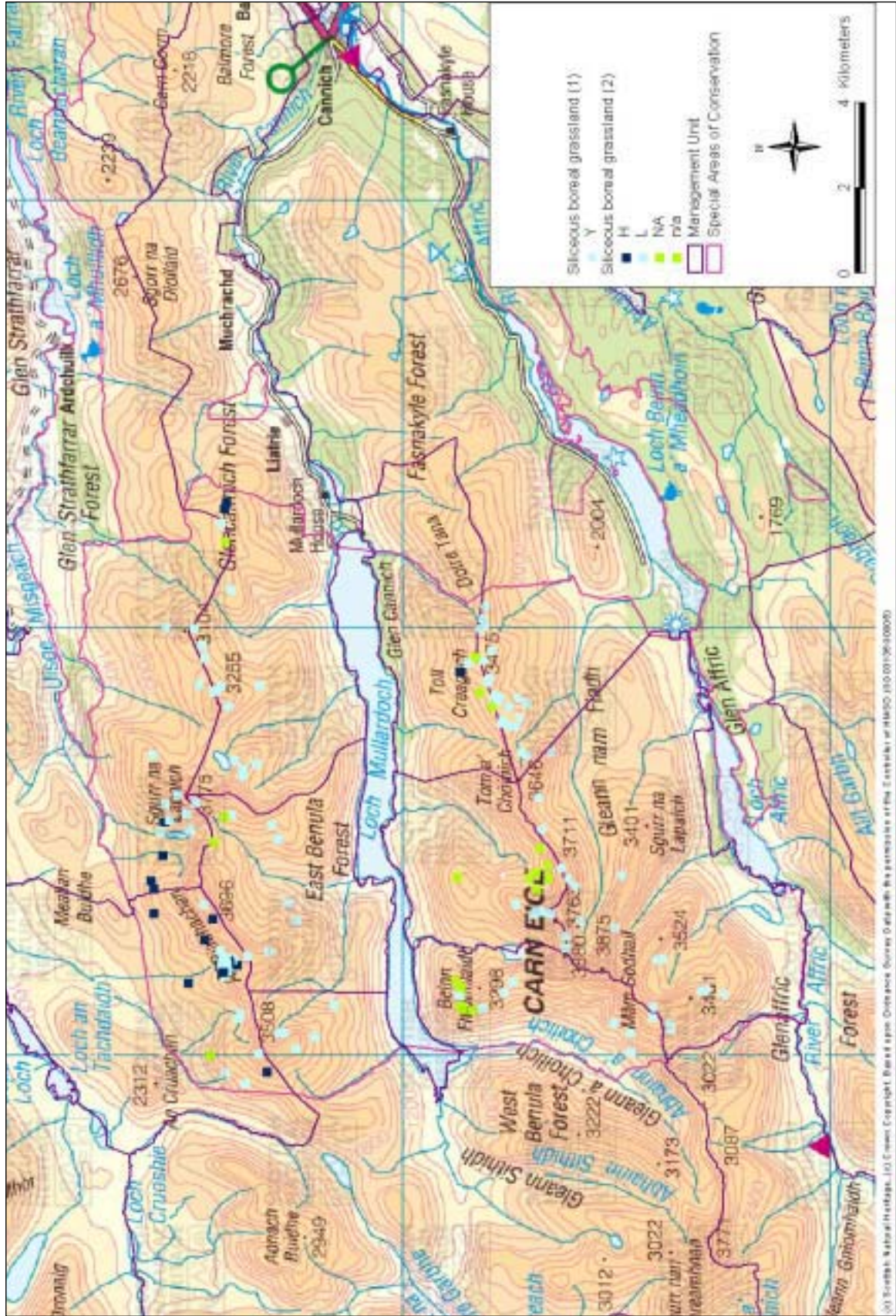
***Siliceous boreal grassland (2)***

Extent, location and size of patches of bare ground (not gravel) and breaks in the vegetation mat.

In areas sheltered from the prevailing wind, patches about 10cm across. **H**

Predominantly on parts of the hill most exposed to the prevailing winds, variable size.  
Very little bare ground elsewhere. **L**

**Map 4** Trampling indicators: Siliceous boreal grasslands – proportion of bare ground



**Map 5** Browsing indicators – alpine heath

**Alpine heath (1)**

Less than 33% of shoots of dwarf-shrubs showing signs of browsing. Y

Greater than 33% of shoots of dwarf-shrubs showing signs of browsing N

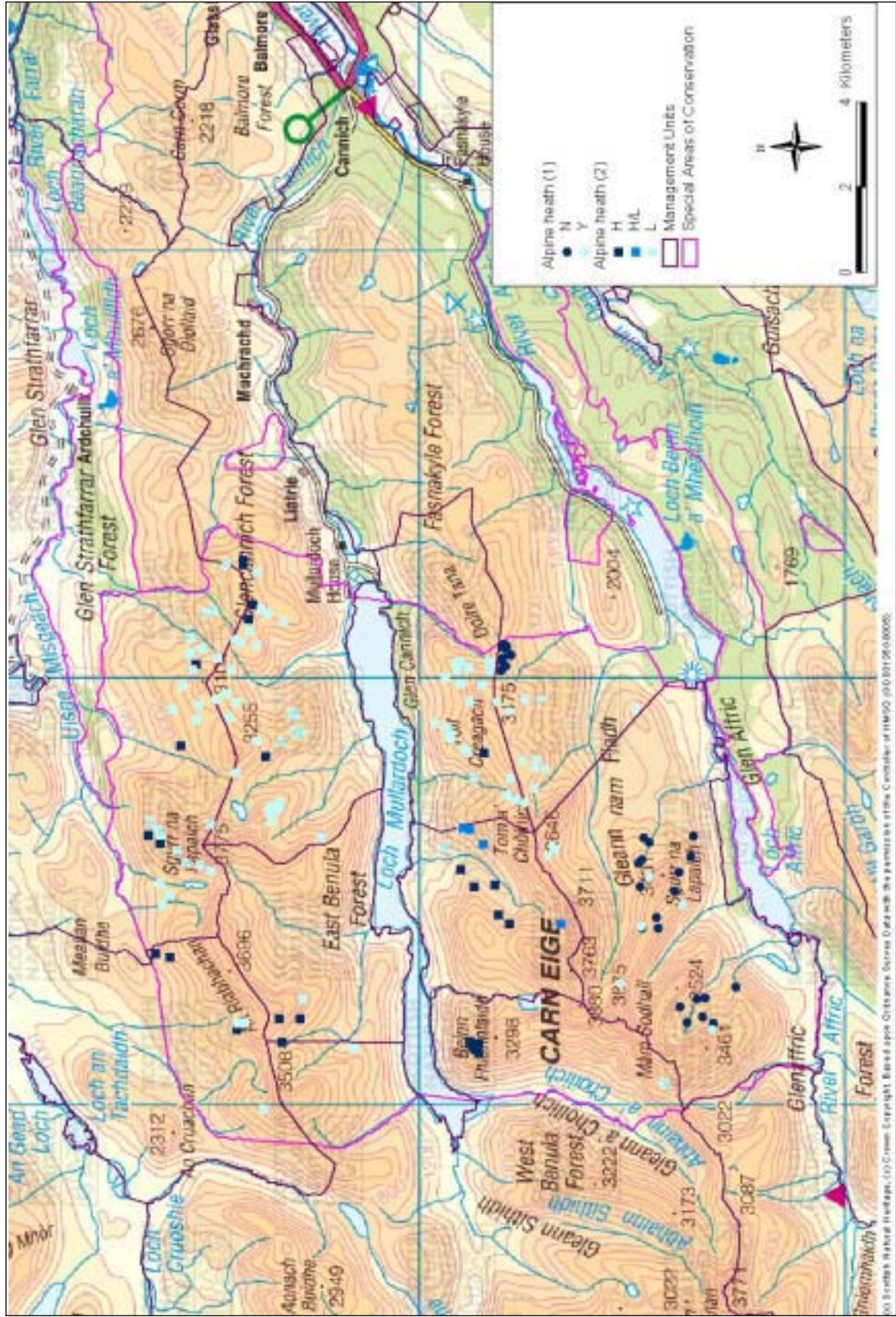
**Alpine heath (2)**

Browsing of any dwarf shrubs present;

