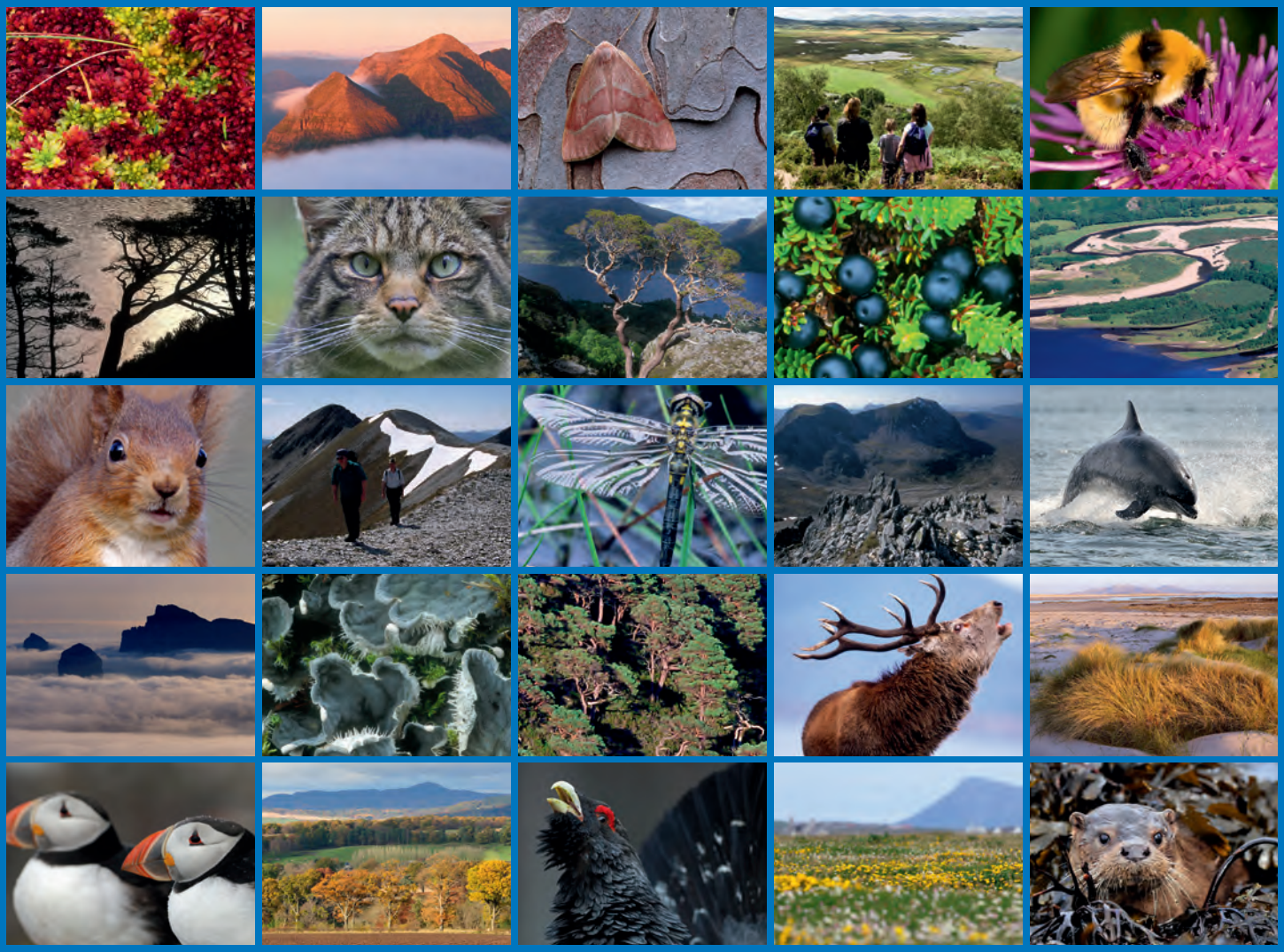
Scottish Natural Heritage
Commissioned Report No. 516

Assesment of herbivore impacts on designated upland habitats on Ben Hope SSSI



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COMMISSIONED REPORT

Commissioned Report No. 516

Assessment of herbivore impacts on designated upland habitats on Ben Hope SSSI

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COMMISSIONED REPORT

Summary

Assessment of Herbivore Impacts on designated Upland Habitats on Ben Hope SSSI

Commissioned Report No. 516 (iBids Project No. 12310)
Contractor: Nikki Dayton
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Summary

A herbivore impact assessment survey was carried out for four features, blanket bog, wet heath, subalpine dry heath and montane communities within the Ben Hope SSSI.

