

# Assessments of grazing and trampling impacts on upland habitats in the Cairngorms Core Area 1995-2000





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# COMMISSIONED REPORT

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**Commissioned Report No. 322**

**Assessments of grazing and trampling impacts  
on upland habitats in the Cairngorms Core Area  
1995-2000**

(ROAME No. RASD/091A/97/CNG)

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## COMMISSIONED REPORT

# Summary

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### **Assessments of grazing and trampling impacts on upland habitats in the Cairngorms Core Area 1995-2000**

Commissioned Report No. 322 (ROAME No. RASD/091A/97/CNG)

Contractor: Scottish Natural Heritage

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Author: David Horsfield

#### **Background**

A survey of grazing, browsing and trampling impacts of large herbivores in the Cairngorms was carried out between 1995 and 2000 to assist the Cairngorms Partnership and Scottish Natural Heritage develop a management strategy for moorland and montane habitats.

Impacts on moorland and montane habitats in the Cairngorms Core Area were assessed in each 0.25 km square of the O.S. grid. The habitats assessed were dwarf-shrub heath, wind-clipped summit heath, blanket bog and grassland. The impact levels scored were light, moderate and heavy, which with mixed categories gave six classes in total. The objective of the assessments was to identify areas where habitats were impacted at levels likely to result in damage, deterioration or loss of the habitat. The survey also provided information on the causes of the impacts. Data were also gathered on the presence of large herbivores and tree and scrub regeneration.

#### **Main findings**

- Grazing or browsing and trampling impacts were assessed within 3903 0.25 km squares of which almost 74% were given overall impact scores of light or light to moderate, with 15% moderate or light to heavy, while about 11% were assessed as moderate to heavy or heavy impacts where damage to habitats is likely.
- Tree and scrub regeneration was recorded from 33% of survey squares but browsing on saplings was noted in almost 80% of these squares.
- Deer (mainly red deer) were recorded from 88% of the survey squares.
- Sheep were recorded from 12% of survey squares while cattle were recorded only from 0.9% of squares.
- Grazing or browsing and trampling impacts were attributable to both red deer and sheep.
- Generally, heavy grazing and trampling impacts, where the habitats were likely to suffer damage and deterioration, were localised.
- The main concentrations of moderate to heavy and heavy impacts were on the vegetation of the base-rich Moinian and Dalradian rocks surrounding the acid granite core in Upper Deeside, Geldie Burn, Glen Quoich, Gleann an t-Slugain, Glen Feshie, Pityoulish, Dorback Burn-Braes of Abernethy, Inchroy, Craig Leek and Glen Clunie.

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**APPENDIX 3 Data file for the project**

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## **1 INTRODUCTION**

In the Cairngorms high numbers of red deer and in places sheep, coupled with current management practices, threaten the existence of moorland and montane habitats that are susceptible to grazing and trampling impacts. A survey of grazing, browsing and trampling impacts of large herbivores in the Cairngorms was carried out to assist the Cairngorms Partnership (Cairngorms Working Party 1993) and Scottish Natural Heritage to develop a management strategy for moorland and montane habitats. The approach of MacDonald *et al.* (1998a, b) was adopted in carrying out the impact assessments.

The aim of the work was to provide impact assessments for four broad habitats of the moorland and montane areas of the Core Area of the Cairngorms (lying within the current Cairngorms National Park). The habitats assessed were dwarf-shrub heath, wind-clipped summit heath, blanket bog and grassland. Collectively these habitats make up the bulk of the vegetation cover of the survey area. The objective of the assessments was to identify areas where habitats were impacted at levels likely to result in damage, deterioration or loss of the habitat. The survey also provided information on the causes of the impacts. Data were also gathered on the presence of large herbivores and tree and scrub regeneration.

Maps are provided of impact assessments for individual habitats and a summary or overall impact map based on taking the assessments for the more susceptible habitats in each survey square. Different levels of impact on the habitats give different outlooks for maintenance or deterioration of the habitat. Generally, heavy grazing and trampling impacts, where the vegetation was likely to suffer damage and deterioration, were only locally extensive. The vegetation of the granite core of the Cairngorms has mainly low impacts while the vegetation of the base-rich Moinian and Dalradian rocks surrounding the granite core show proportionally more high and moderate impacts.

## **2 METHODS**

### **2.1 Field methods**

The field methods were based on MacDonald *et al.* (1998a, b) and are similar to those used in many impact assessments, including Stolte, Henderson and Nolan (1998), Stolte *et al.* (1998), Henderson *et al.* (2000) and McConnell Associates (2001).

Grazing or browsing and trampling impacts in the habitats were assessed within 500 m x 500 m squares based on a subdivision of the O.S. 1 km square grid to give 0.25km square survey squares (referred to as "0.25 km squares"). Habitats assessed were dwarf-shrub heath, wind-clipped summit heath, blanket bog and grassland (smooth and tussock) (Appendix 1, MacDonald *et al.* 1998a).

The impact assessments were based on MacDonald *et al.* (1998a, b), which gives a series of field indicators for various habitats related to different categories or scores of grazing/browsing and trampling impact. Indicators used for the assessments included:

- Direct impacts on plants, such as the proportion of leaf or shoot removed due to grazing or browsing.
- Amount of bare and trampled ground.
- Frequency of erosion scars.
- Amount of herbivore dung deposited.
- Rates of flowering and fruiting of plant species.
- Sward height and cover.
- Growth form of different plant groups.

Trend indicators were used to indicate change in impact over the past year or a few years. These include:

- Persistent grazing- or browsing-induced plant growth forms.
- Relative heights of grasses and dwarf-shrubs.

Locating the 0.25 km squares and navigation was made with the help of O.S. 1:25,000 scale maps and aerial photographs. In 1995 areas of different habitats within survey squares were calculated from LCS88 maps (MLURI 1993), while from 1996, the extent of the habitats within each survey square was estimated as a percentage cover of the square in the field. In 1995, impacts were assessed where, individually, one or more of the target habitats were estimated to occupy at least 1 ha (4% of a survey square). In 1996 and subsequent years this was changed to >10%, or at least 2.5 ha, of the area of a 0.25 km square.

Impact assessments were undertaken by walking through the survey squares to observe and record the grazing and trampling indicators and their extent in the habitats. Routes over uniformly impacted habitats were a diagonal or “V” shape across a square or patch of habitat. In the case of more complex habitat mosaics and topography, routes that were more complex were taken to cover the full range of variation in vegetation and impacts.

Each habitat within a 0.25 km square was assigned an impact score depending on the overall level of the scores of the various indicators used. There were three main impact scores (light L, moderate M and heavy H) for most habitats. Habitats could also be assigned intermediate or mixed scores where more than one impact level occurred within the survey square to give six scores in total (L, LM, M, LH, MH, H). Only three impact scores: light, heavy and an intermediate or mixed score of light to heavy were available for wind-clipped summit heath (MacDonald *et al.* 1998b). In 1996 and in subsequent years the impact levels for each habitat were assigned to one of three ranges of proportion of habitat with particular scores within the survey square: 10<25%, 25-50%, >50%.

Within each 0.25 km square the presence of saplings of Scots pine, birch, rowan, willow and juniper growing above the level of the heather canopy was noted. The presence of browsing on the saplings was also recorded.

The presence of large herbivores including red deer, roe deer, reindeer, stock species sheep and cattle, lagomorphs, grouse and ptarmigan was recorded.

## **2.2 Presentation of results**

### *2.2.1 Impact and condition assessments*

Field survey data were recorded for each 0.25 km square on a proforma giving an impact score for each of the habitats assessed and the impact score assessed for each indicator (Appendix 2).

These proforma refer to “condition categories” and “habitat condition assessments” which followed an early draft of MacDonald *et al.* (1998a, b). Since later drafts and the published guide dropped any reference to condition of habitats, to refer instead to impact categories (or scores) but with no other significant changes in the guidance, the latter has been adopted in the presentation of the results.

### *2.2.2 Standardisation of data*

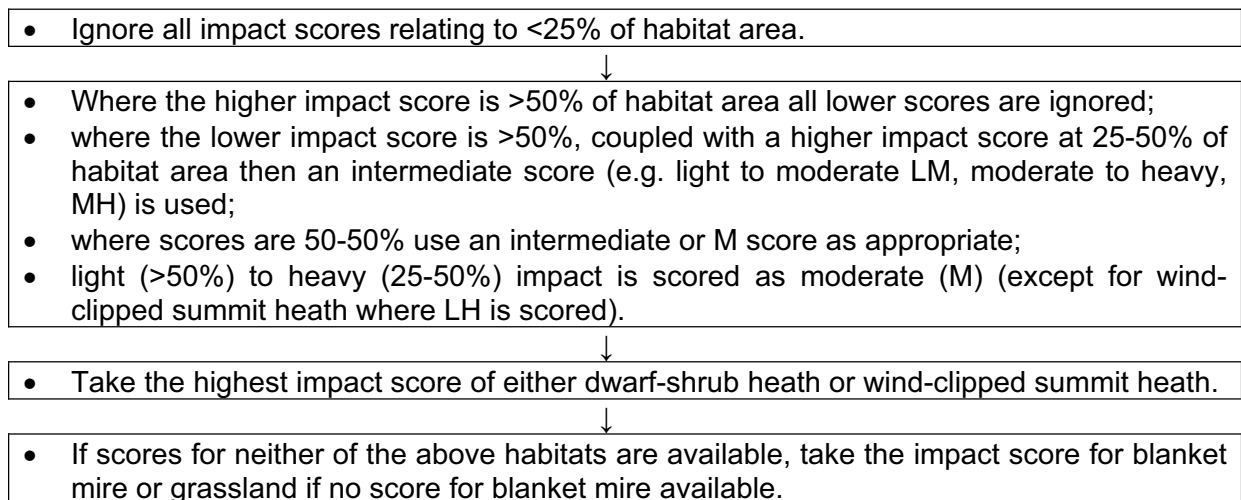
For presentation of the data six impact classes or scores of light (L), light to moderate (LM), moderate (M), light to heavy (LH), moderate to heavy (MH) and heavy (H) are given. The 1995 field data were collected in this form. The field data from 1996 and subsequently, with

three ranges of proportion of impact levels, were standardised to give these six scores. Examples of standardisation are L (>50%) and M (10-25%) for a survey square standardised to LM, and H (>50%) and M (25-50%) standardised to MH.

### 2.2.3 Determination of overall impact

Impact data are presented as an overall or summary impact score following MLURI (Henderson *et al.* 2000, Stolte *et al.* 1998). The MLURI overall assessment gives priority to impact scores for the most sensitive habitats to give a single impact assessment for each 0.25 km square. Dwarf-shrub heath and wind-clipped summit heath are regarded as the most sensitive habitats to herbivore browsing impacts and are given priority in the scoring. The flow chart below gives the procedure for determining the MLURI overall impact score.

*Flow chart for determining the MLURI overall impact assessment for 0.25 km squares (Henderson et al. 2000, Stolte et al. 1998)*



Summarising the data in this way gives six impact scores as in 2.2.2 above.

### 2.2.4 Assignment of survey squares to estates

Where estate boundaries pass through 0.25 km squares the assessments for that square were assigned to the estate with >50% of the square lying within its boundaries based on SNH digitised estate boundaries.

## 3 RESULTS

This report is based on the work of Gill, Sales and Horsfield (1998), Gill and Scott (1996), Pearce (1997a, b) and Rae (1995, 1996 and 1997) who undertook the work on contract to SNH. Data from these surveys were included in Stolte *et al.* (1998), in a report on grazing and trampling impacts within the Cairngorm/Speyside Deer Management Group Area, which overlaps with the Cairngorms Core Area. Horsfield surveyed a gap in the assessments in Glen Clunie in 1999 and 2000. Details of a data file with the results of the project are given in Appendix 3. The file is available by request from the author.

Fig. 1 shows the extent of 0.25 km squares of the impact survey on an O.S. map base. Fig. 2 is a map of the major estates within the Cairngorms Core Area, divided into 0.25 km squares. Fig. 3 is a 0.25 km square distribution map of overall grazing/browsing and trampling impact scores for upland habitats in the Cairngorms Core Area. Table 1 gives the number of overall impact scores at different grazing and trampling impact levels for 0.25 km squares on individual estates. The Cairngorms Core Area was found to be generally not

heavily impacted; almost 74% of 3903 0.25 km squares were assessed as light or light to moderate impact, with 15% moderate or light to heavy, while there were only about 11% of squares assessed as moderate to heavy or heavy.

Figs 4-7 give 0.25 km square distribution maps of standardised grazing and trampling impact scores for respectively dwarf-shrub heath, wind-clipped summit heath, blanket bog and grassland. Table 2 gives the number of standardised impact scores and extent (ha) of different habitats for each impact score within 0.25 km squares. For dwarf-shrub heath and blanket bog 3.8% and 4.6% of squares were assessed as heavy and 8.4% and 5.0% as moderate-heavy respectively. Only 1.7% of 0.25 km squares with wind-clipped summit heath were assessed as heavy and about 11% as light to heavy impact. Grassland has a higher proportion of squares assessed as heavy (10.5%) and moderate impact (17.5%) compared to dwarf-shrub heath and blanket bog.

Tables 3-17 give the numbers of 0.25 km squares and area of habitat scored for each standardised impact score for each habitat on each estate.

Generally, the vegetation of the granite core of the Cairngorms has low grazing and trampling impacts with higher impacts only localised and sparse. The main concentrations of overall moderate to heavy and heavy impacts were found on the vegetation of the richer Moinian and Dalradian rocks (psammite, pelite, semi-pelite and meta-limestone), which surrounds the granite core. Areas with heavier impact include Linn of Dee, Upper Deeside (centred on Carn Bhac, south of Linn of Dee), Geldie Burn, Glen Lui, Glen Luibeg, Glen Derry, Glen Quoich, Gleann an t-Slugain, Glen Feshie, Pityoulish, Dorback Burn-Braes of Abernethy, Inchroy, Craig Leek and Glen Clunie (Figs 1, 3).

For dwarf-shrub heath (Fig. 4), the geographical pattern of impact is similar to overall impact. This is as expected, since dwarf-shrub heath is the predominant habitat determining the overall impact score. The gaps in assessments are mainly due to the absence of dwarf-shrub heath from the high montane plateaux.

The main concentrations of heavy (or light to heavy) impact in wind-clipped summit heath were found on Carn Bàn Mòr, on Mòine Mhòr and Mullach Clach à Bhlàir, on Beinn Bhrotain, in upper Deeside (Carn Liath), around Geldie Burn, on Mòine Bhealaid to North Top of Beinn a' Bhuird and on Carn Eas to Creag an Dail Mhòr (Fig. 5).

Heavy and moderate to heavy impacts in blanket bog were recorded mainly in upper Deeside to the Geldie Burn and on Mòine Bhealaidh at high altitude (Fig. 6). Moderate (or light to heavy) impacts were recorded more widely, mainly on high ground in upper Glen Feshie, Glen Eidart and Allt Luineag and to the east around the River Gairn and in upper Glen Quoich. Smaller concentrations of moderate and heavy impact occurred above the Balloch Burn in Glen Clunie, above Ballochbuie Forest and on Craig Leek.