Noticeable, but not necessarily conspicuous. Moderately to heavily browsed. H

Negligible, browsed shoots very difficult to find L

Map 5 Browsing indicators: alpine heath – proportion of dwarf shrubs browsed



**Map 6** Trampling indicators – alpine heath

**Alpine heath (1)**

Less than 10% of the ground is disturbed bare ground. **Y**

More than 10% of the ground is disturbed bare ground. **N**

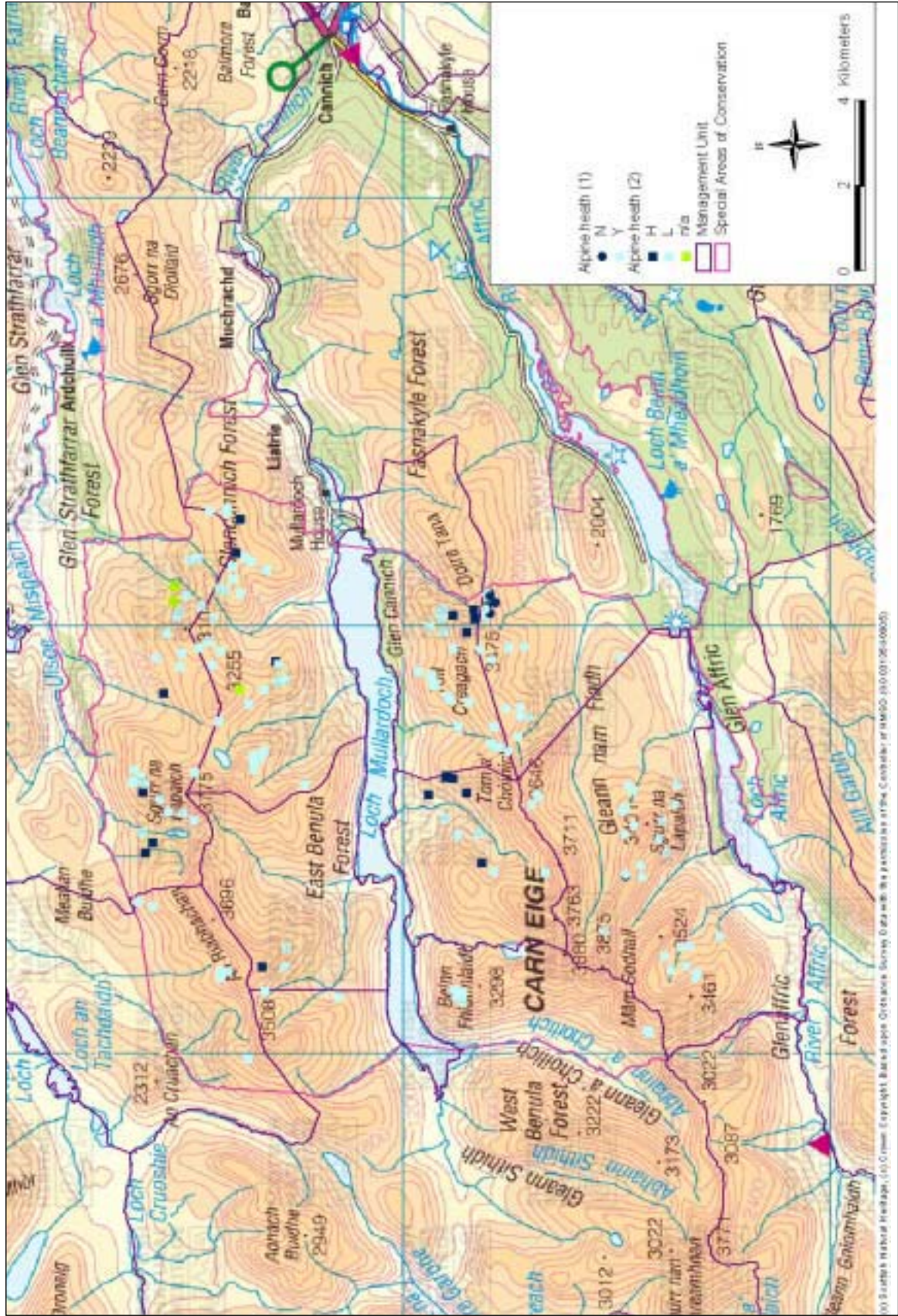
**Alpine heath (2)**

Extent, location and size of patches of bare ground (not gravel) and breaks in the vegetation mat.

In areas sheltered from the prevailing wind, patches about 10cm across. **H**

Predominantly on parts of the hill most exposed to the prevailing winds, variable size.  
Very little bare ground elsewhere. **L**

Map 6 Trampling indicators: alpine heath – proportion of bare ground



**Map 7**      **Browsing indicators – dry heath**

**Dry heath (1)**

Less than 33% of the shoots of dwarf-shrub species collectively (excluding *Betula nana* and *Myrica gale* shows signs of browsing. **Y**

More than 33% of the shoots of dwarf-shrub species collectively (excluding *Betula nana* and *Myrica gale* shows signs of browsing. **N**

**Dry heath (2)**

The average proportion of long-shoots of *Calluna vulgaris* and/or *Vaccinium myrtillus* shows signs of having been browsed.

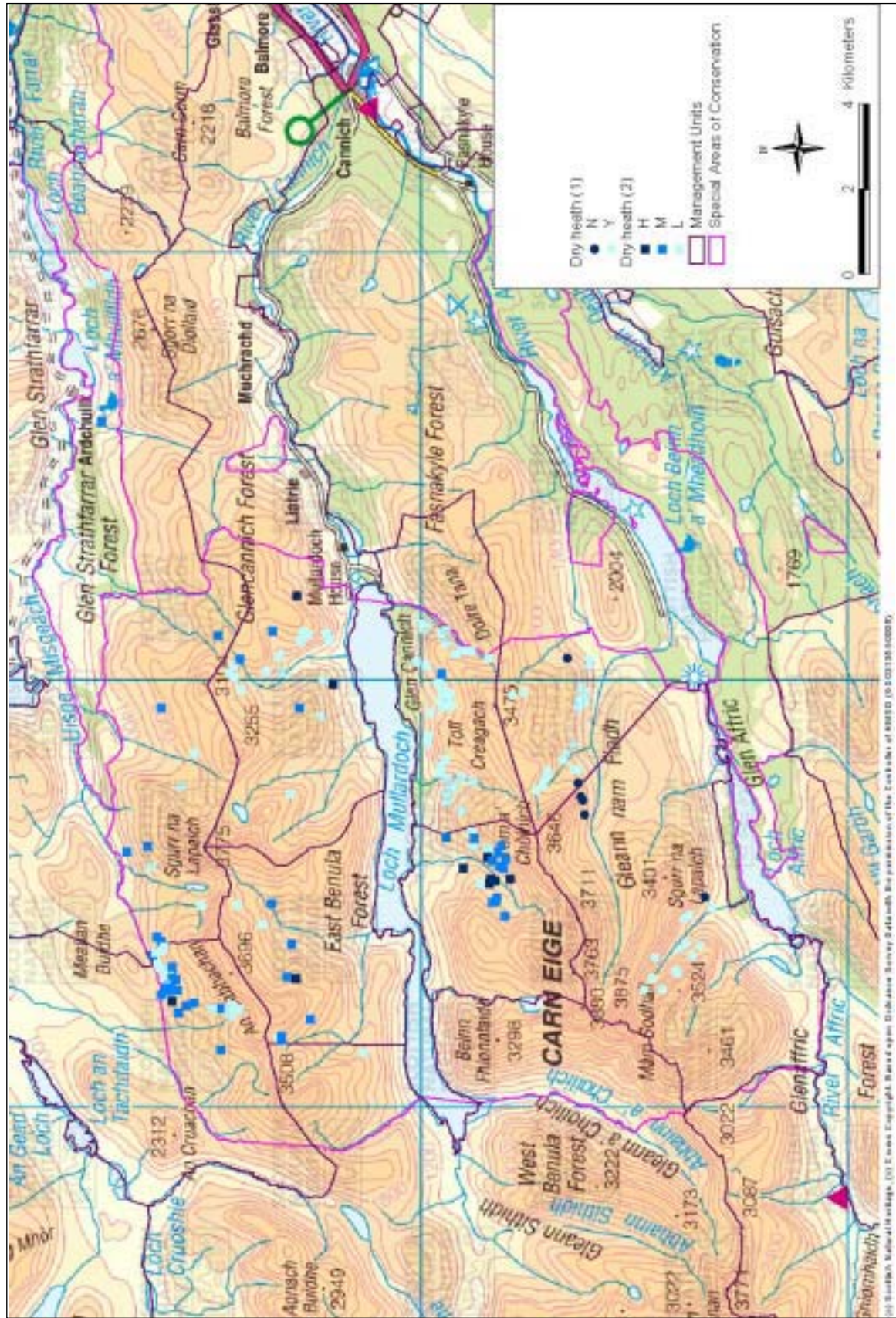
>33% Browsing conspicuous. **H**

16–33% Browsed shoots found after intensive and extensive searching. **M**

<16%. Browsed shoots very difficult to find. **L**

Hence Y in Dry heath (1) encompasses M and L in Dry heath (2).