215 waypoints were assessed using the herbivore impact assessment methods from MacDonald *et al* (1998). Of these, 164 waypoints were previously assessed (Morris 2005), the remaining 51 were opportunistic new locations.

Grazing impacts were Low or Moderate-Low in 69% of blanket bog plots, 69% of dry heath plots, 50% of wet heath plots and 83% of montane plots. Four percent of dry heaths and 7% of wet heaths had High or High-Moderate grazing impacts. No blanket bog or montane plots had grazing impacts in excess of Moderate impacts.

Trampling impacts were generally higher than grazing impacts, especially for wet heaths and montane communities. Thirty five percent of wet heaths had Low or Moderate-Low trampling impacts and 43% had High or High-Moderate impacts. Fourteen percent of montane communities had High trampling impacts. Fifty six percent of blanket bog plots and 50% of dry heath plots had Low or Moderate-Low trampling impacts and 3% of each had High trampling impacts.

The highest trampling impacts were in An Gorm-choire, around Creag Riabach Mhor and in the blanket bog and wet heaths in the south-eastern part of the site. Higher grazing impacts were scattered across the site.

Impacts had changed for most habitats since 2004. Sixty seven percent of dry heath plots had higher grazing impacts in 2011 than in 2004. Trampling impacts decreased in 31% and increased in 25% of dry heath plots. Wet heath grazing and trampling impacts had increased in almost half the plots since 2004 and decreased in 25%. For montane plots, grazing impacts increased in 41% and trampling impacts in 50%. Thirty percent of blanket bog plots had increases in trampling and grazing impacts, but a similar percentage had decreases.

The prognosis for dry heath and blanket bog is mostly good at current impact levels, though localised higher trampling impacts, especially in An Gorm-Choire and the southeast could lead to a deterioration in the condition of the blanket bog feature.

Current impact levels may lead to a deterioration of the wet heath feature by increasing the amount of bare trampled soil. Current grazing levels may also be suppressing levels of dwarf shrub cover, though this could also be due to other factors such as past management and climatic conditions.

Current trampling levels may lead to a deterioration of the montane feature by increasing the amount of bare soil and possibly causing erosion.

The main herbivores at the site are red deer, though small numbers of sheep are present in different parts of the site.

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1. INTRODUCTION

1.1 Background information

During the summer of 2010 the condition of the Upland Assemblage feature on Ben Hope SSSI was monitored as part of SNH's national programme of Site Condition Monitoring.

The upland assemblage feature on Ben Hope is made up of five component habitats: subalpine dry heath, blanket bog, wet heath, montane acid grassland and alpine heath. Of these five habitats, two failed to meet SCM targets: subalpine dry heath and wet heath, and the feature was found to be in unfavourable declining condition. Failures were due to an absence of key indicator species, herbivore trampling and bracken encroachment. The dry heaths suffered particularly from bracken encroachment which was assessed as affecting 10-15% of the total area of dry heath at this site. As a result of the unfavourable assessment and to help inform future land management, SNH commissioned further survey work to examine more closely the factors contributing to the unfavourable condition.

Herbivore impacts were assessed on this site in 2004 (Morris 2004). At that time, it was noted that grazing on the west side of the ridge was generally higher, with deer, sheep and cattle all having access to that area. Since that time there have been some management changes with substantially lower numbers of livestock on the hill, particularly in the west, and some increases in deer numbers, particularly in the east. This survey repeated the 2004 Habitat Impact Assessment (HIA) on this site, with some modifications to improve the robustness of the methods used and to ensure that survey effort was appropriate.

The key aim was to implement a fit for purpose habitat survey to provide information on the nature and extent of herbivore impacts, which can be compared with the 2004 HIA results, and against which future trends can be gauged.