For grassland, the main concentrations of heavy, moderate to heavy and moderate impact were found in upper Deeside, north and south of the Geldie Burn, on Carn Cloich-mhuilinn and at Inchroy (Fig. 7). In Glen Feshie, Glen Clunie, around the River Gairn and in upper Quoich Water the heaviest impacts in grassland were mainly moderate with just a few moderate to heavy and heavy assessments.

Fig. 8 gives a 0.25 km square map of tree and scrub regeneration in the Cairngorms Core Area. Tree and scrub regeneration was recorded from 33% of 3922<sup>1</sup> survey squares but saplings were browsed in almost 80% of these squares. Tree and scrub regeneration was widespread but there were only six main areas where browsing was not recorded (or may be assumed to be light). These were the Northern Corries (Lairig Ghru to Ryvoan), Glen Feshie (Loch an Eilean to Auchlean), Upper Deeside (Cairn Toul to Ben MacDui), Glen Avon (Loch Avon to Strath Nethy) and upper Quoich Water (Carn Eas). The Northern Corries are well known for their profuse regeneration of species in subalpine scrub (Miller and Cummins 1982 and French, Miller and Cummins 1997).

Deer were recorded from 88% of 3922 survey squares (Fig. 9). The percentages for individual species were red deer (86.6%), roe deer (7.4%) and reindeer (0.6%). Red deer were found almost everywhere. Roe deer appear to be more localised and at least seven concentrations of records can be identified: Loch an Eilean to Auchlean, Coire Garbhach, upper Glen Feshie, Linn of Dee to Carn Liath, upper Quoich Water, Craig Leek and Kincardine Hills to Bynack More. Most of these areas were near to woodland but some records are from tall heather moorland far from the edge of woodland.

Sheep were recorded from 12% of survey squares while cattle were only recorded from 0.9% of squares (Fig. 10). Sheep and cattle were highly localised. Sheep were recorded in many areas where heavy or moderate to heavy impacts were recorded (Figs 3-7), such as Allt Fhearnasdail, Pityoulish to Tulloch, Dorback Burn to Braes of Abernethy, Loch Builg to River Gairn, Craig Leek, Glen Clunie and upper Deeside (Carn Bhac, south of Linn of Dee) and may therefore be contributing towards the heavier impacts in these areas. However, they were not recorded from other areas where there were heavy and moderate to heavy impacts including Glen Feshie, Inchrory, Gleann t-Slugain to Glen Quoich, Glen Lui, Glen Luibeg, Glen Derry, Linn of Dee, Geldie Burn and Mòine Bhealaidh. Impacts in these areas may be attributed to red deer. In the largest area of heavy impact in Upper Deeside to the south of the Linn of Dee, sheep were recorded only in a restricted area and most of the impact was due to red deer (Gill and Scott 1996 and Rae 1995, 1996).

Red deer were recorded from almost all areas of heavy impact. There are no records for Allt Fhearnasdail and Craig Leek where sheep were presumably the main grazers. Any impacts in wind-clipped summit heath on the high plateaux can be attributed to red deer since sheep were rarely recorded from high ground and mountain hare were likewise largely absent. In most areas of heavy impact where both red deer and sheep were present, impact was likely to be due to a combination of sheep and red deer. This was the case in Glen Clunie where observations suggested that sheep and red deer were both responsible for impacts on the lower to upper slopes. Red deer tended to concentrate in high-altitude corries where impacts were likely to be due primarily to red deer.

Fig. 11 shows the presence of mountain hares and rabbits in 0.25 km squares. Mountain hare was widely distributed but largely absent from the high plateau and the glen bottoms. Rabbits were localized, usually occurring in smooth grassland. The main concentrations were on Craig Leek and other areas on Deeside; on Inchrory, Glen Feshie, Glen Clunie and the northern slopes of the Kincardine Hills. Fig. 12 shows the presence of grouse species and ptarmigan. Red grouse were widespread except for the high plateaux, while ptarmigan

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<sup>1</sup> Impact assessments are presented for 3903 survey squares but the total number of survey squares was 3922. The extra squares held habitats whose impact assessments are not given in this report, mostly plantation or native woodland. Tree and scrub regeneration and animal records were noted in all squares.

were mainly recorded from the high ground but there was some overlap with red grouse. Black grouse were localized and most records were from the Kincardine Hills and Deeside.

#### 4 DISCUSSION

These impact surveys were designed as a rapid method of covering all the ground. The main aim was to obtain a broad picture of impacts and to identify areas where damaging heavy impacts were concentrated. They were intended to give a baseline of broad impact levels that could be used as a basis for stratification of plot samples of more detailed monitoring such as the work of Welch and Scott (1997). Future comparisons of the 0.25 km square baseline may be by stratified random sampling of squares or complete re-survey of selected areas.

Different levels of impact on the habitats give different prognoses of deterioration or loss of the habitat. Heavy and possibly moderate impacts will generally cause deterioration or loss of the habitat concerned (Table 18, MacDonald *et al.* 1998a). Moderate impacts usually tend to maintain the habitat but may have deleterious structural effects on dwarf-shrub heath and blanket bog. Grazing sensitive species, including heather, may be slowly lost, though the flora is often rich in species generally. Light or light to moderate impacts will often maintain the habitat with high floristic diversity but if too light a few vigorous species may become dominant or scrub and woodland regeneration may occur. For most habitats, a light to moderate grazing impact is considered most beneficial for biodiversity (Milne *et al.* 1998).

The association found in this study of heavier grazing with the richer rocks is part of a wider picture in the Highlands. The poor rocks of the granite core appear to have preserved the area from more intensive grazing and land management practices. Other examples of granite uplands with relatively low intensity land-use are Lochnagar and Arran Northern Mountains. Both areas are managed primarily for deer stalking, but at levels which have generally preserved a predominance of heather. These areas contrast with hills of base-rich schist such as Caenlochan and Ben Lawers which have attracted larger numbers of herbivores both red deer and sheep. On these latter areas, the predominant vegetation is grassland or other vegetation with abundant graminoids. On steep well-drained slopes where there is access to grazing animals, *Vaccinium myrtillus* often dominates where *Calluna* may be expected to dominate. On steep, rocky slopes where animals cannot gain access, patches of *Calluna*-dominated dwarf-shrub heath may occur suggesting that grazing animals, rather than rock types, are responsible for the fragmentary heather cover.

The results of the observations on tree regeneration supports Miller, Cummins and Hester (1998) that saplings are widespread but woodland regeneration is more restricted because of browsing by herbivores. According to Miller, Cummins and Hester (1998) many saplings are maintained in a suppressed state by repeated browsing and constitute a "sapling bank" from which rapid growth can occur once browsing pressure has been relieved.

Thomson *et al.* (2006) summarise comparable herbivore impact data for four Deer Management Groups (DMGs). One of these, Cairngorm/Speyside, overlaps with the Cairngorms Core Area by around two-thirds and data from the current study were incorporated in the full data set (Stolte *et al.* 1998). Consequently the impact profile for this DMG is close to that of the Cairngorms Core Area. Compared with the other three DMGs, all in the eastern Highlands, the Cairngorms Core Area is characterised by a much higher proportion of area with light impact class or score and lower proportions of area with light-moderate, moderate and moderate-heavy impacts. The proportion of area with a heavy impact score for the Cairngorms Core Area is similar to the Angus Glens and Ardverikie but lower than Tayside.

Nolan *et al.* (1996) provide a habitat impact assessment for Invercauld Estate, which overlaps in Deeside and Glen Clunie with the current study. Detailed comparisons are difficult because the impacts are presented as polygons of different sizes rather than as 0.25 km squares. However, the topographic pattern of impact is similar in the two studies. The current study appears to have found more light impact, less moderate impact and possibly less moderate-heavy and less heavy impact than Nolan *et al.* (1996).

Staines, Balharry and Welch (1995) provide evidence that since 1970 *Calluna* heath declined and grassland cover increased in Glen Feshie. Changes in composition of the vegetation were attributed to red deer although 30 cattle were summered in the glen from 1967-1972. Sheep were absent and grazing by hares and rabbits was light. According to Staines, Balharry and Welch (1995) in Glen Lui, where fertilizing has taken place and red deer have been given additional feed, heather has declined dramatically from 65% cover in 1946 to 61% in 1966 and 40% in 1989.

Watson (1989) believed a change occurred from heather-dominated to grass-dominated ground in Glen Clunie where red deer numbers have greatly increased since the late 1960's.

McLeod (2002) reported the results of counts of sheep, red deer and mountain hares in the montane zone, in the summers of 1987-1999 on 47 sites in the Highlands. On two of the 10 Cairngorm study sites a few sheep were found in 1987-1990 but none in 1991-1999. On the Cairngorms red deer densities were generally low but a striking exception to this was Mòine Mhòr with a maximum density (1989-1997) of up to 98 deer per day per km square. Counts on Ben Avon were recorded as high as 21 deer per day per km square. McLeod (2002) suggests that the extremely high densities on Mòine Mhòr were likely to be having a detrimental effect on the montane vegetation. The Mòine Mhòr study site corresponds to an area of heavy impact in wind-clipped summit heath between Carn Bàn Mòr and Mullach Clach a' Blair found in the current study while on Ben Avon wind-clipped summit heath was assessed extensively as light to heavy impact suggesting a more patchy heavy impact.

Scott, Welch and Gornall (1999) examined heather cover, height and offtake in sample plots within 0.25 km squares previously assigned to a range of grazing and trampling impact categories in the current study. Good agreement was found between the 1995/6 assessments (Gill and Scott 1996 and Rae 1995, 1996) and the authors' plots in 1998. Of 40 0.25 km squares, only the six plots in one square were assigned to a different class (M instead of H). H-class plots had a high frequency of carpet heather while M-class plots had a high frequency of topiary heather and L-class had no carpet, drumstick or topiary heather. Heather height increased from H to M to L impact class. April % browsing in H, M and L impact plots was respectively 36%, 20% and 8% of shoots. With a shoot growth on average of 3 cm per year, this corresponds to the shoot browsing range of the three impact classes in MacDonald *et al.* (1998b). In a similar study in Glen Feshie (Scott, Mitchell and Welch 2001) heather cover in H-class plots decreased significantly in winter 1996/97 but not in winter 1999/2000. This suggested that changes in winter feeding sites in 1997 from the main glen where the high impacts occurred, to a side glen were responsible for a decrease in over-winter browsing in 1999/2000 in H-class squares.

Contractors' reports on different parts of the study area provide information on the impacts of different herbivores. In many areas, there were no sheep, or few sheep and impacts were linked to high red deer densities (Gill and Scott 1996; Rae 1995, 1996, 1997 and Gill, Sales and Horsfield 1998). In the largest concentration of 0.25 km squares assessed as heavily impacted, in the south Geldie (and Deeside) area of Mar Lodge Estate, Rae (1996) counted over 3000 red deer, though this may have included some double counting. On the eastern part of the area alone, where heavy impact was particularly concentrated, over 2000 red

deer were counted. Only eight sheep were seen. Rae (1996) believed that red deer were eating out the heather and blaeberry in the area.

Where both red deer and sheep occur it is difficult to separate out their respective impacts. This applied in Glen Clunie where both occur in high numbers. Heavy impacts and apparent continuing loss of heather was attributed to both these large herbivores (personal observations).

Rabbits generally occurred in smooth grassland and areas of old improvement where they grazed the grasses short, but their effects were localised (Gill 1996; Gill, Sales and Horsfield 1998 and Rae 1995, 1996, 1997). They can impact on adjacent dwarf-shrub heath, browsing bushes to topiary form as on the northern slopes of the Kincardine Hills (personal observations). Rae (1995) notes rabbits as particularly numerous in dwarf-shrub heath north of Craig Leek on Deeside, probably because of base-enriched soils. MacDonald (2004) suggests rabbits cause the major impacts on both sward height and soil erosion in calcareous grassland on the eastern slopes of Craig Leek.

McLeod (2002) assessed the density of mountain hares as low on all his ten Cairngorm montane study sites, at around one animal for every 2.5 km<sup>2</sup>. On Inchroy Rae (1997) noted several hares seen per square kilometre. Even though higher densities were observed on other sites, McLeod (2002) concluded that it seemed very unlikely that hares on their own had a marked effect on montane plant communities.

The impact assessment methodology used in this study is easiest to apply where there are large tracts of a few kinds of habitat and where the gradients in impact are large in scale compared with the scale of the survey square. Potential difficulties for field surveyors are as follows:

- Defining where the boundary of the 0.25 km square lies.
- Determining the extent of impact at different levels when the habitat itself is part of a mosaic of habitats and the impact levels vary across the habitat.
- Recognising past burning and past and present climatic effects (and not mistaking them for current browsing/grazing or trampling impacts).
- Use of impact indicators particularly where comparative levels need to be assessed.
- Weighting the value of different indicators to give a summary assessment.

MacDonald (2007) addresses some of these issues.

The exact line of a boundary of a survey square placed by a surveyor could affect the assessment for an individual square, although if impacts are missed in one square, they should be scored for an adjacent square, so that the overall picture of impacts may not be unduly affected. Estimation of proportions is subject to the same variation as estimation of plant cover or domin values but complicated by the large scale and different routes surveyors may take across a survey square. The surveyor also has to make a judgment as to when an adequate picture of impacts within the square has been obtained. This is necessarily subjective and may lead to variation in assessments between surveyors.

To minimise or avoid the last two difficulties, field workers should have a good knowledge of the methodology as described in MacDonald *et al.* (1998a, b). This includes a good understanding of impacts and behaviour, especially of fire and herbivores, including invertebrates. They also need to be able to recognise where damage is historical, whether due to herbivores, fire or due to the influence of climate. Current effects of climate on plant growth and flowering should also be taken into account. Surveyors need to be

knowledgeable enough to deduce the most probable cause of observed impacts and be able to recognise unambiguous field evidence. They should also recognise that uncertainty about the causes of impact may arise, especially where impacts have occurred in the past or where there are interactions between different kinds of impacts.

In conclusion, although some variation between surveyors is to be expected in applying the survey square methodology, this variation should not detract from the broad picture of impacts and their causes built up across a site by knowledgeable surveyors.

*Table 1 Number and proportion of overall impact scores for 0.25 km squares on estates in the Cairngorms Core Area*

Estate name	Overall impact scores								
	L			LM			M		
	No. 0.25 km squares	% in core area	% estate total	No. 0.25 km squares	% in core area	% estate Total	No. 0.25 km squares	% in core area	% estate Total
Balmoral	57	2.6	57.6	9	1.3	9.1	25	4.8	25.3
Cairngorm	87	4.0	87.9	7	1.0	7.1	5	1.0	5.1
Glenavon	361	16.6	67.5	66	9.4	12.3	68	13.0	12.7
Glenfeshie	215	9.9	47.3	98	13.9	21.5	72	13.8	15.8
Invercauld	298	13.7	54.8	77	10.9	14.2	97	18.6	17.8
Killiehuntley	20	0.9	57.1	8	1.1	22.9	3	0.6	8.6
Mar	8	0.5	57.1	1	0.1	7.1	5	1.0	35.7
Mar Lodge	453	20.8	39.3	311	44.2	27.0	156	29.9	13.5
Pityoulish	1	0.0	4.3	5	0.7	21.7	7	1.3	30.4
Revack and Dorback	32	1.5	33.3	28	4.0	29.2	21	4.0	21.9
Rothiemurchus	206	9.4	78.9	20	2.8	7.7	20	3.8	7.7
RSPB	280	12.8	73.3	61	8.7	16.0	31	5.9	8.1
Seafield	12	0.6	48.0	1	0.1	4.0	8	1.5	32.0
SNH	110	5.0	85.3	9	1.3	7.0	0	0.0	0.0
Various	40	1.8	75.5	3	0.4	5.7	4	0.8	7.5
Core area total and % of core area	2180	55.8		704	18.0		522	13.4	

Table 1 (cont.)