**Map 7** Browsing indicators: dry heath – proportion of dwarf shrubs browsed



**Map 8** Trampling indicators – dry heath

**Dry heath (1)**

Less than 10% of the ground cover made up of bare ground. Y

Less than 10% of the ground cover made up of bare ground. N

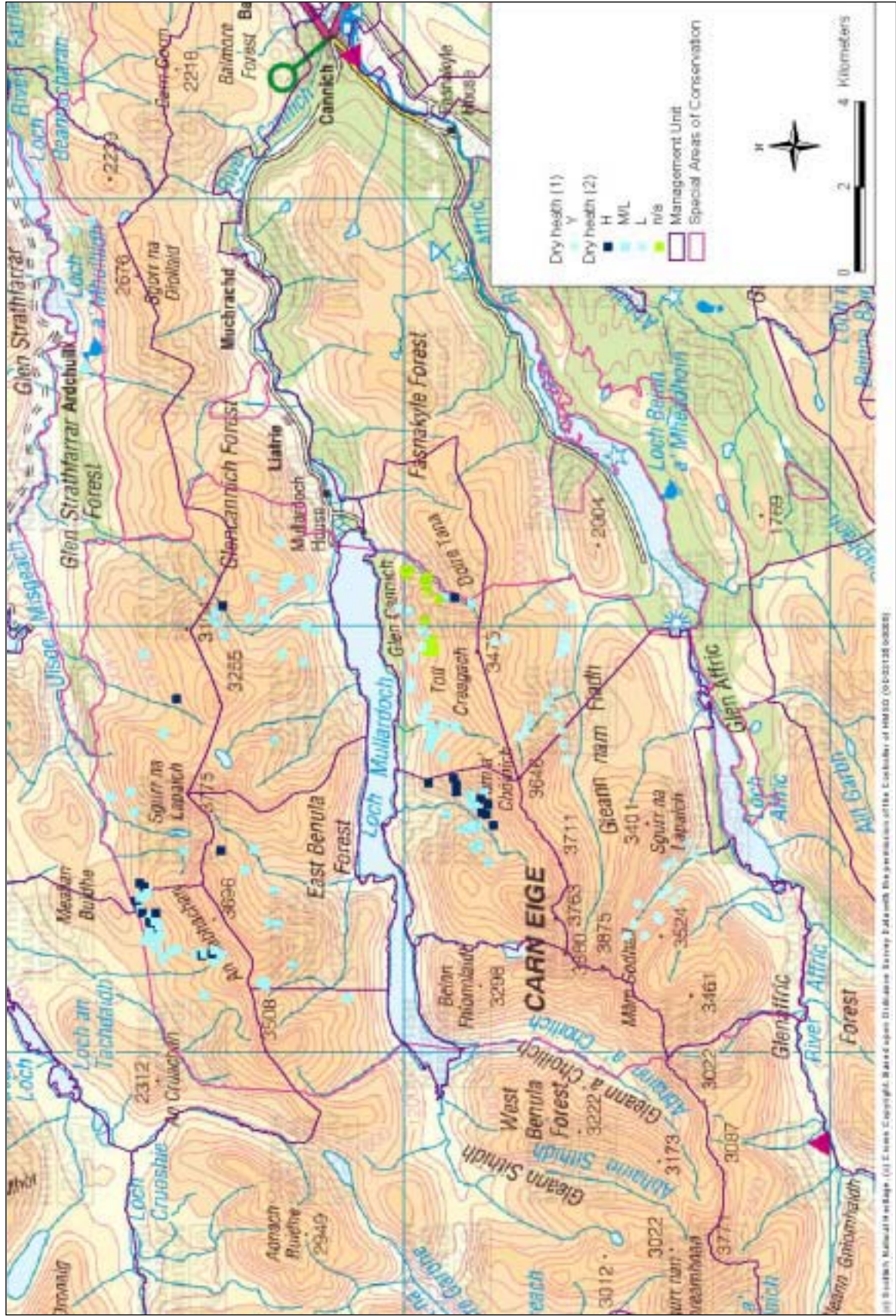
**Dry heath (2)**

Amount of trampled, bare ground.

Frequent, especially in recently burnt patches. H

Little or none except for sporadic sheep scars, or scrapes by hares rabbits,  
or in recently burnt patches (and then only sporadic). M/L

**Map 8** Trampling indicators: dry heath – proportion of bare ground



**Map 9**      Browsing indicators – Wet heath

**Wet heath (1)**

Less than 33% of the shoots of dwarf-shrub species collectively (excluding *Betula nana* and *Myrica gale*), shows signs of browsing. Y

More than 33% of the shoots of dwarf-shrub species collectively (excluding *Betula nana* and *Myrica gale*), shows signs of browsing. N

**Heathy Wet heath (2)**

The average proportion of long-shoots of *Calluna vulgaris* and/or *Vaccinium myrtillus* shows signs of having been browsed.

>33% Browsing conspicuous. H

16–33% Browsed shoots found after intensive and extensive searching. M

<16% Browsed shoots very difficult to find. L

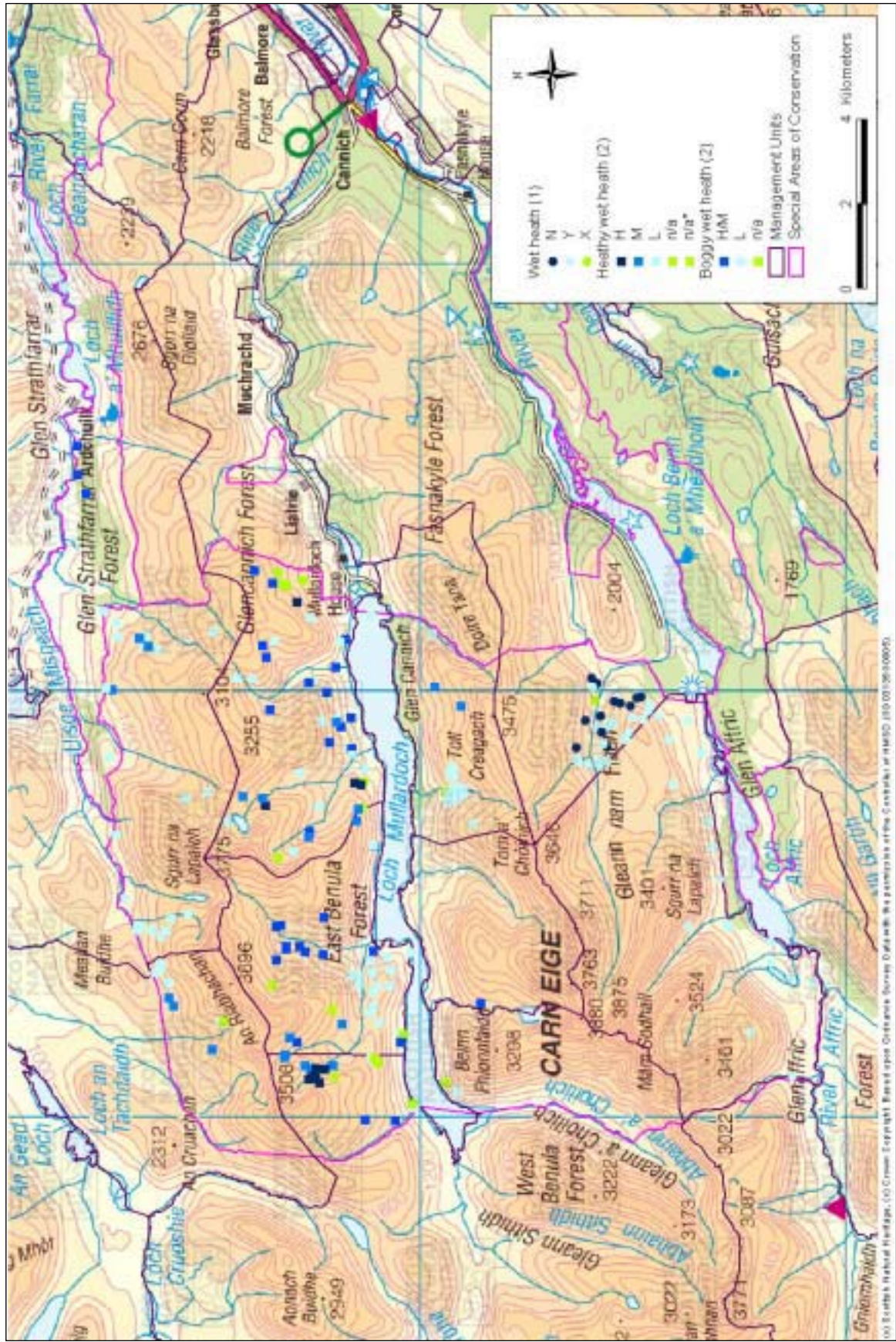
**Boggy Wet Heath (2)**

Conspicuousness of browsing of *Calluna vulgaris* or *Vaccinium myrtillus*.