1.2. Designations

The site was notified as a Site of Special Scientific Interest in 1963 and re-notified in 1971 and 1987, both times with an increase in area. The total area is now 3034 hectares.

1.3 Site description

Ben Hope SSSI is a large upland site in north-west Sutherland. It contains Britain's northernmost Munro, Ben Hope, which reaches an altitude of 927 metres. Ben Hope is an isolated massif which rises abruptly from the surrounding moorland in a series of steep cliffs and sloping shelves. The broad, rocky ridges of the main summit and other outcrops within the site support a diverse range of alpine heath and montane acid grassland communities, including locally abundant H17 *Calluna vulgaris – Arctostaphylos alpinus* heath and species-rich sub-communities of the U10 *Carex bigelowii – Racomitrium lanuginosum* moss-heath. The slopes support a range of wet and dry heath communities, with blanket bog being found on deeper peat in corries, stream valleys and the surrounding lower slopes. There are pockets of calcareous grassland at the base of the cliffs on Leitir Mhuiseil.

The site is notified for its geology, upland habitat assemblage including upland birch woodland, and for a number of rare vascular plant species associated with the calcareous cliffs in the western part of the site.

Map 1 (Appendix 3) shows the Ben Hope SSSI subdivided into the three different ownership units.

1.4 Management

The site is managed for deer stalking. A small number of sheep were seen in the northern part of the site near the Moine path and approximately twenty sheep were present in the montane acid grassland area south of the Ben Hope summit. A few sheep were also seen near Loch a' Ghobha-Dubh in the eastern part of the site.

The site is popular with hill walkers who gain access to the summit of Ben Hope via a footpath from the car park at Muiseal. There is some trampling along the footpath margins with shortcuts and alternate routes along the Allt a' Mhuiseil and its tributaries, but this is localised and only affects a very small part of the site. There is a second footpath across the site, the Moine path which starts north of the Allt Dubh-loch na Beinne. This is quite overgrown and probably not used much by walkers, though fresh hoofprints during the survey suggest that it may be used at least occasionally by horse riders.

1.5 Survey logistics

The survey was carried out between 24 July and 29 July 2011 by Ruth Maier, Colin Wells and Tim Rafferty. Access permission for Kinloch was initially restricted to Sunday 24 July but an additional day was obtained to allow surveying the wet heath and blanket bog to the south of Sail Romascaig. The weather was very variable. It was very cold, wet and windy on the 24th, overcast and drizzly on the 25th, overcast but clearing on the 26th, hot and sunny on the 27th and overcast on the 28th and the 29th with some rain during the morning.

2. METHODS

Five habitats were surveyed within the site; blanket bog, wet heath, subalpine dry heath, montane acid grassland and alpine heath. Montane acid grassland and alpine heath were combined into a single montane feature.

Grazing, browsing and trampling impacts were assessed using a range of small-scale field indicators described in the Guide to Upland Habitats (MacDonald *et al.* 1998). Blanket bog was assessed using the blanket bog indicators and dry heath was assessed using the dwarf-shrub heath indicators. Wet heath was assessed using either the blanket bog indicators or the dwarf-shrub heath indicators depending on the wet heath sub-community present. M15b plots were assessed with blanket bog indicators and M15c with the dwarf-shrub heath indicators. The montane feature was mostly assessed using the wind-clipped summit-heath indicators, though stands belonging to U7 *Nardus stricta – Carex bigelowii* grass-heath were assessed using the grass-dominated snow-bed indicators from the addendum to the Guide to Upland Habitats (MacDonald 2007). The revised assessment combines indicators from the flush, wind-clipped and tussock grassland assessments and includes a new hybrid indicator for grazing on *Carex bigelowii* and fine-leaved grasses.

The same indicators were used for assessing blanket bog and dry heath in 2004 and 2011. All wet heath plots were assessed using the blanket bog indicators in 2004 and all montane plots were assessed using the wind-clipped summit heath indicators.

Additional measures were also recorded to assess habitat condition in a more quantitative way. They will be used to measure changes in habitat condition over time more precisely. These additional measures were only recorded in 2011.