Estate name	Overall impact scores									
	LH			MH			H			Total
	No. 0.25 km squares	% in core area	% estate total	No. 0.25 km squares	% in core area	% estate Total	No. 0.25 km squares	% in core area	% estate total	
Balmoral	0	0.0	0.0	1	0.5	1.0	7	3.0	7.1	99
Cairngorm	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	99
Glenavon	3	5.1	0.6	30	14.6	5.6	7	3.0	1.3	535
Glenfeshie	9	15.3	2.0	30	14.6	6.6	31	13.2	6.8	455
Invercauld	5	8.5	0.9	40	19.5	7.4	27	11.5	5.0	544
Killiehuntley	0	0.0	0.0	2	1.0	5.7	2	0.9	5.7	35
Mar	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	14
Mar Lodge	27	45.8	2.3	79	38.5	6.9	127	54.0	11.0	1153
Pityoulish	0	0.0	0.0	10	4.9	43.5	0	0.0	0.0	23
Revack and Dorback	2	3.4	2.1	5	2.4	5.2	8	3.4	8.3	96
Rothiemurchus	3	5.1	1.1	1	0.5	0.4	11	4.7	4.2	261
RSPB	0	0.0	0.0	4	2.0	1.0	6	2.6	1.6	382
Seafield	0	0.0	0.0	2	1.0	8.0	2	0.9	8.0	25
SNH	10	16.9	7.8	0	0.0	0.0	0	0.0	0.0	129
Various	0	0.0	0.0	1	0.5	1.9	5	2.1	9.4	53
Core area total and % of core area	59	1.5		205	5.2		235	6.0		3903

Table 2 Number of standardised impact scores for different habitats and extent of the habitat for each score within 0.25 km squares in the Cairngorms Core Area

Habitat/ Standardised impact score	Dwarf-shrub heath				Wind-clipped summit heath				Blanket bog			
	No. 0.25 km squares	% 0.25 km squares	Habitat area (ha)	% habitat area	No. 0.25 km squares	% 0.25 km squares	Habitat area (ha)	% habitat area	No. 0.25 km squares	% 0.25 km squares	Habitat area (ha)	% habitat area
L	1221	38.4	17396.3	37.0	1251	87.4	12289.6	85.2	799	53.9	5642.8	50.8
LM	1072	33.7	16654.3	35.4	0	0	0.0	0.0	330	22.3	2686.6	24.2
M	359	11.3	5385.1	11.5	0	0	0.0	0.9	184	12.4	1292.8	11.6
LH	140	4.4	2449.1	5.2	156	10.9	1923.1	13.3	27	1.8	322.9	2.9
MH	268	8.4	3863.9	8.2	0	0	0.0	0.0	74	5.0	620.9	5.6
H	121	3.8	1262.1	2.7	24	1.7	217.5	1.5	68	4.6	546.3	4.9
Total	3181		47010.8		1431		14430.2		1482		11112.3	

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Table 2 (cont.)

Habitat/ Standardised impact score	Grassland				All habitats			
	No. 0.25 km squares	% 0.25 km squares	Habitat area (ha)	% habitat area	No. 0.25 km squares	% 0.25 km squares	Habitat area (ha)	% habitat area
L	686	48.5	1749.5	36.7	3957	52.7	37078.2	48.0
LM	219	15.5	984.2	20.6	1621	21.6	20325.1	26.3
M	247	17.5	772.6	16.2	790	10.5	7450.6	9.6
LH	43	3.0	157.6	3.3	366	4.9	4852.7	6.3
MH	72	5.1	319.5	6.7	414	5.5	4804.3	6.2
H	148	10.5	786.1	16.5	361	4.8	2812.0	3.6
Total	1415		4769.6		7509		77322.9	

Table 3 Number of standardised impact scores for different habitats and extent of each habitat within 0.25 km squares for Balmoral Estate within the Cairngorms Core Area

Habitat/ Standardised impact score	Dwarf-shrub heath				Wind-clipped summit heath				
	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%	
L	27	27.3	621.1	26.2	3	60.0	17.7	97.3	
LM	42	42.4	1019.8	43.0	0	0.0	0.0	0.0	
M	9	9.1	222.5	9.4	0	0.0	0.0	0.0	
LH	8	8.1	197.5	8.3	2	40.0	0.5	2.7	
MH	11	11.1	260.0	11.0	0	0.0	0.0	0.0	
H	2	2.0	50.0	2.1	0	0.0	0.0	0.0	
Total	99		2370.8		5		18.2		

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Habitat/ Standardised	Blanket bog				Grassland				
	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%	
L	1	14.3	12.5	48.1	6	60.0	12.5	62.5	
LM	3	42.9	3.0	11.5	1	10.0	0.0	0.0	
M	1	14.3	2.5	9.6	3	30.0	7.5	37.5	
LH	0	0.0	0.0	0.0	0	0.0	0.0	0.0	
MH	1	14.3	0.5	1.9	0	0.0	0.0	0.0	
H	1	14.3	7.5	28.8	0	0.0	0.0	0.0	
Total	7		26.0		10		20.0		

Table 4 Number of standardised impact scores for different habitats and extent of each habitat within 0.25 km squares for Cairngorm Estate within the Cairngorms Core Area

Habitat/	Dwarf-shrub heath			Wind-clipped summit heath					
	Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%
L		58	73.4	828.0	68.8	58	100.0	637.5	100.0
LM		13	16.5	240.0	19.9	0	0.0	0.0	0.0
M		6	7.6	100.3	8.3	0	0.0	0.0	0.0
LH		1	1.3	13.8	1.1	0	0.0	0.0	0.0
MH		1	1.3	21.3	1.8	0	0.0	0.0	0.0
H		0	0.0	0.0	0.0	0	0.0	0.0	0.0
Total		79		1203.3		58		637.5	

Habitat/	Blanket bog			Grassland					
	Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%
L		39	90.7	51.3	91.1	28	93.3	16.3	86.7
LM		1	2.3	0.0	0.0	0	0.0	0.0	0.0
M		2	4.7	5.0	8.9	1	3.3	0.0	0.0
LH		1	2.3	0.0	0.0	1	3.3	2.5	13.3
MH		0	0.0	0.0	0.0	0	0.0	0.0	0.0
H		0	0.0	0.0	0.0	0	0.0	0.0	0.0
Total		43		56.3		30		18.8	

Table 5 Number of standardised impact scores for different habitats and extent of each habitat within 0.25 km squares for Glenavon Estate within the Cairngorms Core Area

Habitat/	Dwarf-shrub heath			Wind-clipped summit heath					
	Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%
L		165	49.8	2352.7	34.2	209	91.3	2189.0	85.2
LM		68	20.5	2765.5	40.2	0	0.0	0.0	0.0
M		34	10.3	629.2	9.2	0	0.0	0.0	0.0
LH		25	7.6	488.2	7.1	20	8.7	380.0	14.8
MH		38	11.5	627.2	9.1	0	0.0	0.0	0.0
H		1	0.3	8.4	0.1	0	0.0	0.0	0.0
Total		331		6871.2		229		2569.0	

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Habitat/	Blanket bog			Grassland					
	Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%
L		160	80.4	2059.4	87.9	60	33.0	210.0	31.0
LM		28	14.1	242.7	10.4	53	29.1	183.8	27.1
M		6	3.0	17.2	0.7	36	19.8	134.0	19.8
LH		2	1.0	22.5	1.0	7	3.8	45.0	6.6
MH		1	0.5	0.0	0.0	14	7.7	55.8	8.2
H		2	1.0	0.0	0.0	12	6.6	49.0	7.2
Total		199		2341.7		182		677.5	

Table 6 Number of standardised impact scores for different habitats and extent of each habitat within 0.25 km squares for Glenfeshie Estate within the Cairngorms Core Area

Habitat/	Dwarf-shrub heath				Wind-clipped summit heath				
	Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%
L		119	33.1	1605.2	36.8	127	78.4	1194.5	78.9
LM		123	34.3	1477.8	33.9	0	0.0	0.0	0.0
M		40	11.1	441.2	10.1	0	0.0	0.0	0.0
LH		24	6.7	350.2	8.0	26	16.0	235.2	15.5
MH		31	8.6	333.6	7.6	0	0.0	0.0	0.0
H		22	6.1	154.9	3.6	9	5.6	85.1	5.6
Total		359		4362.9		162		1514.7	

Habitat/	Blanket bog				Grassland				
	Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%
L		118	49.6	946.9	46.2	116	48.7	130.6	25.2
LM		54	22.7	471.3	23.0	62	26.1	229.2	44.3
M		44	18.5	373.6	18.2	45	18.9	117.0	22.6
LH		7	2.9	115.5	5.6	10	4.2	21.6	4.2
MH		15	6.3	144.3	7.0	5	2.1	19.1	3.7
H		0	0.0	0.0	0.0	0	0.0	0.0	0.0
Total		238		2051.7		238		517.4	

Table 7 Number of standardised impact scores for different habitats and extent of each habitat within 0.25 km squares for Invercauld Estate within the Cairngorms Core Area

Habitat/	Dwarf-shrub heath			Wind-clipped summit heath					
	Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%
L		212	44.4	3636.2	46.9	160	84.7	1492.2	82.5
LM		106	22.2	1761.7	22.7	0	0.0	0.0	0.0
M		64	13.4	1020.7	13.2	0	0.0	0.0	0.0
LH		29	6.1	453.7	5.8	27	14.3	304.2	16.8
MH		51	10.7	756.4	9.8	0	0.0	0.0	0.0
H		15	3.1	128.9	1.7	2	1.1	12.3	0.7
Total		477		7757.5		189		1808.7	

Habitat/	Blanket bog			Grassland					
	Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%
L		60	38.5	119.3	25.0	137	50.9	481.0	37.3
LM		44	28.2	138.2	29.0	39	14.5	339.3	26.3
M		36	23.1	171.2	35.9	58	21.6	277.5	21.5
LH		3	1.9	0.0	0.0	6	2.2	53.5	4.1
MH		8	5.1	18.3	3.8	22	8.2	80.7	6.2
H		5	3.2	29.5	6.2	7	2.6	59.0	4.6
Total		156		476.5		269		1291.1	

Table 8 Number of standardised impact scores for different habitats and extent of each habitat within 0.25 km squares for Killiehuntley Estate within the Cairngorms Core Area

Habitat/	Dwarf-shrub heath				Wind-clipped summit heath				
	Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%
L		20	57.1	295.8	66.8	4	100.0	34.7	100.0
LM		8	22.9	88.4	20.0	0	0.0	0.0	0.0
M		1	2.9	10.7	2.4	0	0.0	0.0	0.0
LH		2	5.7	19.2	4.3	0	0.0	0.0	0.0
MH		2	5.7	1.2	0.3	0	0.0	0.0	0.0
H		2	5.7	27.6	6.2	0	0.0	0.0	0.0
Total		35		443.0		4		34.7	

Habitat/	Blanket bog				Grassland				
	Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%
L		17	85.0	117.0	86.4	4	25.0	0.0	0.0
LM		1	5.0	5.4	3.9	1	6.3	0.0	0.0
M		0	0.0	0.0	0.0	3	18.8	10.2	20.5
LH		0	0.0	0.0	0.0	2	12.5	0.1	0.3
MH		0	0.0	0.0	0.0	0	0.0	0.0	0.0
H		2	10.0	13.1	9.7	6	37.5	39.3	79.2
Total		20		135.5		16		49.6	

Table 9 Number of standardised impact scores for different habitats and extent of each habitat within 0.25 km squares for Mar Estate within the Cairngorms Core Area

Habitat/	Dwarf-shrub heath			Wind-clipped summit heath				
	Standardised impact score	No. of 0.25 km squares	Area of habitat (ha)	%	No. of 0.25 km squares	Area of habitat (ha)	%	
L	6	50.0	103.4	54.2	4	100.0	25.0	100.0
LM	1	8.3	25.0	13.1	0	0.0	0.0	0.0
M	3	25.0	40.0	21.0	0	0.0	0.0	0.0
LH	2	16.7	22.5	11.8	0	0.0	0.0	0.0
MH	0	0.0	0.0	0.0	0	0.0	0.0	0.0
H	0	0.0	0.0	0.0	0	0.0	0.0	0.0
Total	12		190.9		4		25.0	

Habitat/	Blanket bog			Grassland				
	Standardised impact score	No. of 0.25 km squares	Area of habitat (ha)	%	No. of 0.25 km squares	Area of habitat (ha)	%	
L	0	0.0	0.0	0.0	0	0.0	0.0	
LM	0	0.0	0.0	0.0	0	0.0	0.0	
M	0	0.0	0.0	0.0	1	100.0	0.1	100.0
LH	0	0.0	0.0	0.0	0	0.0	0.0	
MH	0	0.0	0.0	0.0	0	0.0	0.0	
H	0	0.0	0.0	0.0	0	0.0	0.0	
Total	0		0.0		1		0.1	

Table 10 Number of standardised impact scores for different habitats and extent of each habitat within 0.25 km squares for Mar Lodge Estate within the Cairngorms Core Area

Habitat/	Dwarf-shrub heath			Wind-clipped summit heath					
	Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%
L		267	28.6	3180.2	24.9	364	85.2	3439.7	82.3
LM		353	37.8	5098.2	39.9	0	0.0	0.0	0.0
M		123	13.2	1830.2	14.3	0	0.0	0.0	0.0
LH		24	2.6	388.6	3.0	54	12.6	668.2	16.0
MH		102	10.9	1459.8	11.4	0	0.0	0.0	0.0
H		65	7.0	807.7	6.3	9	2.1	73.2	1.8
Total		934		12764.7		427		4181.1	

Habitat/	Blanket bog			Grassland					
	Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%
L		136	36.0	412.5	17.8	193	41.1	512.0	31.9
LM		67	17.7	411.1	17.8	30	6.4	116.9	7.3
M		70	18.5	494.7	21.4	86	18.3	190.7	11.9
LH		10	2.6	117.1	5.1	14	3.0	35.0	2.2
MH		39	10.3	402.8	17.4	27	5.7	128.2	8.0
H		56	14.8	474.9	20.5	120	25.5	620.1	38.7
Total		378		2313.1		470		1602.7	

Table 11 Number of standardised impact scores for different habitats and extent of each habitat within 0.25 km squares for Pityoulish Estate within the Cairngorms Core Area