Clearly browsed in general appearance though browsing may be patchy.  
Browsed shoots easy to find. H/M

Not obviously browsed. Browsed shoots difficult to find without both intensive and extensive searching. L

Map 9 Browsing indicators: Wet heath – proportion of dwarf shrubs browsed



**Map 10** Trampling indicators – wet heath

**Wet heath (1)**

Less than 10% of the ground is disturbed bare ground. Y

More than 10% of the ground is disturbed bare ground. N

**Heathy Wet Heath (2)**

Amount of trampled, bare ground.

Frequent, especially in recently burnt patches. H

Little or none except for sporadic sheep scars, or scrapes by hares, rabbits, or in recently burnt patches (and then only sporadic). M/L

**Boggy Wet Heath (2)**

Trampling of *Sphagnum* moss hummocks and lawns.

Most *Sphagnum* moss surfaces broken by hoof prints over most of the bog surface. Loose and leached portions of *Sphagnum* mosses frequent. H

Minority of *Sphagnum* moss surfaces broken by hoof prints, locally distributed over the bog surface. Loose and bleached portions of *Sphagnum* mosses very local. M

Most *Sphagnum* moss surfaces intact. Evidence of hoof prints only found after extensive searching. Loose and bleached portions of *Sphagnum* mosses absent or very infrequent. L



**Map 11 Browsing indicators – blanket bog**

**Blanket bog (1)**

Less than 33% of the shoots of dwarf-shrub species collectively (excluding *Betula nana* and *Myrica gale*), shows signs of browsing.

Y

Greater than 33% of the shoots of dwarf-shrub species collectively (excluding *Betula nana* and *Myrica gale*), shows signs of browsing.

N

**Blanket bog (2)**

Conspicuousness of browsing of *Calluna vulgaris* or *Vaccinium myrtillus*.

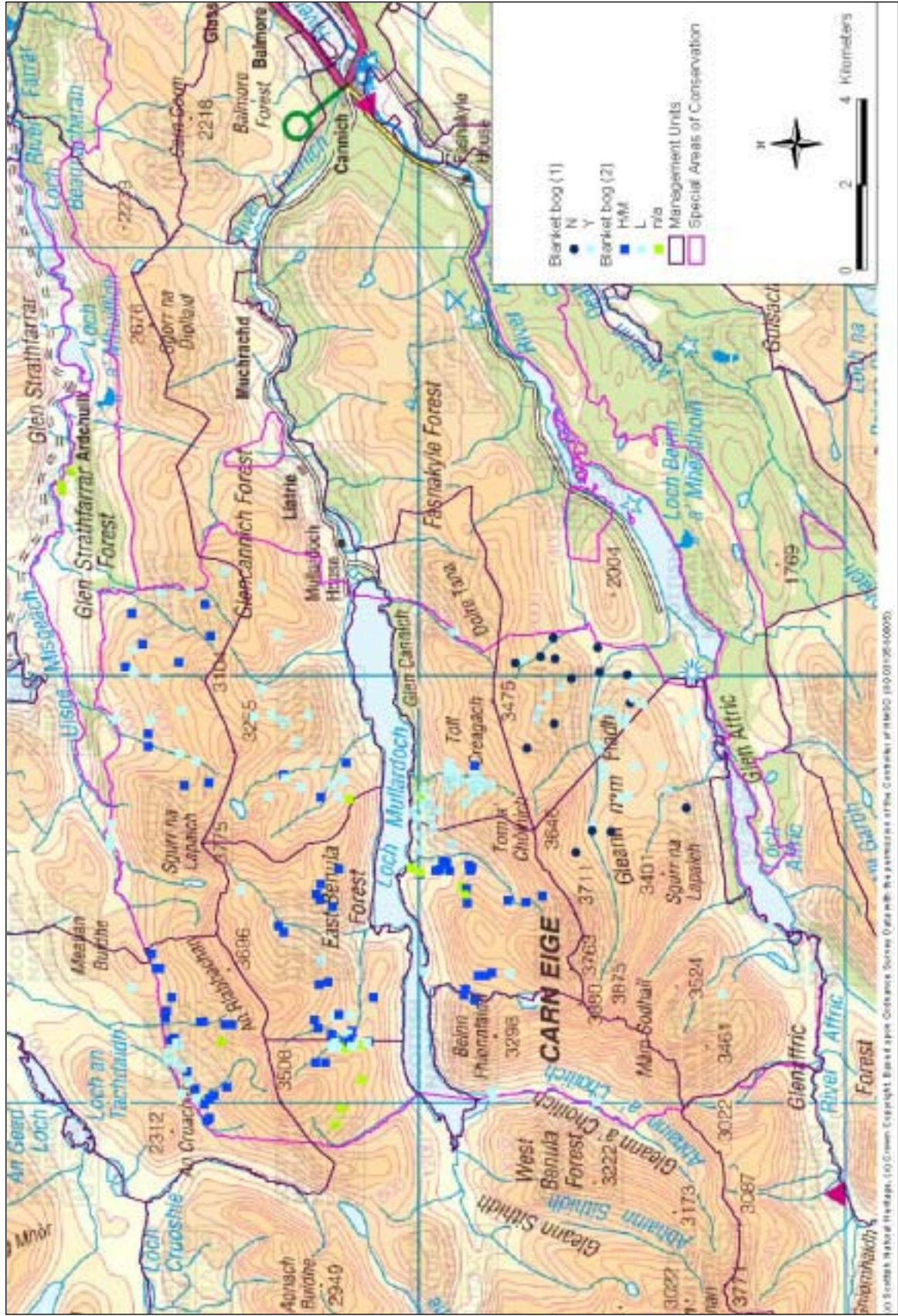
Clearly browsed in general appearance though browsing may be patchy. Browsed shoots easy to find.

H/M

Not obviously browsed. Browsed shoots difficult to find without both intensive and extensive searching.