The additional measures included estimating the percentage cover of the plot disturbed by hoof prints and, for blanket bog assessments, the percentage cover of intact *Sphagnum* spp, bare peat and revegetating peat. The percentage cover of grazing on *Carex bigelowii* and fine-leaved grasses and browsing on long shoots of *Calluna vulgaris* and *Vaccinium myrtillus* was estimated based on an average assessment of ten handfuls of shoots. The average height of dwarf shrub cover was recorded based on ten measurements taken in each plot.

There are three ownership units within the site. One of these, Hope Estate, occupies only a small part, and most of the site is split between Strathmore Estate west of the main ridge and Kinloch Estate to the east.

As the survey was a repeat of the survey carried out in 2004, the same randomly located waypoints were used, and a total of 201 waypoints were supplied, 70 for blanket bog, 58 for wet heath, 47 for dry heath and 26 for montane habitats. Waypoints were split between the two main management units, Strathmore Estate and Kinloch Estate. Extra waypoints were assessed opportunistically to achieve a total of 28 assessments for the blanket bog, wet heath and dry heath features in each of the two main management units. For the montane feature 28 waypoints were recorded for the whole site. The part of Kinloch Estate east of Loch na Seilg was not included in the 2004 survey so opportunistic points were recorded here for all habitats, as agreed with the nominated officer.

Hope Estate was not surveyed previously and no waypoints were supplied. Ten waypoints for wet heath and four for blanket bog were assessed opportunistically for this part of the site.

Point numbers used in the 2004 survey were retained. Opportunistic waypoints were numbered consecutively, starting with '300'.

The random locations were located with a hand-held GPS, either a Gamin Fortrex 201 or a MobileMapper. At each location the relevant feature was searched for within a 20-metre radius and assessed if it was present. A new ten figure grid reference was recorded if the plot was moved from the supplied grid reference.

As the number of dry heath plots for both management units was limited (18 in management unit 1 and 29 in management unit 2), dry heath plots were sometimes moved more than 20 metres from the original grid reference and occasionally up to 50 metres to the nearest alternative location where the habitat occurred. Plots moved further than 50 metres were given a new ID number and the original plot was discarded. A wet heath plot in management unit 1, Strathmore Estate was also moved more than 50 metres and renumbered. No opportunistic points were added to habitats with sufficient supplied waypoints apart from those recorded east of Loch na Seilg.

Plots measuring 2m x 2m were marked at each sample location and aligned north from the recorded grid reference. The NVC community present at each plot was recorded in order to identify the correct assessment form to be used (see Table 1).

Two photographs were taken of each plot, one close-up and one context shot to aid plot relocation.

Table 1. Relevant NVC communities and habitat assessment indicators used for each feature.

Feature assessed	Habitat assessment used	NVC community
Blanket bog	Blanket bog	M17, M19
European dry Heath	Dwarf-shrub heath	H10, H12, H18, H21, H22 (parts)
Wet heath	Blanket bog	M15b
Wet heath	Dwarf-shrub heath	M15c
Montane	Wind-clipped summit heath	U9, U10, H13, H14, H17, H19, H20
Montane	Grass-dominated snow bed (MacDonald 2007)	U7

For each plot, current herbivore trampling and grazing impacts were assessed using the appropriate small-scale grazing and trampling indicators from MacDonald *et al.* (1998). Impacts were recorded as H -High, M - Moderate or L - Low or as intermediate HM or ML when appropriate. If an assessment could not be carried out because it referred to plant species not present, the impact was recorded as NA – not applicable.

Trend indicators were also recorded which used the terms CH – Chronic High, CM – Chronic Moderate and CL – Chronic Low to describe long-term impacts and trends. Trend indicators were also recorded as D – Decreasing or I – Increasing if any changes in impact could be determined, otherwise they were assumed to be undetermined. The assessment of trend indicators is based on observations of the

current vegetation structure and composition to infer historical and any recent changes in impact levels.

To make an overall assessment for each plot, High impact results were scored 3, High-Moderate impacts 2.5, Moderate impacts 2, Moderate-Low impacts 1.5 and Low impacts 1. The combined scores were then averaged to give an overall score that was reclassified as follows:

0-1.249	Low
1.25-1.749	Moderate - Low
1.75-2.249	Moderate
2.25-2.749	High - Moderate
2.75-3	High

This was carried out separately for grazing and trampling indicators to give an overall grazing and trampling score for each feature.