Habitat/	Dwarf-shrub heath			Wind-clipped summit heath					
	Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%
L		0	0.0	0.0	0.0	0	0.0	0.0	0.0
LM		6	26.1	105.0	33.5	0	0.0	0.0	0.0
M		10	43.5	152.5	48.6	0	0.0	0.0	0.0
LH		1	4.3	12.5	4.0	0	0.0	0.0	0.0
MH		6	26.1	43.8	13.9	0	0.0	0.0	0.0
H		0	0.0	0.0	0.0	0	0.0	0.0	0.0
Total		23		313.8		0		0.0	

Habitat/	Blanket bog			Grassland					
	Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%
L		2	50.0	15.0	54.5	1	50.0	6.3	55.6
LM		1	25.0	10.0	36.4	0	0.0	0.0	0.0
M		1	25.0	2.5	9.1	1	50.0	5.0	44.4
LH		0	0.0	0.0	0.0	0	0.0	0.0	0.0
MH		0	0.0	0.0	0.0	0	0.0	0.0	0.0
H		0	0.0	0.0	0.0	0	0.0	0.0	0.0
Total		4		27.5		2		11.3	

Table 12 Number of standardised impact scores for different habitats and extent of each habitat within 0.25 km squares for Revack and Dorback Estate within the Cairngorms Core Area

Habitat/	Dwarf-shrub heath				Wind-clipped summit heath				
	Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%
L		11	12.6	76.5	8.8	20	83.3	144.3	85.9
LM		37	42.5	392.5	45.0	0	0.0	0.0	0.0
M		23	26.4	216.5	24.8	0	0.0	0.0	0.0
LH		2	2.3	36.3	4.2	3	12.5	21.3	12.6
MH		11	12.6	135.0	15.5	0	0.0	0.0	0.0
H		3	3.4	16.3	1.9	1	4.2	2.5	1.5
Total		87		873.0		24		168.0	

Habitat/	Blanket bog				Grassland				
	Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%
L		33	38.8	354.3	41.5	0	0.0	0.0	0.0
LM		40	47.1	404.8	47.4	4	30.8	11.3	23.9
M		7	8.2	45.0	5.3	6	46.2	12.5	26.6
LH		1	1.2	20.0	2.3	0	0.0	0.0	0.0
MH		3	3.5	25.0	2.9	3	23.1	23.3	49.5
H		1	1.2	5.0	0.6	0	0.0	0.0	0.0
Total		85		854.0		13		47.0	

Table 13 Number of standardised impact scores for different habitats and extent of each habitat within 0.25 km squares for Rothiemurchus Estate within the Cairngorms Core Area

Habitat/	Dwarf-shrub heath				Wind-clipped summit heath				
	Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%
L		85	42.1	1467.3	40.2	100	90.9	1169.1	90.6
LM		89	44.1	1673.8	45.9	0	0.0	0.0	0.0
M		10	5.0	176.3	4.8	0	0.0	0.0	0.0
LH		11	5.4	267.5	7.3	7	6.4	77.0	6.0
MH		3	1.5	41.8	1.1	0	0.0	0.0	0.0
H		4	2.0	22.5	0.6	3	2.7	44.3	3.4
Total		202		3649.1		110		1290.4	

Habitat/	Blanket bog				Grassland				
	Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%
L		23	63.9	153.7	68.2	58	82.9	218.8	86.8
LM		10	27.8	27.9	12.4	8	11.4	27.5	10.9
M		1	2.8	6.3	2.8	3	4.3	5.8	2.3
LH		1	2.8	12.5	5.5	1	1.4	0.0	0.0
MH		1	2.8	25.0	11.1	0	0.0	0.0	0.0
H		0	0.0	0.0	0.0	0	0.0	0.0	0.0
Total		36		225.3		70		252.0	

Table 14 Number of standardised impact scores for different habitats and extent of each habitat within 0.25 km squares for RSPB estate within the Cairngorms Core Area

Habitat/	Dwarf-shrub heath				Wind-clipped summit heath				
Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)		
L	133	47.8	1622.3	44.0	140	95.9	1186.2	94.5	
LM	102	36.7	1439.2	39.1	0	0.0	0.0	0.0	
M	25	9.0	338.8	9.2	0	0.0	0.0	0.0	
LH	7	2.5	130.0	3.5	6	4.1	68.8	5.5	
MH	7	2.5	110.0	3.0	0	0.0	0.0	0.0	
H	4	1.4	45.0	1.2	0	0.0	0.0	0.0	
Total	278		3685.2		146		1254.9		

Habitat/	Blanket bog				Grassland				
Standardised impact score	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)		
L	171	64.5	1095.4	49.8	28	54.9	107.5	57.0	
LM	76	28.7	914.8	41.6	21	41.2	76.3	40.4	
M	15	5.7	175.0	8.0	2	3.9	5.0	2.6	
LH	0	0.0	0.0	0.0	0	0.0	0.0	0.0	
MH	2	0.8	2.5	0.1	0	0.0	0.0	0.0	
H	1	0.4	10.0	0.5	0	0.0	0.0	0.0	
Total	265		2197.6		51		188.8		

Table 15 Number of standardised impact scores for different habitats and extent of each habitat within 0.25 km squares for Seafield Estate within the Cairngorms Core Area

Habitat/ Standardised impact score	Dwarf-shrub heath				Wind-clipped summit heath				
	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%	
L	6	25.0	107.5	27.0	1	100.0	6.3	100.0	
LM	6	25.0	104.3	26.2	0	0.0	0.0	0.0	
M	8	33.3	133.8	33.6	0	0.0	0.0	0.0	
LH	1	4.2	25.0	6.3	0	0.0	0.0	0.0	
MH	3	12.5	27.5	6.9	0	0.0	0.0	0.0	
H	0	0.0	0.0	0.0	0	0.0	0.0	0.0	
Total	24		398.0		1		6.3		

Habitat/ Standardised impact score	Blanket bog				Grassland				
	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%	
L	6	66.7	60.0	72.7	0	0.0	0.0	0.0	
LM	2	22.2	20.0	24.2	0	0.0	0.0	0.0	
M	0	0.0	0.0	0.0	2	66.7	7.5	37.5	
LH	0	0.0	0.0	0.0	0	0.0	0.0	0.0	
MH	1	11.1	2.5	3.0	1	33.3	12.5	62.5	
H	0	0.0	0.0	0.0	0	0.0	0.0	0.0	
Total	9		82.5		3		20.0		

Table 16 Number of standardised impact scores for different habitats and extent of each habitat within 0.25 km squares for SNH estate within the Cairngorms Core Area

Habitat/ Standardised impact score	Dwarf-shrub heath			Wind-clipped summit heath					
	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%	
L	79	76.7	1028.5	74.0	56	83.6	731.0	81.3	
LM	23	22.3	350.8	25.3	0	0.0	0.0	0.0	
M	0	0.0	0.0	0.0	0	0.0	0.0	0.0	
LH	1	1.0	9.7	0.7	11	16.4	168.0	18.7	
MH	0	0.0	0.0	0.0	0	0.0	0.0	0.0	
H	0	0.0	0.0	0.0	0	0.0	0.0	0.0	
Total	103		1388.9		67		899.0		

Habitat/ Standardised impact score	Blanket bog			Grassland					
	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%	
L	20	80.0	175.6	82.4	52	94.5	73.0	100.0	
LM	4	16.0	37.5	17.6	0	0.0	0.0	0.0	
M	1	4.0	0.0	0.0	1	1.8	0.0	0.0	
LH	0	0.0	0.0	0.0	2	3.6	0.0	0.0	
MH	0	0.0	0.0	0.0	0	0.0	0.0	0.0	
H	0	0.0	0.0	0.0	0	0.0	0.0	0.0	
Total	25		213.1		55		73.0		

Table 17 Number of standardised impact scores for different habitats and extent of each habitat within 0.25 km squares for various estates within the Cairngorms Core Area

Habitat/ Standardised impact score	Dwarf-shrub heath			Wind-clipped summit heath					
	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%	
L	33	67.3	471.8	63.9	6	100.0	22.5	100.0	
LM	6	12.2	112.5	15.2	0	0.0	0.0	0.0	
M	3	6.1	72.5	9.8	0	0.0	0.0	0.0	
LH	2	4.1	34.6	4.7	0	0.0	0.0	0.0	
MH	2	4.1	46.3	6.3	0	0.0	0.0	0.0	
H	3	6.1	0.9	0.1	0	0.0	0.0	0.0	
Total	49		738.4		6		22.5		

Habitat/ Standardised impact score	Blanket bog			Grassland					
	No. of 0.25 km squares	%	Area of habitat (ha)	%	No. of 0.25 km squares	%	Area of habitat (ha)	%	
L	13	100.0	70.0	100.0	3	50.0	8.8	31.9	
LM	0	0.0	0.0	0.0	0	0.0	0.0	0.0	
M	0	0.0	0.0	0.0	0	0.0	0.0	0.0	
LH	0	0.0	0.0	0.0	0	0.0	0.0	0.0	
MH	0	0.0	0.0	0.0	0	0.0	0.0	0.0	
H	0	0.0	0.0	0.0	3	50.0	18.7	68.1	
Total	13		70.0		6		27.4		

Table 18 Interpretation of surveys of browsing/grazing and trampling impact

HABITAT	BROWSING/GRAZING AND TRAMPLING IMPACT CLASS		
	Light	Moderate	Heavy
<b>Dwarf shrub heath</b>	Maximum structural development and microclimatic effects; diverse bryophyte and lichen flora; potential for woodland regeneration	Changes to heather structure, potential loss of heather cover and replacement by other dwarf shrubs; increase of grassland cover and species	Death of heather, loss of structural diversity, lack of flowering leading to reduced nectar, pollen, fruit and seed resources; trend towards replacement of dwarf-shrub by grassland cover
<b>Wind-clipped summit heath</b>	High diversity of specialist high-altitude species; often with high cover of woolly-fringe moss ( <i>Racomitrium</i> ) and lichens; where appropriate dwarf-shrubs abundant		Loss of woolly-fringe moss, lichens and dwarf shrubs and increase in grass and herb cover
<b>Blanket bog</b>	Maximum bryophyte and structural diversity; mix of heather, other dwarf-shrubs and sedges	Loss of bryophyte diversity, decrease in heather cover, increase in sedge cover and of non-bog species, some risk of erosion especially on slopes	Loss of structural diversity, damage to pools, widespread peat erosion, loss of heather, often dominance of sedges
<b>Grassland</b>	Potential for dominance of a few vigorous species; loss of species diversity especially smaller herb species; potential for invasion by dwarf shrubs, scrub or trees	Maximum plant species diversity	Possible loss of herb species; risk of soil erosion on steep slopes; lower diversity of invertebrates

**Grey shading = some damage under moderate impact, widespread damage under heavy impacts.**

**No shading = existing habitat type likely to persist.**

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Figure 1 0.25 km square survey squares of the grazing and trampling impact survey in the Cairngorms Core Area

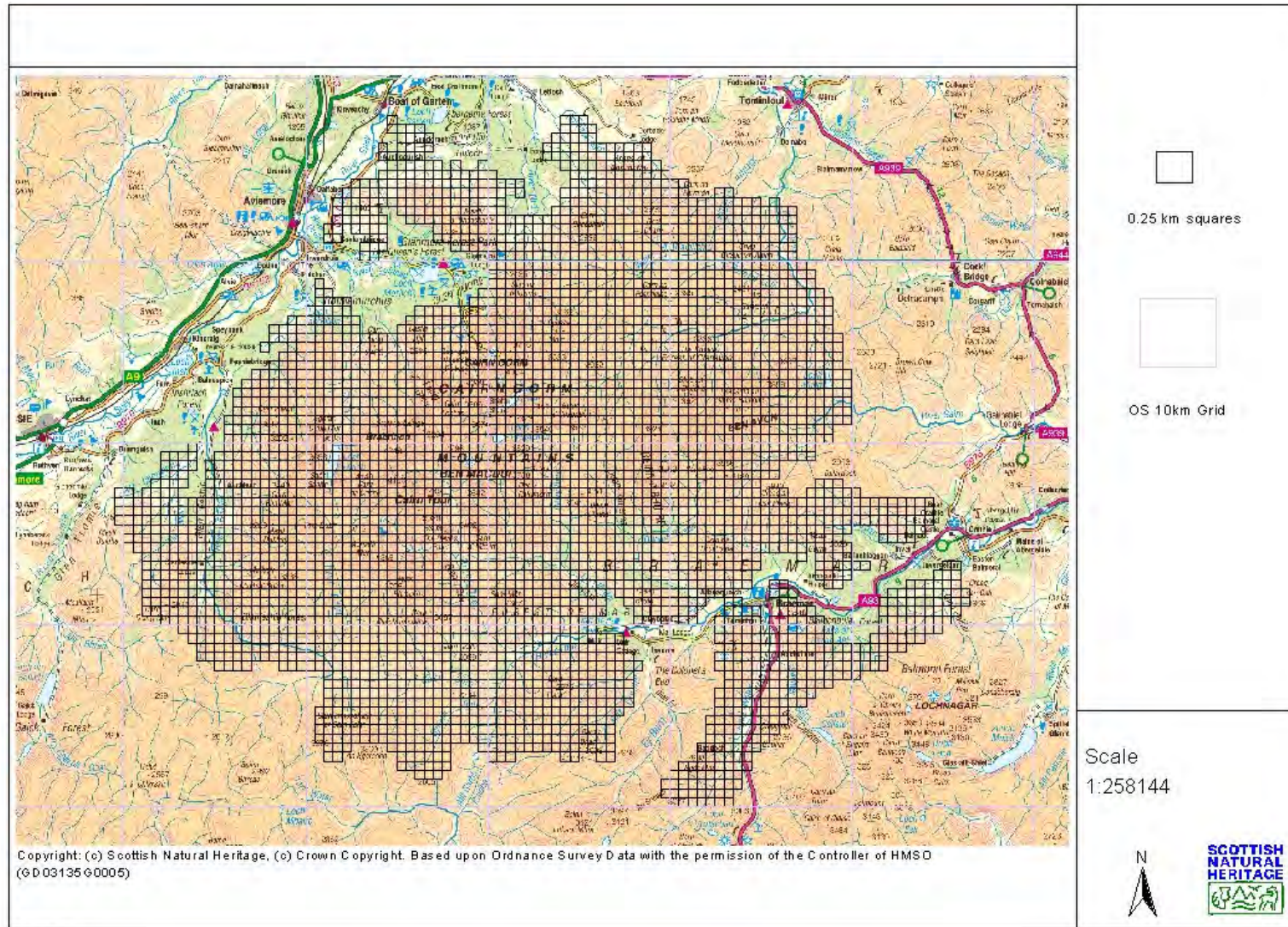


Figure 2 Map of major estates in the Cairngorms Core Area divided into 0.25 km squares