L

Map 11 Browsing indicators: blanket bog – proportion of dwarf browsed



**Map 12** Trampling indicators – blanket bog

**Blanket bog (1)**

Less than 10% of the *Sphagnum* cover crushed, broken, and/or pulled-up. **Y**

More than 10% of the *Sphagnum* cover crushed, broken, and/or pulled-up. **N**

**Blanket bog (2)**

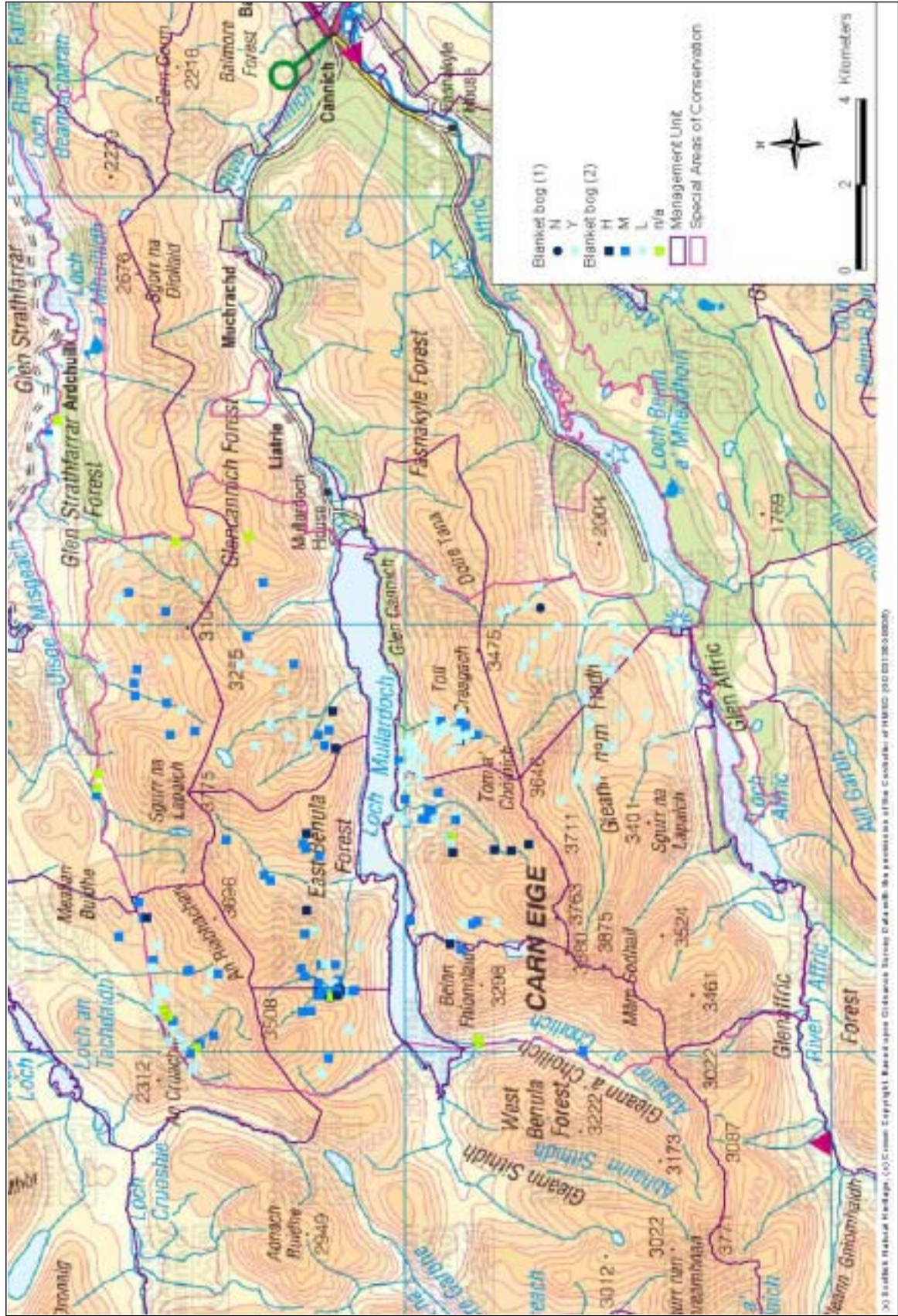
Trampling of *Sphagnum* moss hummocks and lawns.

Most *Sphagnum* moss surfaces broken by hoof prints over most of the bog surface.  
Loose and leached portions of *Sphagnum* mosses frequent. **H**

Minority of *Sphagnum* moss surfaces broken by hoof prints, locally distributed over the bog surface. Loose and bleached portions of *Sphagnum* mosses very local. **M**

Most *Sphagnum* moss surfaces intact. Evidence of hoof prints only found after extensive searching. Loose and bleached portions of *Sphagnum* mosses absent or very infrequent. **L**

Map 12 Trampling indicators: blanket bog – proportion of mosses trampled



**Map 13** Browsing indicators – minor habitats

***Siliceous scree (1) and Siliceous rocky slopes (1) & (2)***

Less than 50% of live leaves (forbs) and/or the shoots (dwarf-shrubs) shows signs of having been grazed or browsed. Y

>50% N

***Tall herbs (2)***

Signs of grazing, vigour and flowering of commoner tall herbs.

All plants obviously heavily cropped, probably dwarfed if present, non-flowering. Only *Luzula sylvatica* likely to be abundant. H

Some plants partially cropped or ungrazed. Some species in addition to *Luzula* recognisable and sparsely flowering. M

Many plants only partially cropped or ungrazed. L

***Willow scrub (2)***

Evidence of browsing of trees and shrubs.

Distinct browse line or severe clipping – topiary form. H

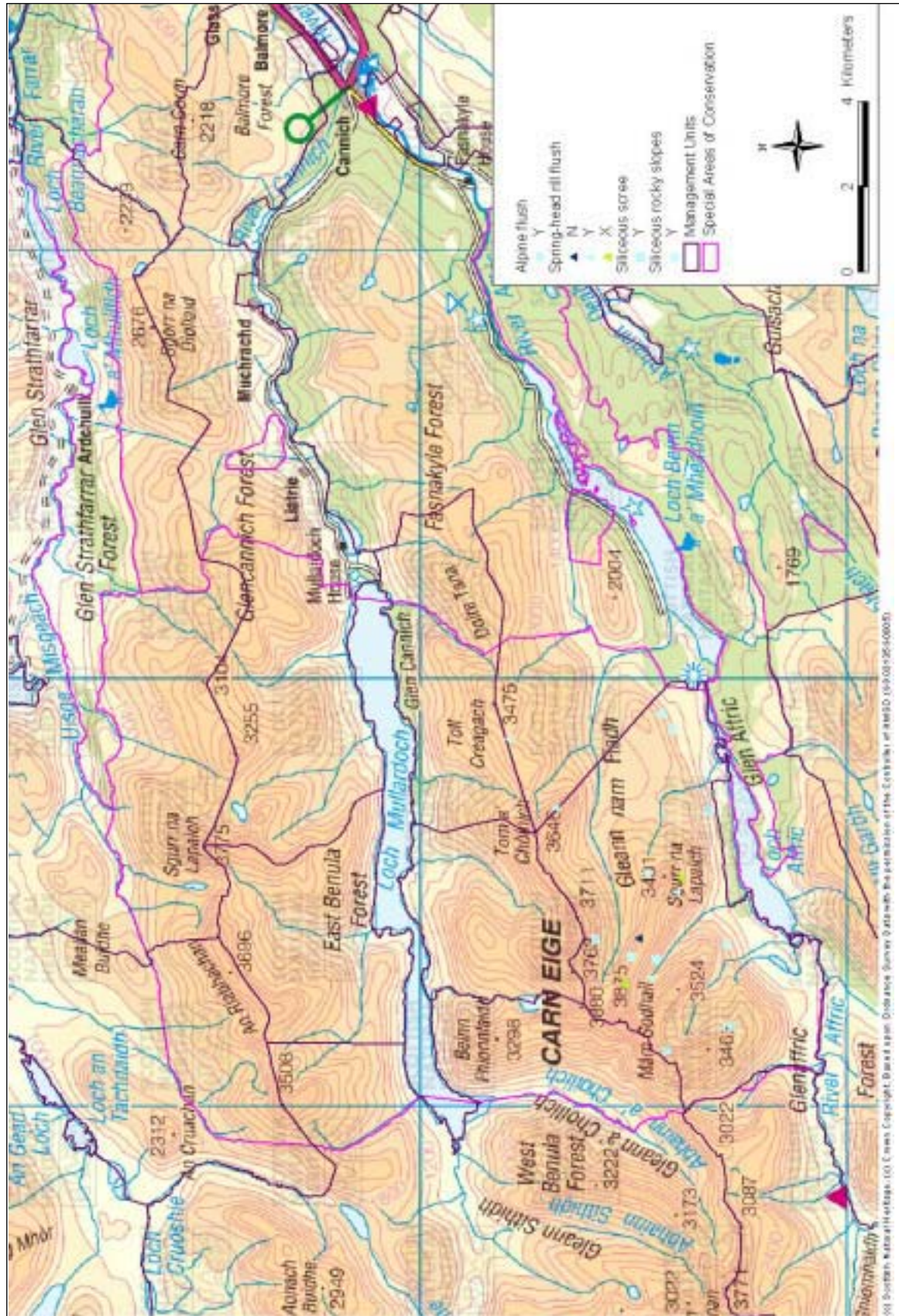
Diffuse or patchy browse line – no effects on form. M

No obvious browse line, browsed shoots difficult to find. L

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N.B. There are only a few points with trampling indicators for willow scrub and siliceous scree, hence these are not shown.