Overall trend indicators were obtained by averaging the results from all the trend indicators recorded for each plot. As only a few trend indicators were relevant for each plot this was usually straightforward. If the recorded trend indicators were apparently contradictory (e.g. with CH for one indicator and CL for another at the same plot), the appropriateness of each indicator was assessed before reaching a conclusion. The relevance and usefulness of different indicators for each habitat is discussed further in the relevant results sections.

A direct comparison was also made between current impacts recorded in 2004 and in 2011, providing a more accurate indication of impact trends. As the 2004 report does not show the overall grazing and trampling impact results per plot, the original data from 2004 was summarised and analysed in the same way as the 2011 data. The results for the two types of assessments of trends are presented separately in this report.

2.1. Application of indicators

Assessment of browsing on *Calluna* was often difficult for this site. *Calluna* often lacked flowering long shoots giving the canopy a very dense and tight appearance. This type of growth form occurred in sheltered locations and at low altitudes and was not considered to be due to wind-clipping. Dense Calluna was often, but not always, discoloured with signs of greying or browning in the tips. Close examination of the discoloured tips showed that this was unlikely to be due to heather beetle as there was no sign of leaf damage. It is possible that the lack of healthy growth was due to adverse weather conditions during the two long cold winters preceding this survey.

If *Calluna* appeared otherwise healthy, this type of growth form was considered to be due to regular browsing of the shoot tips only, which can be difficult to determine due to the absence of clearly browsed shoots. *Vaccinium myrtillus*, if present, was always checked and used as verification of dwarf shrub browsing levels, though it was frequently too scarce to be used for guidance.

3. RESULTS

A total of 179 of the supplied waypoints were visited and 164 were assessed. Fifteen were discarded due to lack of appropriate habitat within 50 metres. All discards were replaced with opportunistic waypoints in the nearest patch of suitable habitat for the feature. Twenty-two waypoints were not visited as the total number of required assessments had already been achieved.

Table 2. Summary of waypoints.

Feature	Assessed existing waypoints	Discarded existing waypoints	Opportunistic waypoints (includes replacements)	Not visited	Total assessed
Blanket bog	54	0	7	16	61
Wet heath	51	2	15	5	66
Dry heath	37	9	22	1	59
Montane	22	4	7	0	29
Total	164	15	51	22	215

The totals for blanket bog and wet heath include ten opportunistic wet heath and four opportunistic blanket bog samples recorded for Hope Estate. A further ten opportunistic waypoints were recorded east of Loch na Seilg on Kinloch Estate, an area not included in the 2004 assessment. The waypoints recorded east of Loch na Seilg consisted of two dry heath, two montane, three blanket bog and three wet heath samples.

Tables of all the assessments made for each feature in each management unit are given in Appendix 1 Detailed results for each indicator are in the results spreadsheets in Appendix 4. In the following sections the results are described and discussed separately for each feature for the whole site and for each management unit.

3.1 Results by habitat type

Table 3 shows the total number and percentage of plots recorded for each impact class for each habitat in the Ben Hope SSSI. The results are described in detail in the following sections and maps showing grazing and trampling impacts for each feature are in Appendix 3.

Table 3. Number and percentage of plots in each impact class. G – grazing impacts, T – trampling impacts.

		L	%	ML	%	M	%	HM	%	H	%	TOTAL
Blanket	**G**	**16**	*26*	**26**	*43*	**19**	*31*	**0**	*0*	**0**	*0*	**61**
bog	**T**	**16**	*26*	**22**	*36*	**11**	*18*	**10**	*16*	**2**	*3*	**61**
Dry heath	**G**	**6**	*10*	**35**	*59*	**16**	*27*	**1**	*2*	**1**	*2*	**59**
	T	**22**	*37*	**28**	*48*	**6**	*10*	**1**	*2*	**2**	*3*	**59**
Wet heath	**G**	**7**	*11*	**26**	*39*	**29**	*44*	**3**	*5*	**1**	*2*	**66**
	T	**10**	*15*	**13**	*20*	**15**	*23*	**19**	*29*	**9**	*14*	**66**
Montane	**G**	**15**	*52*	**9**	*31*	**5**	*17*	**0**	*0*	**0**	*0*	**29**
	T	**13**	*45*	**0**	*0*	**9**	*31*	**0**	*0*	**7**	*24*	**29**