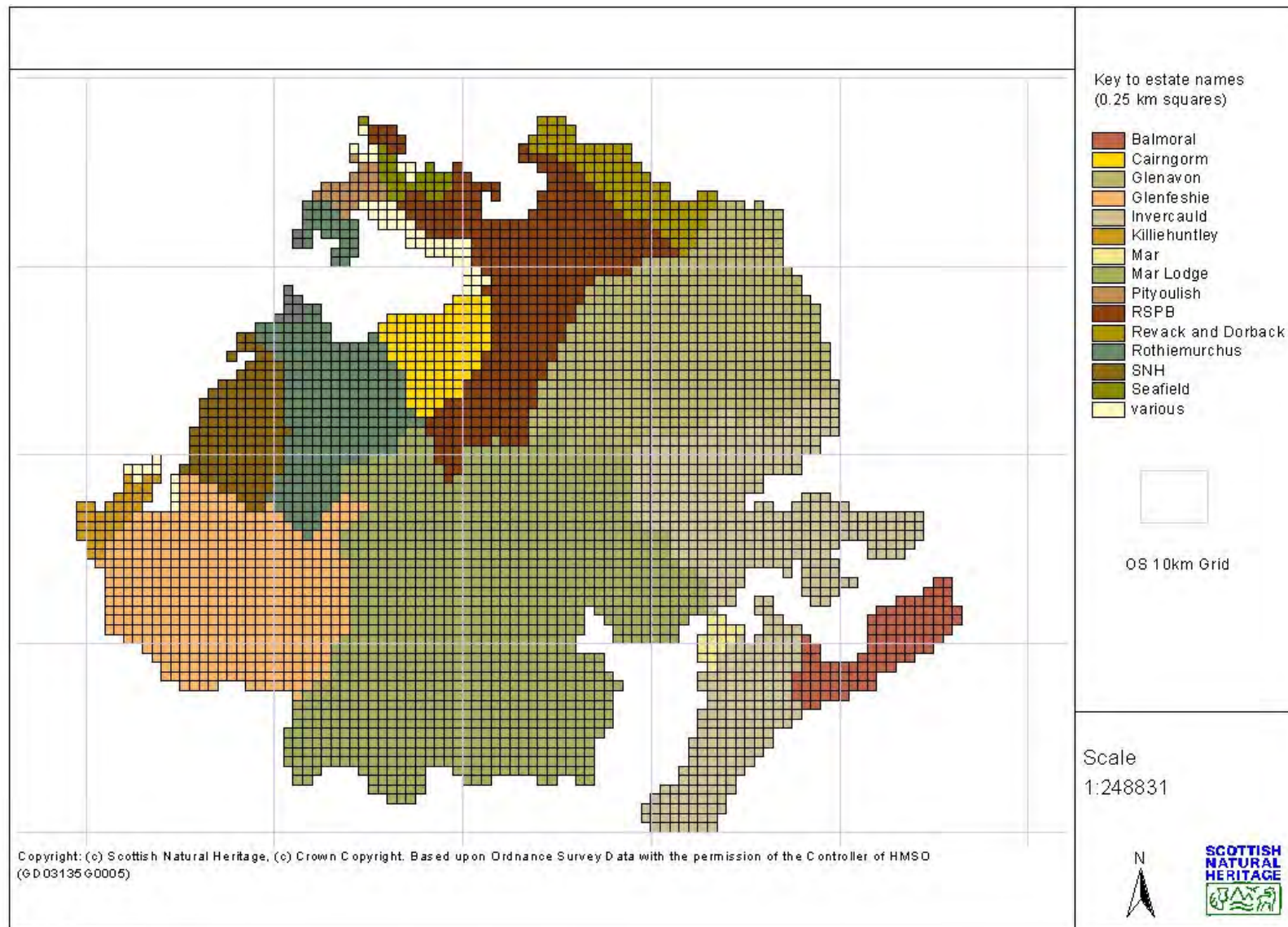


Figure 3 0.25 km squares with overall grazing/browsing and trampling impact scores for upland habitats in the Cairngorms Core Area

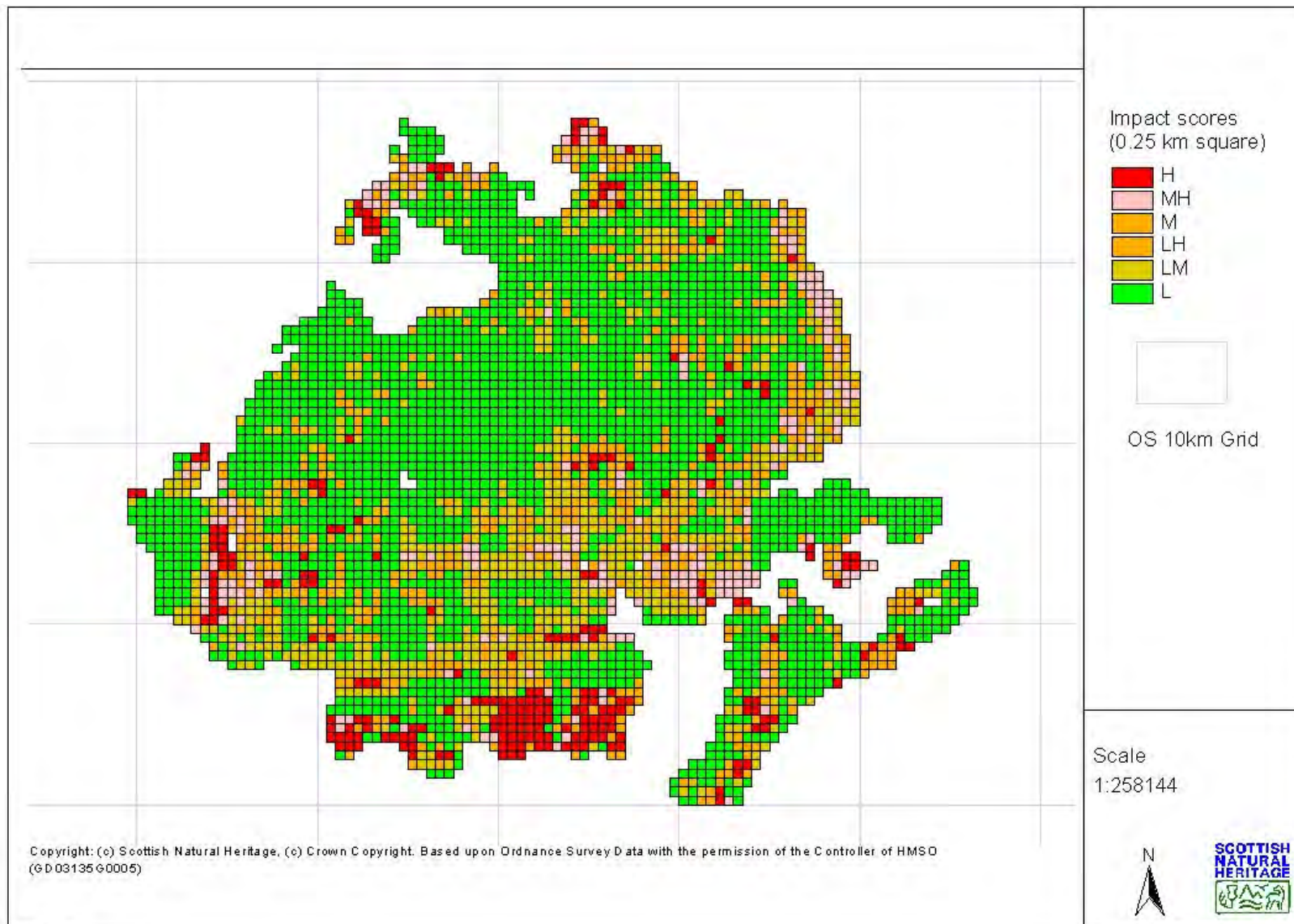


Figure 4 0.25 km squares with standardised browsing and trampling impact scores for dwarf-shrub heath in the Cairngorms Core Area

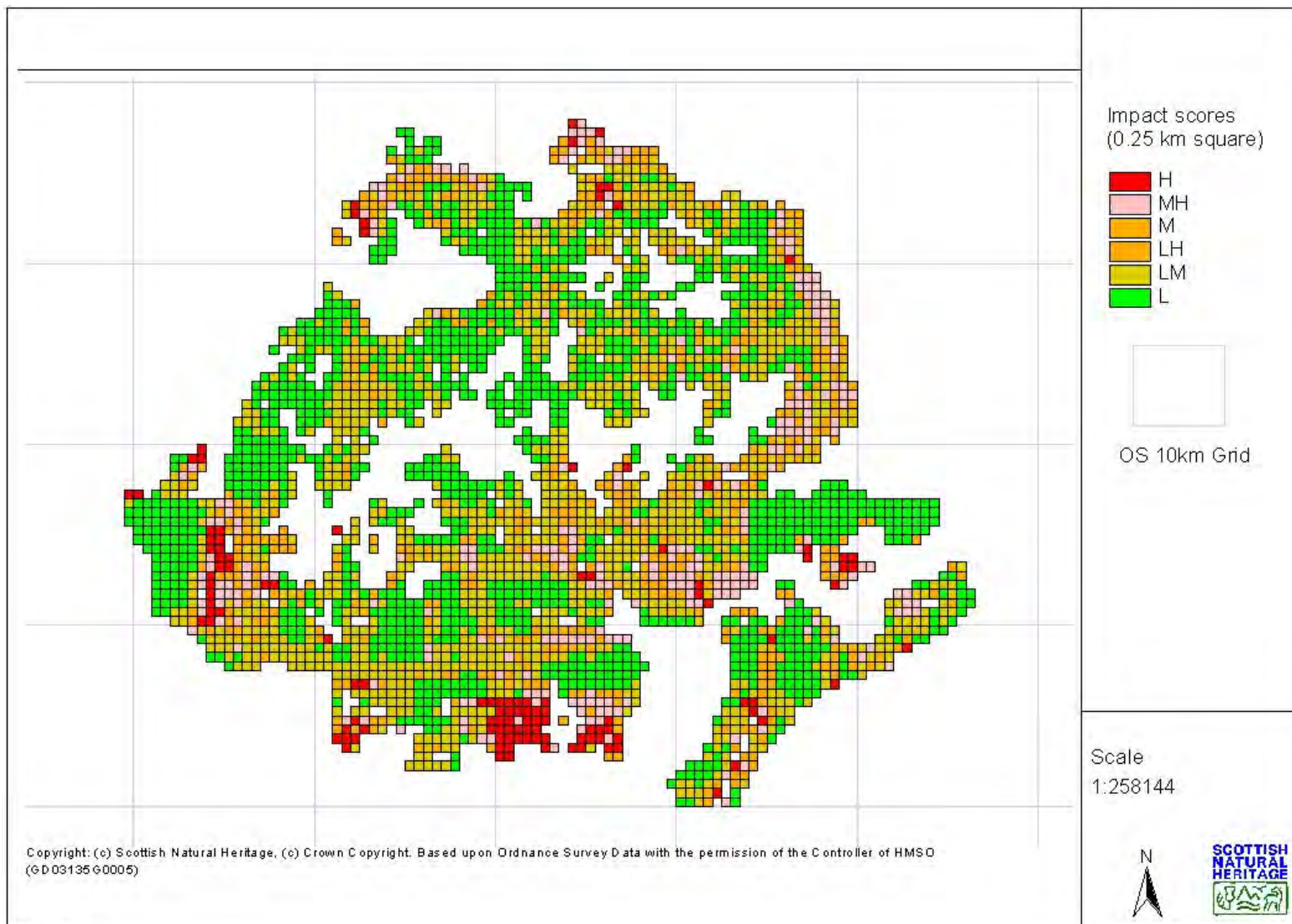


Figure 5 0.25 km squares with standardised grazing/browsing and trampling impact scores for wind-clipped summit heath in the Cairngorms Core Area

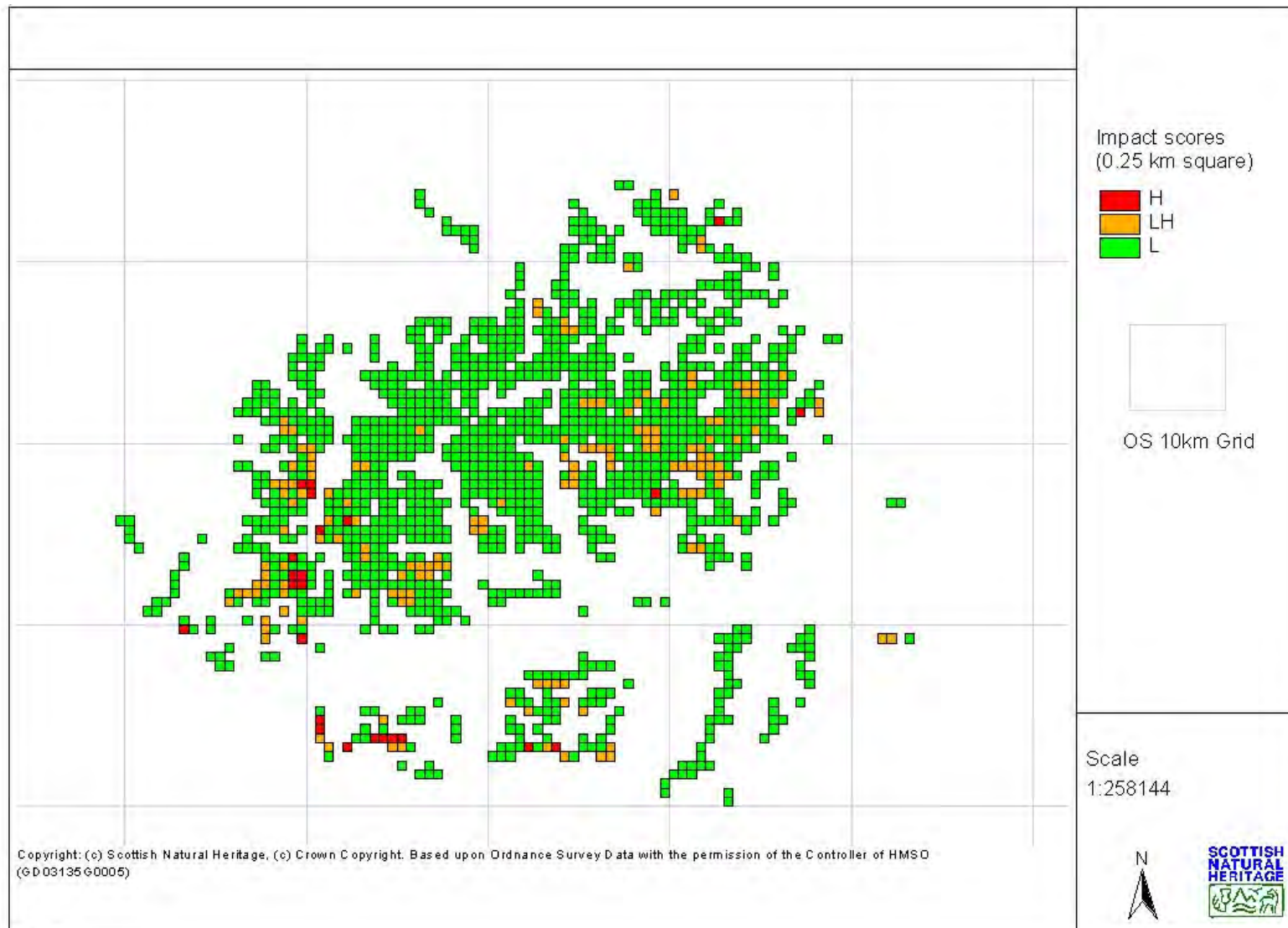


Figure 6 0.25 km squares with standardised grazing/browsing and trampling impact scores for blanket bog in the Cairngorms Core Area