Map 13 Browsing indicators: minor habitat types – proportion of leaves and shoots browsed



**Map 14** Browsing indicators – flushes

***Alpine flush (1)***

At least one flowering shoot of each of the arctic-alpine species present not grazed. Y

Failure to achieve above. N

***Spring-head rill flush (1)***

For M32, M35, M37, M38 less than 50% of live leaves of sedges and grasses should show any evidence of having been grazed, and for M7, M8, M31, M33, M34 less than 25% of live leaves of sedges and grasses shows any evidence of having been grazed. Y

>50% N

***Alpine, Alkaline and spring-head rill flushes (2)***

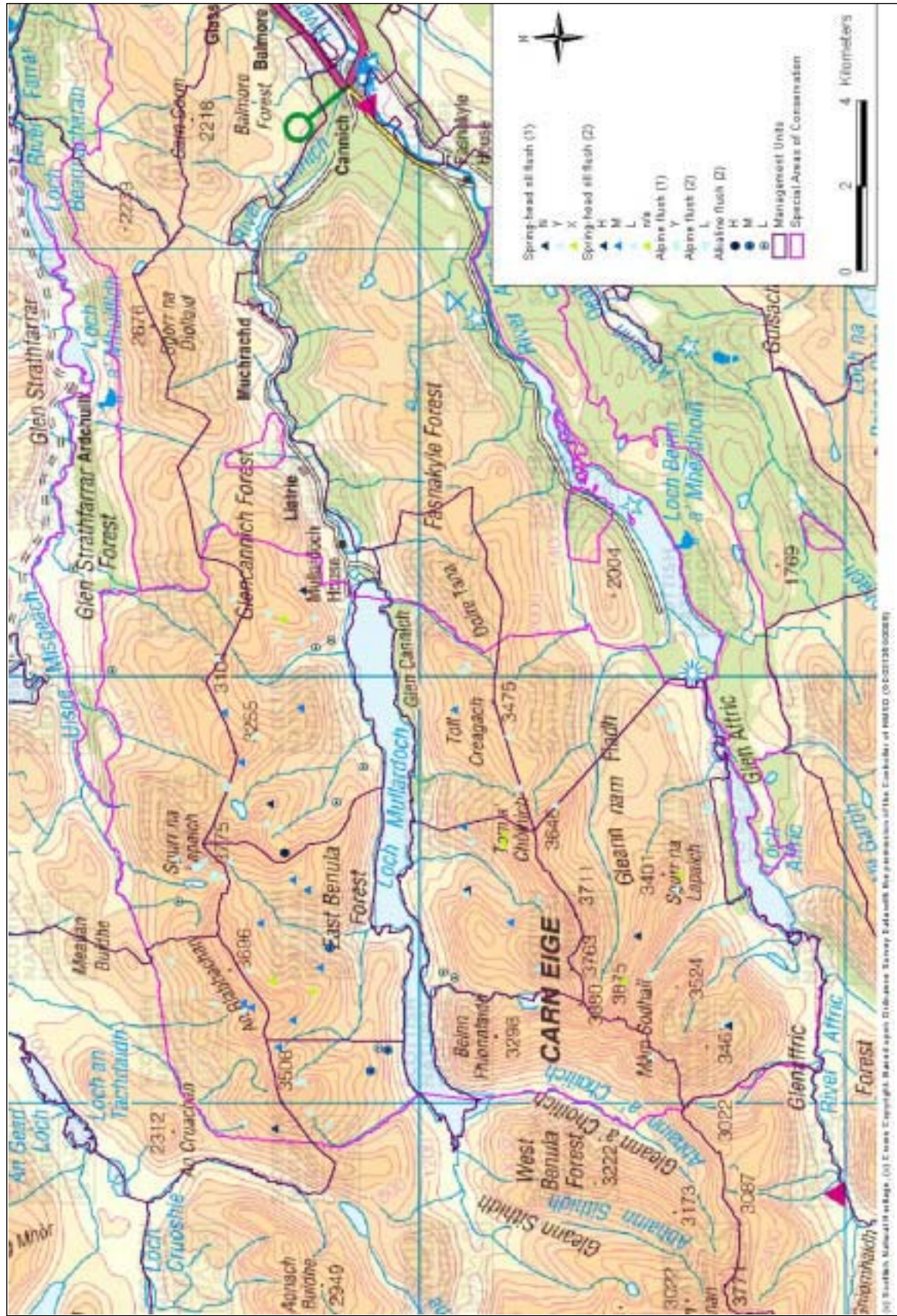
Percentage of leaves of sedges and grasses which collectively show signs of having been grazed.

>50% H

25–50% M

<25% L

Map 14 Browsing indicators: flushes – proportion of leaves and shoots browsed



**Map 15** Trampling indicators – flushes

***Alpine flush (1), Spring-head rill flush (1)***

Over the whole feature, less than 10% of ground cover is disturbed bare ground. **Y**

Over the whole feature, more than 10% of ground cover is disturbed bare ground. **N**

***Alpine, Alkaline and spring-head rill flushes (2)***

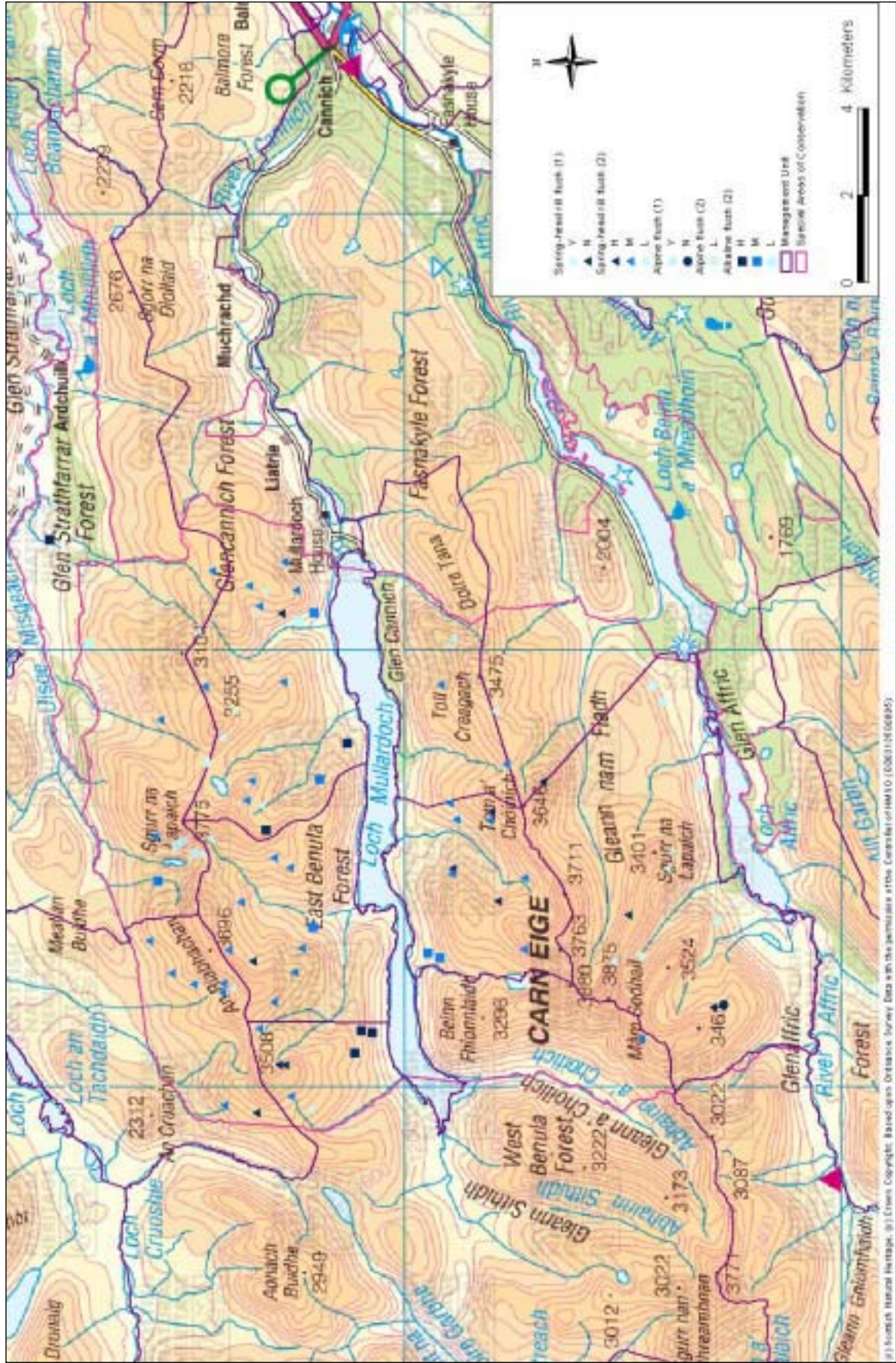
Percentage of surface churned and deeply pock-marked with hoof prints.

>50% of surface, hoof prints clearly visible over virtually entire flush. **H**

<50% of surface, hoof-prints not clearly visible, or absent from some parts of the flush. **M**

Relatively smooth surface (vegetated, or of silt or gravel hoof prints sparse or absent. **L**

**Map 15** Trampling indicators: flushes – presence of trampling/poaching



**Map 16** Caledonian Forest – current impacts

The map illustrates the sum of current impacts – this is an aggregate of the following individual indicators:

Browsing of field layers – assessed as 'H', 'M' or 'L'.