3.1.1 Blanket bog

3.1.1.1 Habitat description

Blanket bog is widespread on the lower slopes to the north, east and south of the main ridge. It is also found in some of the corries to the east and on shallow slopes in stream valleys below the steep escarpments to the west. Much of the blanket bog belongs to the M17 *Scirpus cespitosus – Eriophorum vaginatum* blanket mire. This community is often dominated by graminoids, especially *Scirpus cespitosus* which is most abundant in the southern and central parts of the site, and *Molinia caerulea* which is abundant in the north and west. There is also some M19 *Calluna vulgaris – Eriophorum vaginatum* blanket mire, usually on steeper slopes. This is often dominated by *Calluna vulgaris* and grades into bryophyte-rich dry heath in the eastern corries.

3.1.1.2 Grazing impacts

Map 2 (Appendix 3) shows the blanket bog grazing impacts within the Ben Hope SSSI. Twenty-six percent of blanket bog plots had Low grazing impacts, 43% Moderate-Low impacts, 31% had Moderate impacts and none had High impacts (see table 3).

Plots with Moderate scores were scattered across the site with no clear aggregations. None of the Low grazing impact plots were situated in An Gorm-choire.

Three separate plots had High impact scores for either flowering of *Rubus chamaemorus* or flowering of *Eriphorum spp*. (see table 4). High-Moderate impacts scores were recorded for the browsing on *Calluna* and *Vaccinium myrtillus* indicator for 46% of the plots, while the remaining 54% of plots had a Low score for this indicator. Browsing on unpalatable dwarf shrubs such as *Erica tetralix* was Moderate-Low for all plots.

Myrica gale was present in 13% of plots and the growth-form and browsing target for this species was assessed as Moderate for all of these.

Table 4. The number of blanket bog plots assigned to each grazing impact category for each field indicator. Percentages are given in brackets. *H – High, HM-High-Moderate, M-Moderate, ML-Moderate—Low, L-low, NA – Not applicable*

	Browsing of unpalatable dwarf shrubs	**Flowering of *R. chamaemorus***	**Flowering of *Eriophorum***	**Growth-form and browsing on *Myrica***	**Browsing of *Calluna/V. myrtillus***
H	0	1 (2)	2 (3)	0	0
HM	0	0	0	0	28 (46)
M	0	0	24 (39)	8 (13)	0
ML	56 (92)	0	0	0	0
L	0	1 (2)	34 (56)	0	33 (54)
TOTAL	56 (92)	2 (3)	60 (98)	8 (13)	61 (100)
NA	5 (8)	59 (97)	1 (2)	53 (87)	0

3.1.1.3 Trampling impacts

Map 3 (Appendix 3) shows trampling impacts on the blanket bog within the Ben Hope SSSI. Twenty-six percent of blanket bog plots had Low trampling impacts, 36% had Moderate-Low impacts, 18% had Moderate impacts, 16% had High-Moderate impacts and three percent had High trampling impacts (see table 3).

The highest trampling impacts were recorded in An-Gorm Choire in the east. Both blanket bog plots with a High trampling score were located here. The area also contains a further five blanket bog plots with High-Moderate trampling impacts as well as one plot with Low, one with Moderate-Low and another with Moderate trampling impacts. A further four plots with High-Moderate trampling impacts were scattered in the northern and north-eastern part of the site. Blanket bog plots in the southern part all had Moderate or Low trampling impacts.

High impact scores were recorded for all trampling indicators for some of the plots. A High score was recorded for 11 of the 26 plots assessed for trampling of pools and water tracks and for eight of the 54 plots assessed for hoof prints in bare peat. A High score was also recorded for five out of 51 assessments of *Sphagnum* trampling and four out of 61 assessments of bryophyte/lichen cover.