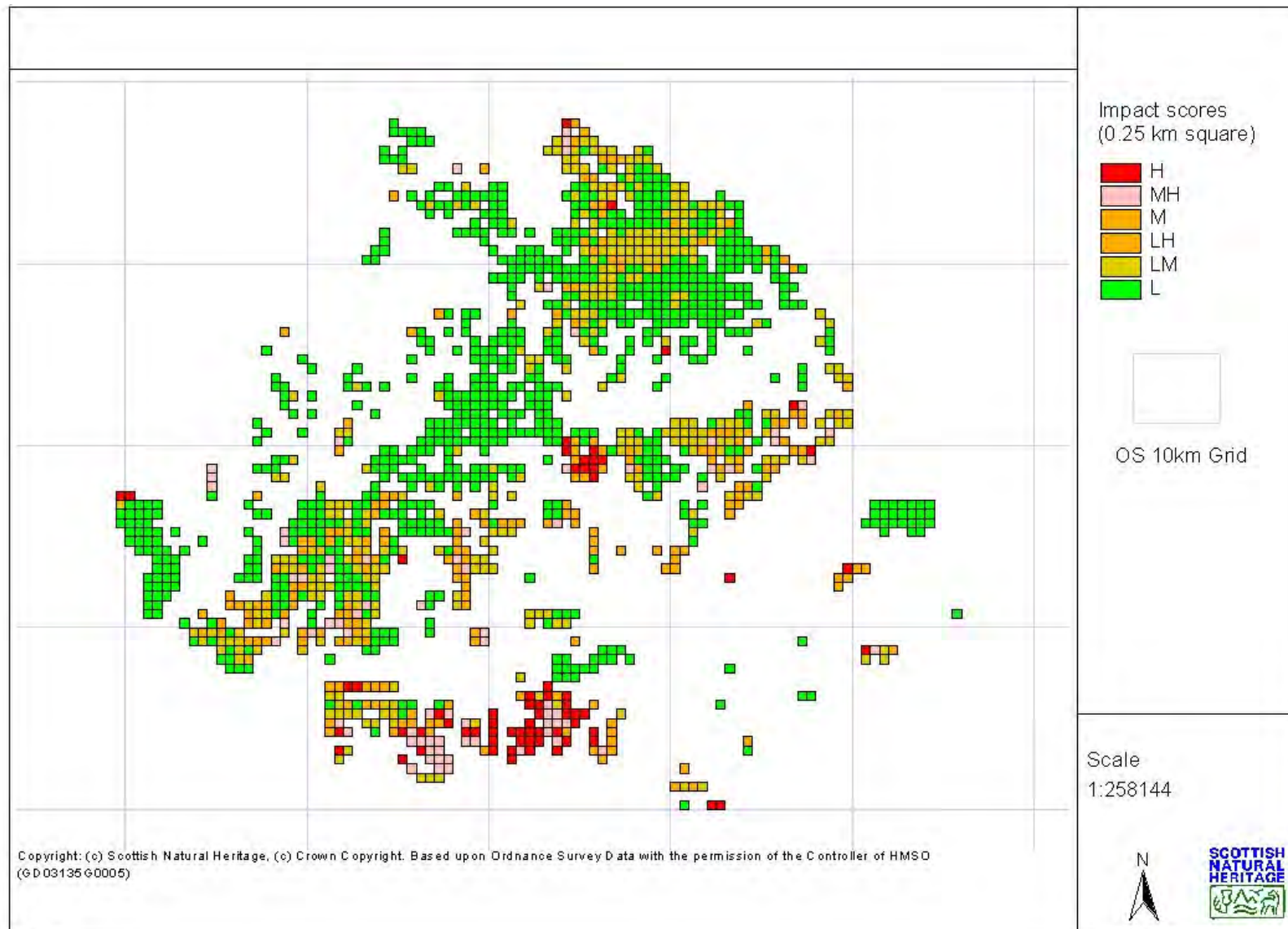


Figure 7 0.25 km squares with standardised grazing and trampling impact scores for grassland in the Cairngorms Core Area

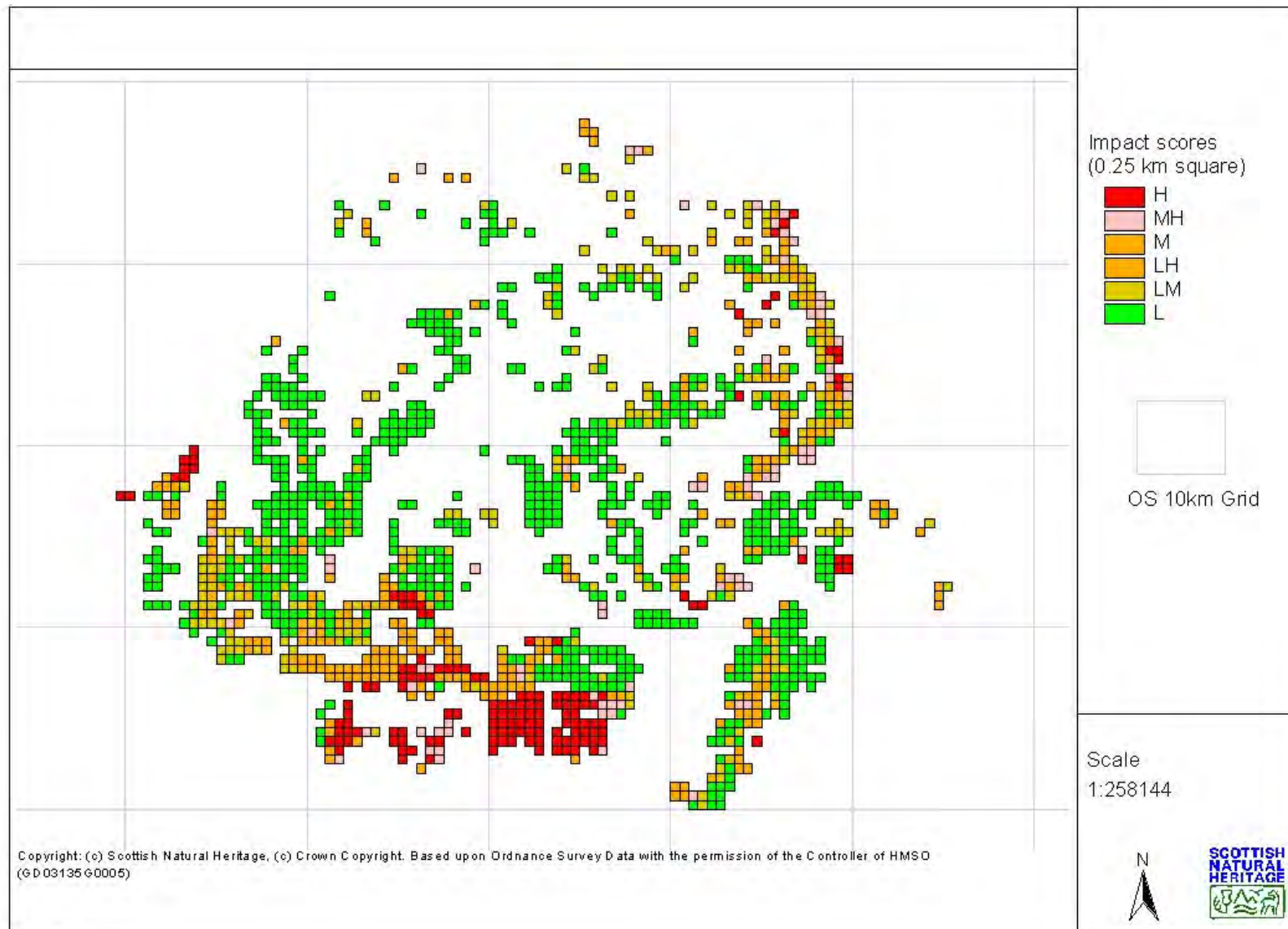


Figure 8 0.25 km squares with tree and scrub regeneration in the Cairngorms Core Area

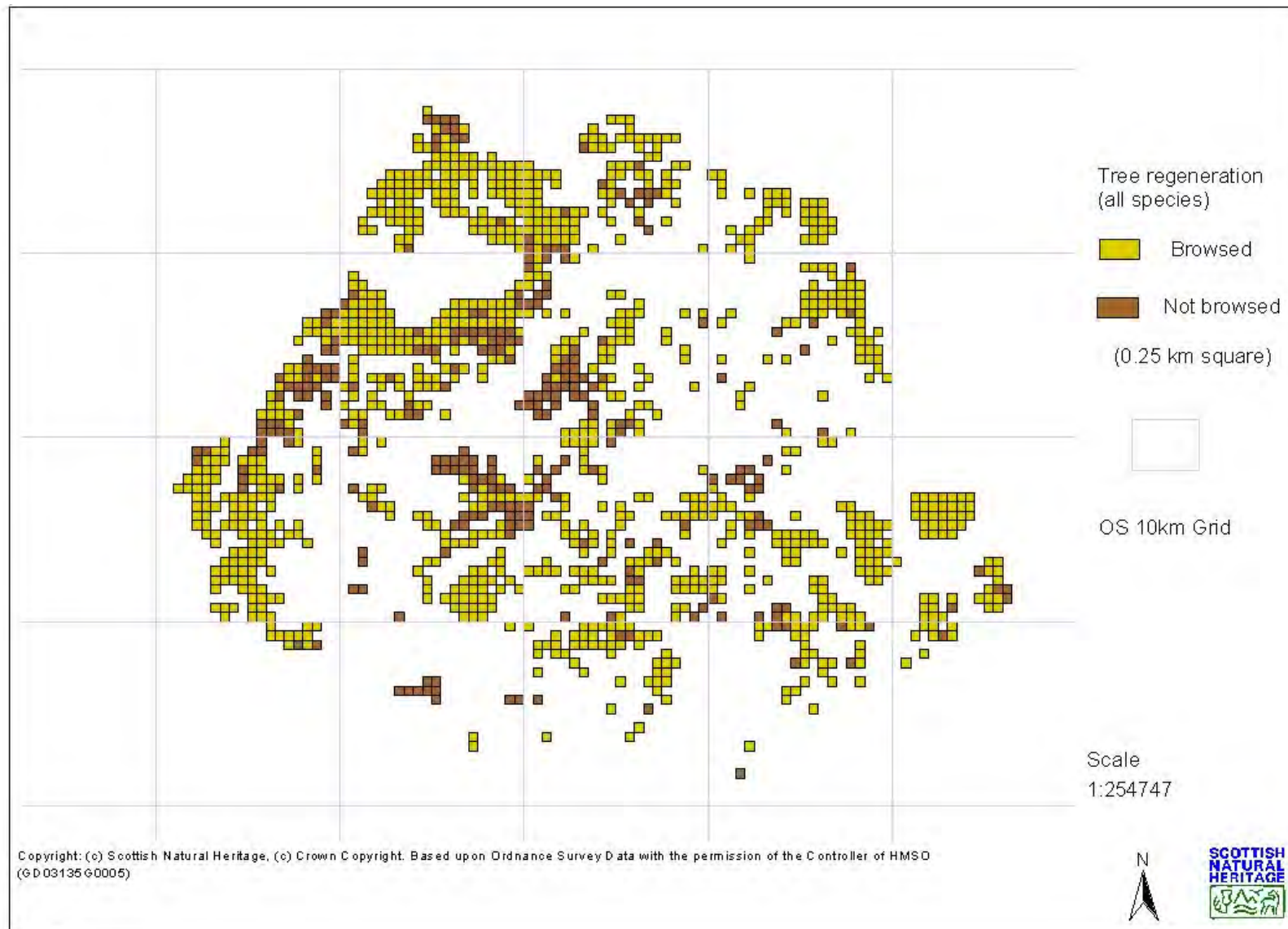


Figure 9 0.25 km squares showing presence of deer species in the Cairngorms Core Area

40

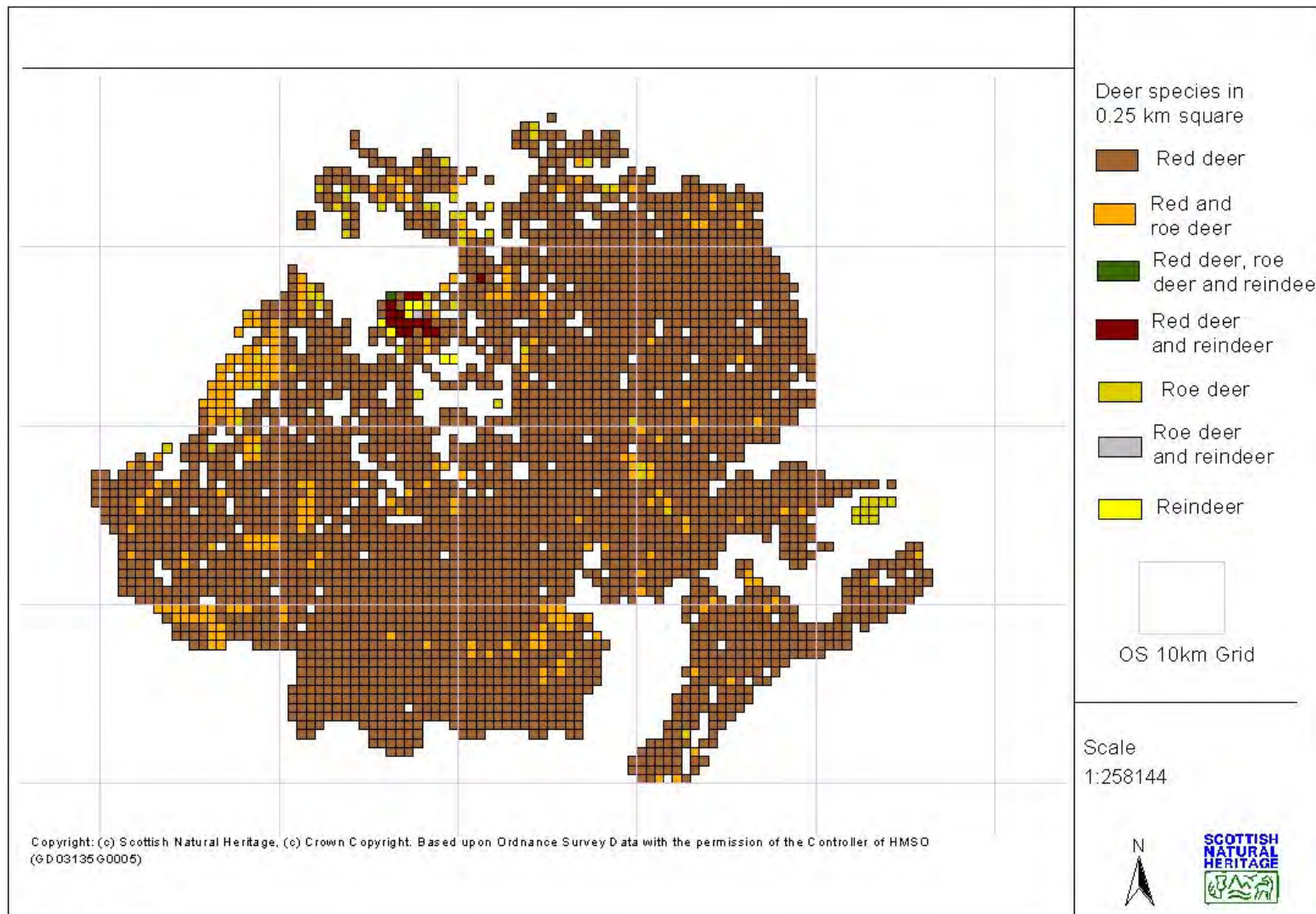


Figure 10 0.25 km squares showing presence of sheep and cattle in the Cairngorms Core Area