Potential for and presence of regeneration – where present classified as;

1 = below height of surrounding vegetation,

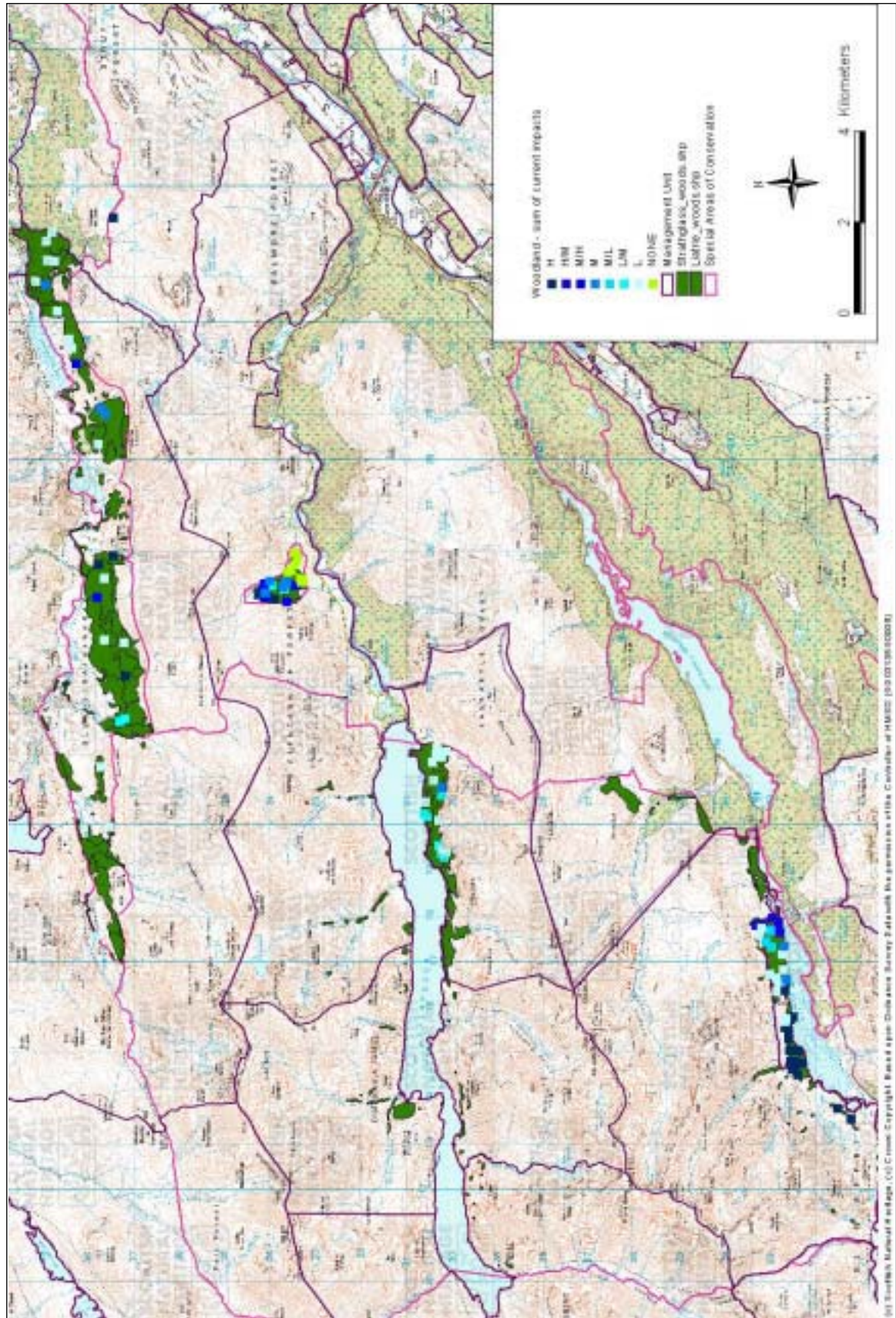
2 = above the height of the surrounding vegetation or

3 = above 1.5m

Damage to regeneration – recorded as <1/3, >1/3 or >2/3

Trampling and dunging – recorded as 'H', 'M' or 'L'.

Map 16 Caledonian Forest: summary of current impact indicators



**Map 17** Caledonian Forest – life classes

Presence of different life-classes at sample points:

Mauve = young classes present (2 and or 3)

Pink = only mature and older classes present

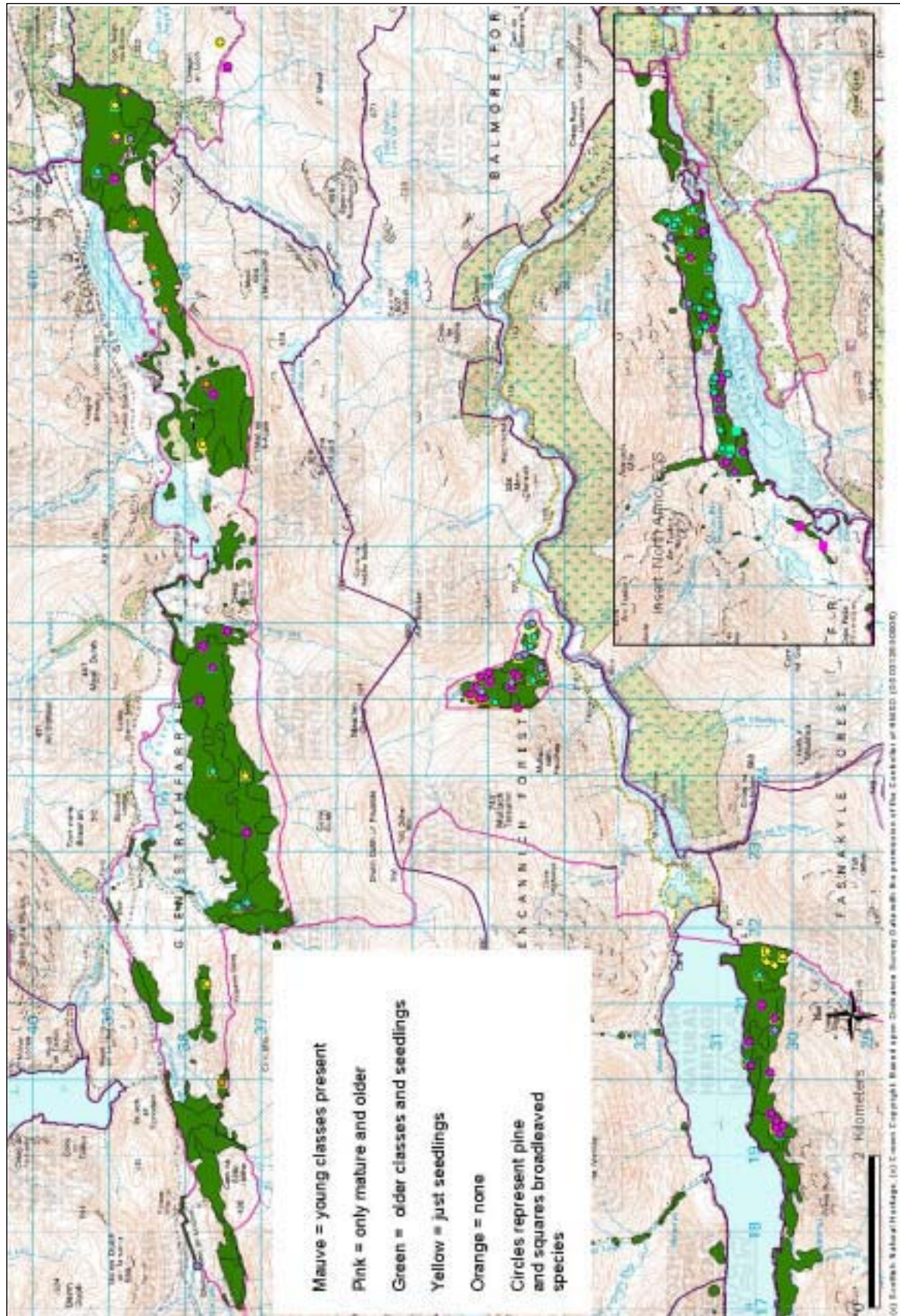
Green = mature or older classes plus seedlings

Yellow = just seedlings

Orange = none

Circles represent pine and squares broadleaved species

Map 17 Caledonian Forest – life classes present at sample points



## **Caledonian Forest – regeneration**

### **Map 18** North Affric, FCS Fasnakyle and Mullardoch

These maps illustrate the presence of regeneration at sample points:

The presence of regeneration is only assessed where there is judged to be the potential – i.e. canopy gaps and woodland edge, seed sources and a suitable substrate. The presence of regeneration is classified as;

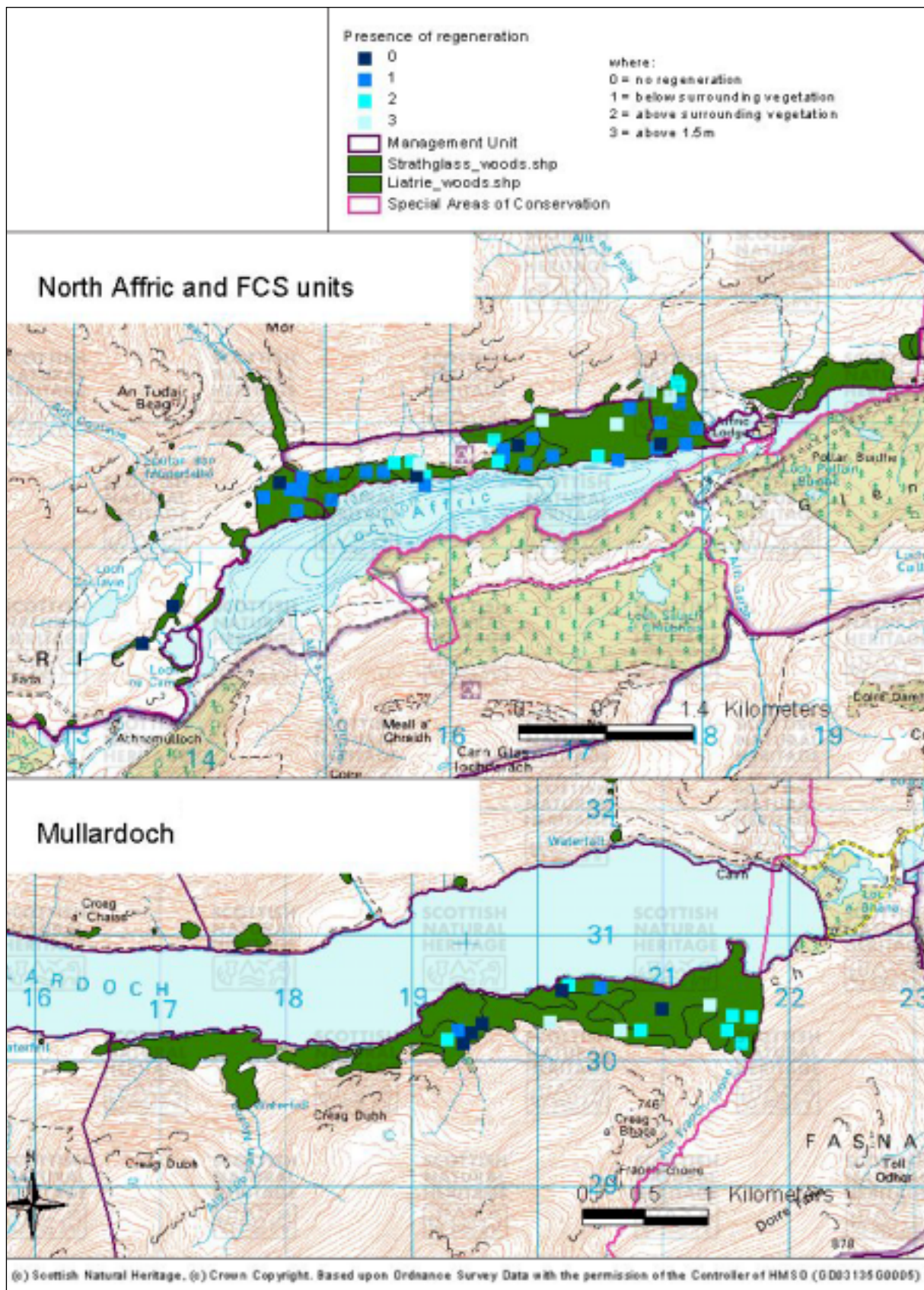
0 = no regeneration

1 = below height of surrounding vegetation,

2 = above the height of the surrounding vegetation or

3 = above 1.5m

Map 18 North Affric, FCS Fasnakyle and Mullardoch



## **Caledonian Forest – regeneration**

### **Map 19 Braulen and Glencannich (Liatrie Burn SSSI)**

These maps illustrate the presence of regeneration at sample points:

The presence of regeneration is only assessed where there is judged to be the potential – i.e. canopy gaps and woodland edge, seed sources and a suitable substrate. The presence of regeneration is classified as;

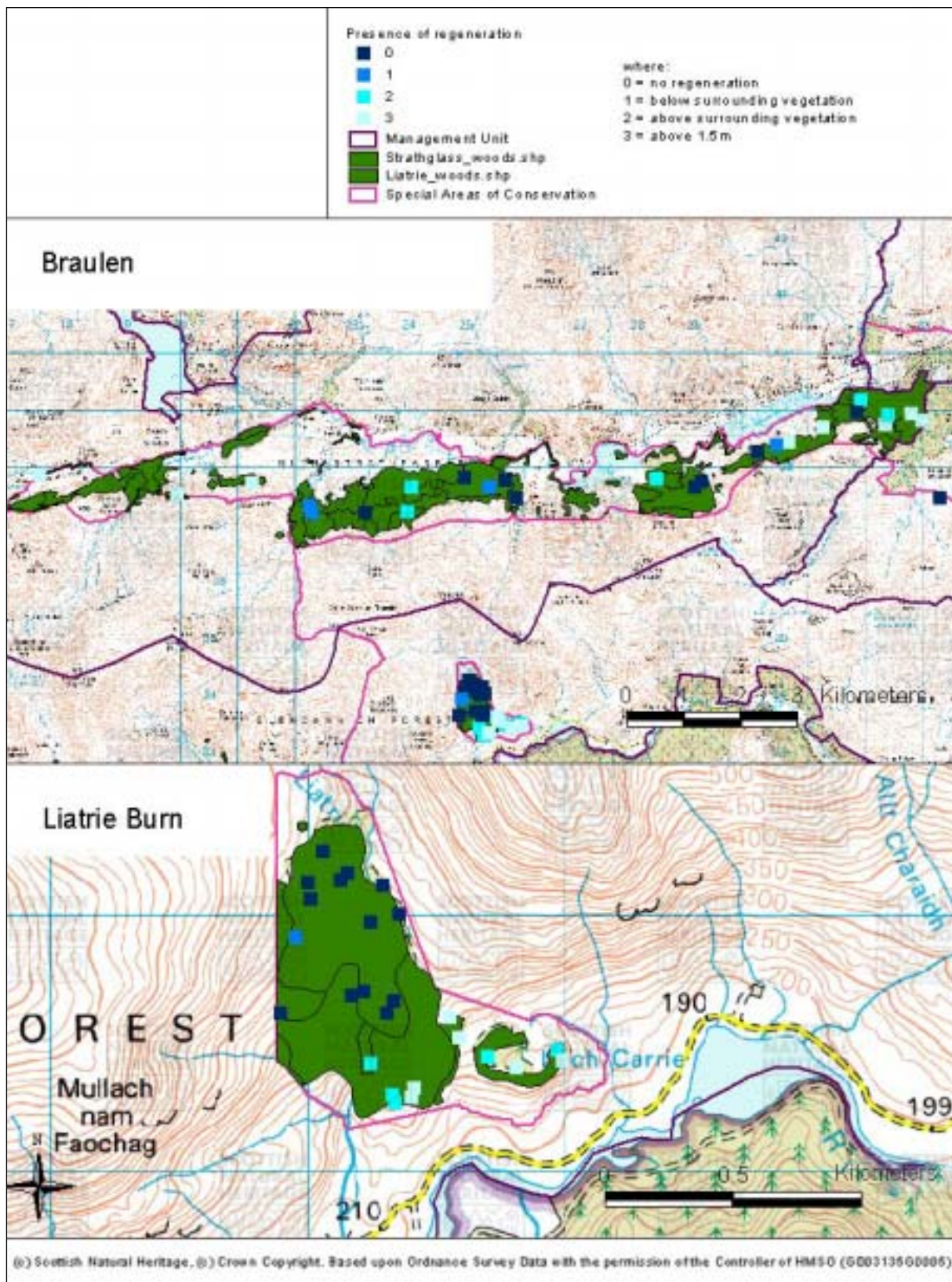
0 = no regeneration

1 = below height of surrounding vegetation,

2 = above the height of the surrounding vegetation or

3 = above 1.5m

Map 19 Braulen and Glencannich (Liatric Burn SSSI)



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