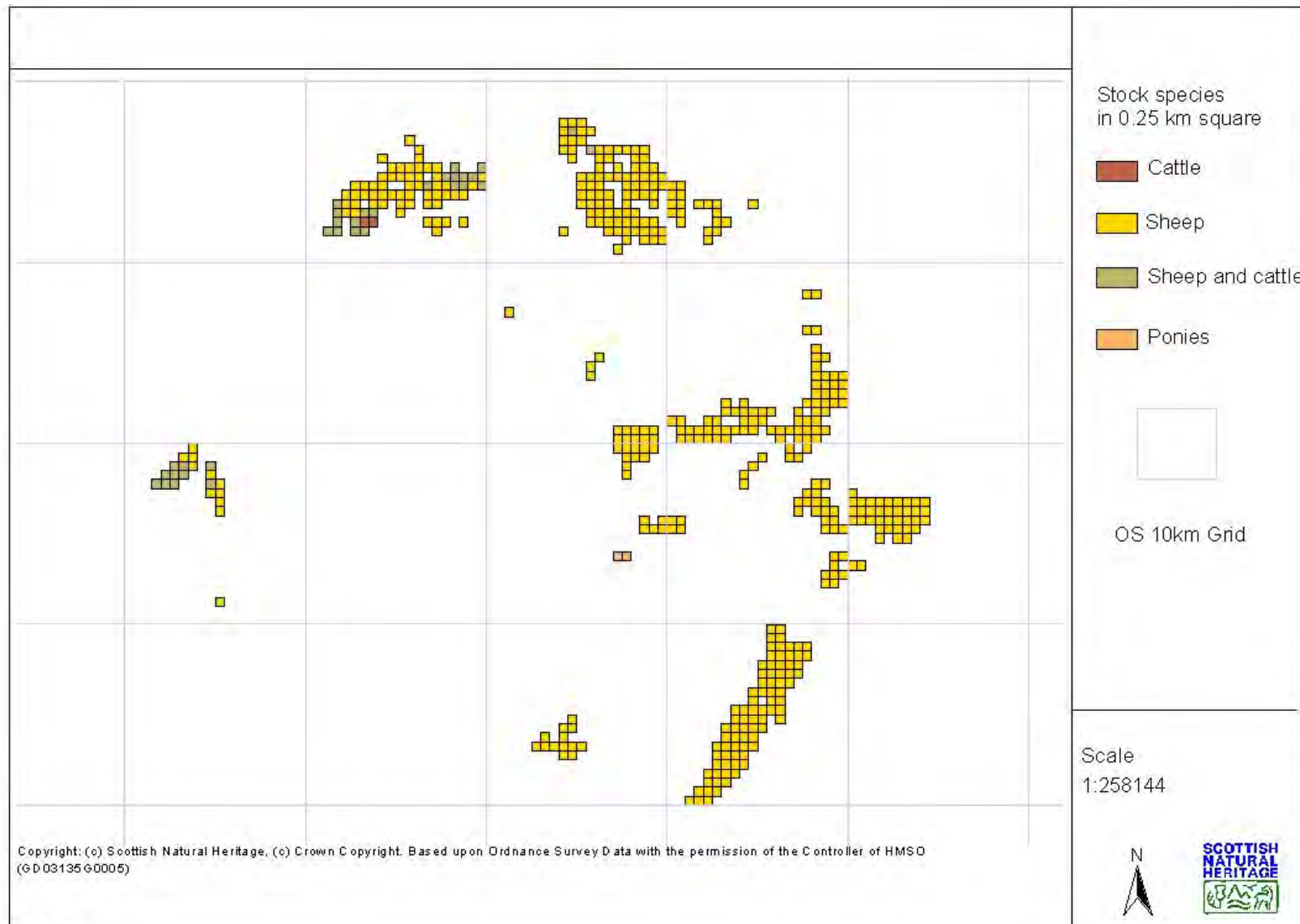


Figure 11 0.25 km squares showing presence of mountain hare and rabbit in the Cairngorms Core Area

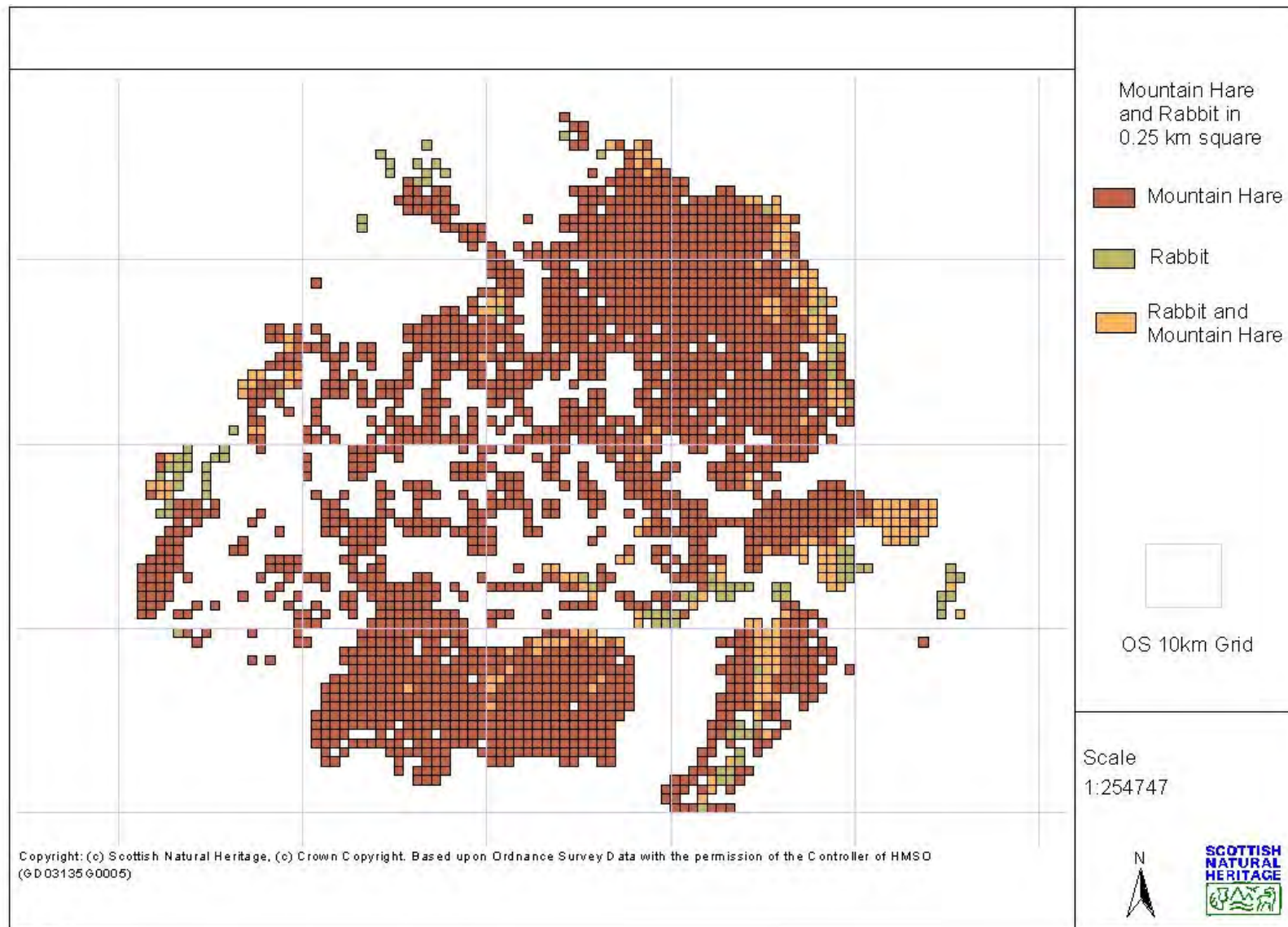
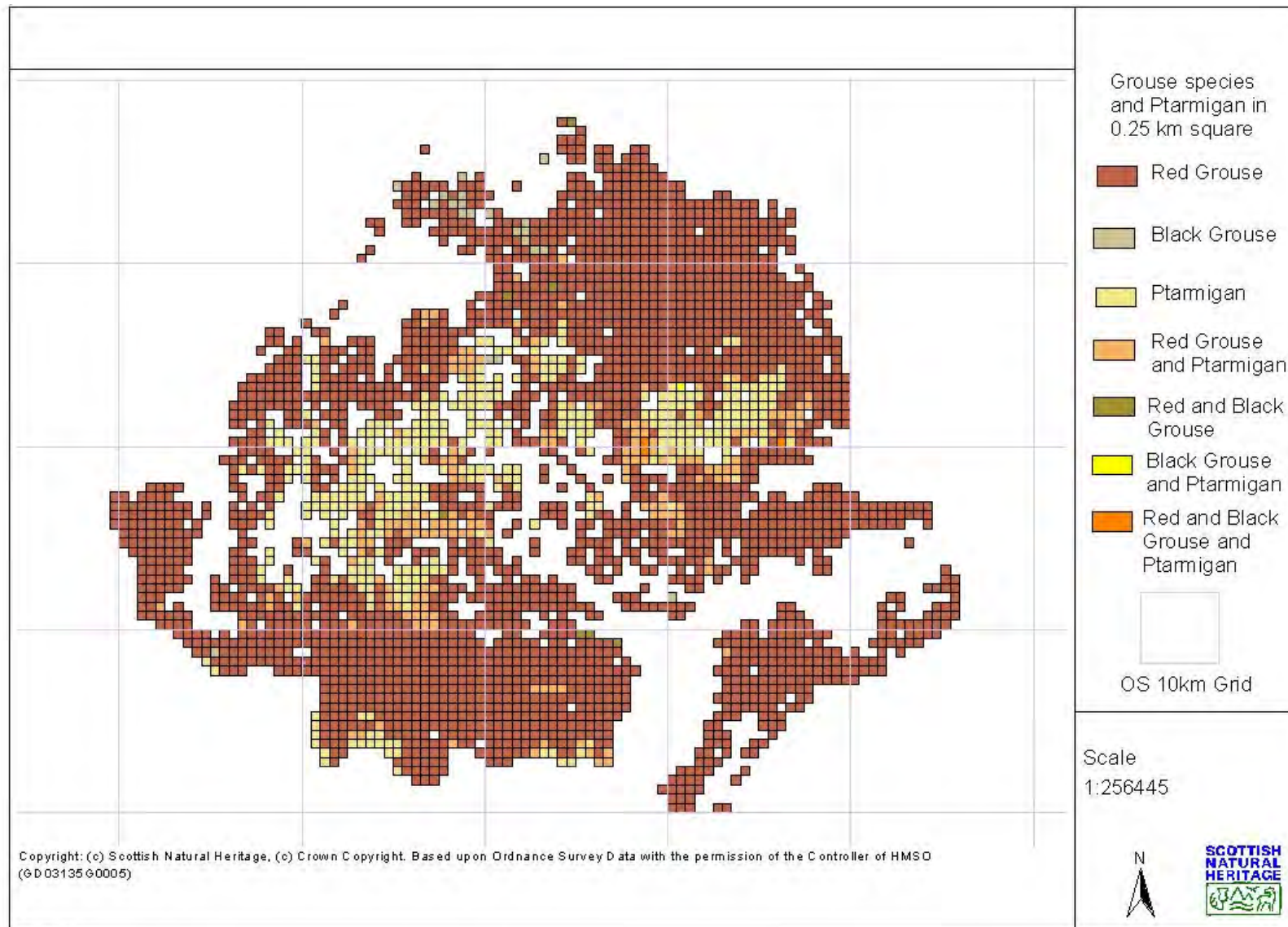


Figure 12 0.25 km squares showing presence of grouse species and ptarmigan in the Cairngorms Core Area





*Figure 13 Light browsing impacts in dry dwarf-shrub heath showing tree regeneration (Scots pine and birch) on the northern slopes of the Kincardine Hills.*



*Figure 14 Light browsing impacts in dry dwarf-shrub heath with tree regeneration (Scots pine and birch) in the Pass of Ryvoan*



*Figure 15 Heavy browsing impacts in dry dwarf-shrub heath showing drumstick and topiary heather, dead stems of heather and invasion by grassland*



*Figure 16 Heavy browsing impacts in dry dwarf-shrub heath showing short, browsed heather, twisted and dead stems of heather and abundance of blueberry apparently favoured by browsing.*



*Figure 17 Moderate browsing impacts in dry dwarf-shrub heath showing rounded bushes of heather and patchy incursion of grassland.*



*Figure 18 Heavy browsing impacts in dry dwarf-shrub heath showing development of grassland and soil erosion on steep slopes.*



*Figure 19 Dry dwarf-shrub heath showing heavy browsing impacts in glen bottom with gradients to mostly light impact on steep slopes at Baddoch, Glen Clunie.*



*Figure 20 Dry dwarf-shrub heath in Glen Clunie showing gradients in browsing impacts from heavy to moderate and light with moderate grazing impacts in smooth grassland.*



*Figure 21 Mixed heavy, moderate and light browsing impacts on dwarf-shrub heath in Glen Clunie and showing patchy development of grassland.*



*Figure 22 Red deer tracks crossing dry dwarf-shrub heath showing localised heavy and moderate browsing impacts.*



*Figure 23 Moderate trampling damage in Calluna-Eriophorum blanket bog showing widespread but patchy bare peat.*



*Figure 24 Light grazing in tussock grassland dominated by mat-grass (Nardus stricta), showing the development of a tall, dense sward.*

## APPENDIX 1 Habitats assessed

### Dwarf-shrub heath

Dwarf-shrub heath includes both dry heaths and wet heaths. Dry heaths are dominated solely by dwarf-shrubs. The main dominant of dry dwarf-shrub heath in the Cairngorms is heather (*Calluna vulgaris*), often mixed with blaeberry (*Vaccinium myrtillus*) while bell-heather (*Erica cinerea*) and crowberry (*Empetrum nigrum*) are more locally abundant. Wet heaths are dominated typically by dwarf-shrubs, usually heather and cross-leaved heath (*Erica tetralix*) mixed with sedges and grasses usually deer-grass (*Trichophorum cespitosum*) and purple moor-grass (*Molinia caerulea*).

All tall dwarf-shrub heath with upright growth forms is included. Therefore, all sub-montane or sub-alpine and forest-zone heath is included, while tall *Calluna*-dominated montane or alpine heaths are also included. Roughly, these heaths extend up to around an altitude of 850 m in the Cairngorms. Dry heath is the predominant vegetation on steep slopes while wet heath occupies shallow slopes which are generally too steep or too well-drained for blanket bog formation.

### Wind-clipped summit heath

This habitat includes vegetation of exposed ridges, cols, summits and the high plateaux of the Cairngorms. A wide range of montane or alpine dwarf-shrub heaths, moss-, sedge- and rush- heaths are included as follows:

1. prostrate dwarf-shrub heaths which are usually rich in lichens in the Cairngorms (dominated by either heather, blaeberry or crowberry or mixtures of these);
2. stiff-sedge – woolly-fringe moss-heath (*Carex bigelowii*-*Racomitrium lanuginosum* moss-heaths);
3. stiff-sedge and three-leaved rush (*Juncus trifidus*) heaths of the higher summits and plateaux.

Roughly, these habitats extend from an altitude of 750m up on to the highest ground in the Cairngorms. Prostrate heather heath can occur down to 600 m in exposed places.

### Blanket bog

Blanket bog is ombrogenous (rain fed) bog dominated by mixtures of heather and cotton-grasses (*Eriophorum vaginatum* and *E. angustifolium*), with cross-leaved heath, deer-grass, flying bent and usually with an abundance of bog-mosses (*Sphagnum* spp.). They are differentiated from wet heath by the abundance of single-headed cotton grass (*E. vaginatum*) and hummock-forming bog mosses such as *S. capillifolium*, *S. papillosum* and *S. magellanicum*. Blanket bogs are characterised by a structural patterning of hummocks and hollows, which sometimes includes bog-pools.

These bogs develop on deep peat; generally over 2 m in depth, but can occur on shallower peat of about 0.5 m in depth.

### Grasslands (smooth and tussock)

Two types of grassland, smooth and tussock are included. The smooth grasslands are the bent – sheep's fescue (*Agrostis-Festuca*) grasslands of richer soils and include both species-poor and species-rich types. Tussock grasslands include grassland dominated by mat-grass (*Nardus stricta*) and heath-rush (*Juncus squarrosus*), which are usually developed on highly acidic soils and are species-poor.

These are grasslands of the sub-alpine and forest zones. They are only locally extensive in the Cairngorms, often occurring where there has been disturbance such as on debris fans,

on alluvial soils or on the richer rocks e.g. at Inchrory and in Glen Feshie and where heavy grazing has favoured grassland. Also included are snow-bed mat-grass grasslands of the montane or alpine zone, which are extensive above about 650 m.

**Habitats with scattered trees**

These were assessed for impacts using the appropriate open habitat sections such as that for dwarf-shrub heath or grassland.



## APPENDIX 2 (cont.)

DWARF-SHRUB HEATH AND SMOOTH GRASSLAND						
Site name:	1 km <sup>2</sup> grid ref.:	0.25 km square:	NW	NE	Date:	
			SW	SE		
<b>GRAZING AND TRAMPLING FIELD INDICATORS</b>						
	<b>Grazing/browsing impact</b>					
	<b>Severe (additional indicators)</b>	<b>Heavy</b>		<b>Moderate</b>		<b>Light</b>
Dwarf-shrub heath (H10, H12, H16, H18, H21, H22, M15, M16)	>80% long shoots browsed	>66% (>33%)		33-66% (16-33%)		<33% (<16%)
% of vigorous heather or blaeberry shoots browsed (figs in brackets where shoot growth <4 cm)						
Summer browsing of heather		Easy to find		Negligible		Negligible
Browsing of cross-leaved heath, cowberry, bearberry & crowberry		Some		None		None
Stem and branch breakage of heather by large herbivores	Widespread throughout the stand	Conspicuous		Inconspicuous		Inconspicuous
Breadth of heavily browsed shrubs at interface with grassland	Very obviously heavily browsed throughout	Broad (>10 m)		Narrow (1-10 m)		Very narrow or absent (<1 m)
Dwarf-shrub seedlings uprooted in burnt areas		Conspicuous		Not conspicuous		Little or none
Flowering and fruiting of heather or blaeberry		Sparse		Patchy		Abundant
Amount of bare, trampled ground	Widespread	Frequent		Little or none		Little or none
Amount of herbivore dung present (sheep and/or deer)		V. conspicuous.		Easy to find		Difficult to find or absent
<b>Trend indicators</b>	<b>Chronic severe</b>	<b>Chronic heavy</b>	<b>I &gt;Impact</b>	<b>Chronic moderate</b>	<b>D &lt;Impact</b>	<b>Chronic light</b>
Presence/development of grazing-induced growth forms of <i>Calluna/Vaccinium</i>						
1) presence of drumstick, topiary or carpet	Almost everywhere	Widespread		Localised		Very few or none
2) older growth contorted, recent growth less contorted					Yes (Fre)	
3) scattered, variably developed growth forms			Yes			
Upper canopy stripped of upright shoots ("lattered") with upright bush structure			Yes			
Dwarf-shrubs short (<10cm), shorter and of lower ground cover than graminoids		Yes				
Dwarf-shrubs mod. tall (>10cm), starting to overtop graminoids, variable cover					Yes	
Sheep scars		Actively eroding =>	Yes		Yes	<= Revegetating
<b>Smooth grassland (U1, U2, U4, CG10...CG14 inc.)</b>		<b>Heavy</b>		<b>Moderate</b>		<b>Light</b>
Leaves grazed of grasses ( <i>Agrostis canina</i> , <i>Festuca ovina/vivipara</i> )		>66%		33-66%		<33%
Grazing of leaves of <i>Ag cap</i> , <i>An od</i> , <i>Dan dec</i> , <i>D flex.</i> , <i>F rubra</i> etc.		Nearly all		>50%		<50%
Moss cover (particularly "feather" mosses)		>50% cover		<50% cover		Not conspicuous
Sward height		Mostly <3 cm		Mostly 3-6 cm		Mostly 6-9 cm
Flowering of grasses and forbs >3 cm tall		Sparse/none		Scattered		Abundant
Accumulation of dead plant litter in the sward		<1 cm deep		1-3 cm deep		>3 cm deep
Bare ground not caused by moles, slippages or rock falls		Frequent >20 ha <sup>-1</sup>				Scarce/absent
Bare ground with surface disturbed by hoof marks		Widespread		None		None
Herbivore dung, sheep and/or deer (no. of pellet groups/100m <sup>2</sup> )		Abundant (>30)		Mod. abundant (10-30)		Little or none (<10)
<b>Trend indicators</b>		<b>Chronic heavy</b>	<b>I &gt;Impact</b>	<b>Chronic moderate</b>	<b>D &lt;Impact</b>	<b>Chronic light</b>
Grazing impact assessment by sward ht. < or > by grazing of leaves			<		>	
Flowering and height of potential tall herbs: 1) Dwarfed v. well developed		Yes (dwarfed)				Yes (well developed)
2) Not dwarfed but leaves and flowers grazed or dwarfed but flowering and little/no sign grazed			Yes (grazed)		Yes (little or no grazing)	
Cover of small, rosette, creeping or mat species (<>grass cover)		High (>grass)				Low (<grass)
Tree and shrub saplings present and sward short					Yes	

## APPENDIX 2 (cont.)

TUSSOCK GRASSLAND, WIND-CLIPPED HEATHS AND BLANKET BOG					
Site name:	1 km <sup>2</sup> grid ref.:	0.25 km square:	NW NE	Date:	
			SW SE		
<b>GRAZING AND TRAMPLING FIELD INDICATORS</b>					
<b>Tussock grassland (U5, U6, U7)</b>		<b>Heavy</b>		<b>Moderate</b>	<b>Light</b>
Signs of grazing of <i>Nardus</i> tussocks (sheep/deer)		Present		Virtually none	Virtually none
Leaves grazed of grasses ( <i>Agrostis canina</i> , <i>Festuca ovina/vivipara</i> )		>66%		33-66%	<33%
Grazing of leaves of <i>Ag cap</i> , <i>An od</i> , <i>Dan dec</i> , <i>D flex.</i> , <i>F rubra</i> etc.		Nearly all		>50%	<50%
Average inter-tussock sward height		<3 cm		3-6 cm	>6 cm
Flowering of associated inter-tussock herbs		Sparse/none		Majority not flowering	Abundant
Seedlings and saplings of trees & shrubs > 5 cm high		Absent		Absent	Present
Cover of <i>Polytrichum commune</i> and feather mosses		High		Present	Present
Dead plant litter		Thin mat <3 cm		Mat 3-6 cm	Deep >6 cm
Amount of bare ground: surface disturbed by hoof marks		Widespread		None or sparse	None or sparse
Sheep scars		Frequent (>20ha <sup>-1</sup> )		Very localised (<20ha <sup>-1</sup> )	Scarce or absent
<b>Trend indicators</b>		<b>Chronic heavy</b>	<b>I &gt;Impact</b>	<b>Chronic moderate</b>	<b>D &lt;Impact</b>
Grazing impact assessment by sward ht. < or > by grazing of lvs/flws		<	>	>	<
Flowering and height of potential tall herbs: 1) Dwarfed v. well developed		Yes (dwarfed)			Yes (well developed)
2) Not dwarfed but leaves and flowers grazed v. dwarfed but flowering and little/no sign grazed			Yes (grazed)		Yes (little or no grazing)
<i>J. squ</i> and small, rosette and mat herbs v. grasses and mosses abundant		<i>J. squ</i> /mat herbs major component		=>	These being overgrown
Cover of mosses ( <i>Polytrichum commune</i> and feather mosses) with other indicators suggesting light or mod. grazing					High cover
Tree and shrub sapling present and inter-tussock sward short			Yes		
<b>Wind-clipped heaths (H13, H14, H19, H20, U9, U10)</b>	<b>Severe</b>	<b>Heavy</b>			<b>Light</b>
Grazing of leaves of <i>J trif</i> , <i>C bige</i> , <i>Des flex</i> and <i>Festuca</i> spp	>30%	>10%			<10%
Browsing of any dwarf-shrubs present		Noticeable			Negligible
Grazing of leaves of broad-leaved <i>Agrostis</i> , <i>Anthoxanthum</i> , <i>Poa</i> spp.		Majority			Infrequent
Patches of bare ground about 10cm across (in sheltered areas)	Extensive	Present			Very little
Herbivore dung, sheep and/or deer (no. of pellet groups/100m <sup>2</sup> , minimum of 5 counts in each kind of heath/0.25km <sup>2</sup> )	>10 (>15 sheep only)	>3 (>5 sheep only)			<3 (<5 sheep only)
<b>Trend indicators</b>	<b>Chronic severe</b>	<b>Chronic heavy</b>	<b>I &gt;Impact</b>	<b>D &lt;Impact</b>	<b>Chronic light</b>
Total cover of <i>Galium saxatile</i> , <i>Potentilla erecta</i> and fescues and wavy-hair grass	>30%	>10% (>20% on lime-rich soils)			<10% (<20% on lime-rich soils)
Total cover of broad-leaved <i>Agrostis</i> , <i>Anthoxanthum</i> , <i>Poa</i> spp.	Frequent	>negligible			Negligible
Indicators as for the two above AND other indicators suggest heavy or light usage			Heavy		Light
<b>Blanket bog (M17, M18, M19)</b>	<b>Severe</b>	<b>Heavy</b>		<b>Moderate</b>	<b>Light</b>
Browsing on heather or blaeberry	Extensive	Easy to find		Easy to find	Difficult to find
See also <b>Dwarf-shrub heath</b> indicators					
Browsing on <i>Arcto uva-ursi</i> , <i>Emp nigrum</i> , <i>Erica tet</i> & <i>Vac vitis-idaea</i>		Some		None	None
Browsing on <i>Myrica gale</i>	Extensive	Conspicuous and easy to find		Some - easy to find but not conspicuous	Absent or difficult to find
Browsing of <i>Betula nana</i>		Majority browsed		Majority browsed	Majority not browsed
Amount of flower or fruit on <i>Rubus chamaemorus</i> during season	None	Majority none			Majority with
Cotton-grass ( <i>Eriophorum</i> spp.) flowers during season	Virtually none	Little or none		Patchy	Abundant
<i>Sphagnum</i> and/or lichen cover		Absent/patchy		Patchy	Abundant
Cover of "feather" mosses		Thin mats <<5cm deep		Mats <10 cm deep	Mats >10cm deep
Trampling and grazing of pool systems and water tracks inc. <i>Sphagnum</i>		Obviously trampled			No trampling, Intact
Trampling of <i>Sphagnum</i> moss hummocks and lawns		Most trampled		Minority trampled	Most intact
Abundance of deer/sheep hoof prints in bare peat	Virtually everywhere	Extensive		Patchy	Absent/ Inconspicuous
Herbivore dung: sheep and/or deer		Easy to find		Easy to find	Rare/absent
<b>Trend indicators</b>		<b>Chronic heavy</b>	<b>I &gt;Impact</b>	<b>Chronic moderate</b>	<b>D &lt;Impact</b>
Upper <i>Calluna</i> canopy stripped of upright shoots with a "tattered", open, upright canopy			Yes		

### **APPENDIX 3 Data file for the project**

An Excel spreadsheet with the data for the project is available on SNH's eRDMS (Cairngorms Grazing and Trampling Impact Assessments 1995 2000 Summary Data, objective id A244877). The following gives a description of each of the fields:

#### **ID1**

This field gives a reference number for each of the 3922 records holding data relating to a 0.25 km square.

#### **GRID REF**

This field gives a 6-figure grid reference to the 1 km square and the quarter square is given by the compass bearings NW, NE, SE and SW.

#### **SURVEYOR**

This is the name of the surveyor, or organisation that carried out the field survey.

#### **ESTATE NAME**

Names of all the estates represented within each of the 0.25 km squares. These data were derived from the SNH GIS database.

#### **ESTATE NAME (>50% 0.25 KM SQUARE)**

Names of the estates represented within each of the 0.25 km squares and occupying >50% of the area of the square.

#### **YEAR**

This is year of survey.

#### **GRID REF4**

This field gives the grid reference for the mid point of the 0.25 km square.

#### **X\_COOR1**

X coordinate of each 0.25 km square.

#### **Y\_COOR1**

Y coordinate of each 0.25 km square.

#### **STANDARDISED IMPACT SCORE DWARF-SHRUB HEATH (and other habitats)**

Grazing/browsing and trampling impact score standardised to one of six scores: L – light, LM – light to moderate, M – moderate, MH – moderate to heavy, H – heavy and for wind-clipped heath only LH –light to heavy.

#### **OVERALL IMPACT SCORE**

This is a summary impact score for a 0.25 km square giving priority to the score for the most sensitive habitat scored within the square. Due to the method of conversion from the field data they may not correspond to the standardised scores.

#### **AREA OF DWARF-SHRUB HEATH (HA) (and other habitats)**

This is the area of the habitat within the 0.25 km square.

#### **DEER, STOCK, LAGOMORPHS, GROUSE and PTARMIGAN**

This is presence of different species within each 0.25 km square.

## TREE REGENERATION

Presence of tree regeneration within each 0.25 km square (browsed and unbrowsed saplings).

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