Half the plots recorded Low impact scores for the bryophyte or lichen cover target and the *Sphagnum* trampling target. Eight of the 26 plots assessed for trampling of pools and water tracks had Low impacts while 20 out of 54 plots had Low impacts for hoof prints in bare peat.

Not all targets were assessed for each plot, and table 5 also lists the number of plots where the indicator could not be applied. This was highest for the firmness of ground indicator where 80% of plots were not assessed.

Table 5. The number of blanket bog plots assigned to each trampling impact category for each field indicator. Percentages are given in brackets. *H – High, HM-High-Moderate, M-Moderate, ML-Moderate—Low, L-low, NA – Not applicable*

	Pools/ water tracks trampling	***Sphagnum* trampling**	**Bryophyte/ lichen cover**	**Hoof prints**	**Firmness of ground**
H	11 (18)	5 (8)	4 (7)	8 (13)	0
HM	0	0	0	0	0
M	7 (11)	14 (23)	28 (46)	26 (43)	0
ML	0	0	0	0	12 (20)
L	8 (13)	32 (52)	29 (48)	20 (33)	0
TOTAL	26 (43)	51 (84)	61 (100)	54 (89)	12 (20)
NA	35 (57)	10 (16)	0	7 (11)	48 (80)

3.1.1.4 Quantitative measures

The average cover of intact *Sphagnum* in plots was 24%. No *Sphagnum* was present in 14 out of the 61 plots while another 14 plots had more than 50% cover. Hoofprints were present in 39 out of 61 plots. Fourteen out of the 61 plots had some bare peat while 11 had re-vegetating peat. The average cover of bare peat was 6%. Nine plots had a cover of bare peat higher than 25% and 6 of these were located in An Gorm-choire.

3.1.1.5 Trends

Map 4 (Appendix 3) shows the blanket bog impact trends within Ben Hope SSSI. Forty-three percent had impact trends that were Chronic High (see table 6). Eighteen percent had Decreasing impacts and 9% had Increasing impacts. No impact trend could be determined for a third of all plots as none of the indicators were applicable.

Plots with a Chronic High score were scattered across the site. Three of the plots with an Increasing impact were located in An Gorm-choire. The two plots with Chronic High impacts east of Loch na Seilg had Decreasing impact trends. All the plots in the southern part of the site where a trend direction could be determined were found to have Decreasing impacts.

Table 6. The number of plots in each trend category.

Category	CH	CM	CL	CH/D	CH/I	D	I	NA
Total	18	0	0	8	4	10	1	20
Percent	30	0	0	13	7	16	2	33

The analysis is based on four indicators which were applied to some or most of the plots (see table 7). The two remaining indicators, presence of U4 *spp* and presence of *Carex panicea* were disregarded for the analysis as they were uninformative. While presence of grass species or *Carex panicea* may suggest peat drying and blanket bog degradation, absence of such species does not necessarily mean that the blanket bog has low impacts.

The most useful indicator was the height and cover of dwarf shrubs versus graminoids which was applied in 41% of plots. Dwarf shrubs were often very short in the blanket bog plots and this indicator was assessed as Chronic High for 26% of the plots and Decreasing in 13% of plots. The changes in growth form indicator was assessed for 21% of plots. It was found to suggest a Decreasing impact trend in two thirds of these and Increasing trend in one third. Half of the plots assessed for the abundance of *Juncus squarrosus* were recorded as Chronic High, the other half as Decreasing.

Table 7. The number of blanket bog plots assigned to each trend impact category for each field indicator. Percentages are given in brackets. *CH-Chronic High, CL-Chronic Low, D-Decreasing, I-Increasing, NA-Not applicable.*

	Change in growth form of dwarf shrubs	**Height of Myrica gale**	**Height & cover of dwarf shrubs versus graminoids**	**Abundance of *Juncus squarrosus***
CH	0	8 (13)	16 (26)	9 (15)
CL	0	0	0	0
D	8 (13)	0	8 (13)	10 (16)
I	5 (8)	0	0	0
TOTAL	13 (21)	8 (13)	25 (41)	19 (31)
NA	48 (79)	53 (87)	36 (61)	42 (69)

3.1.2 Dry heath

3.1.2.1 Habitat description

Dry heath is found on steeper, often rocky slopes within Ben Hope SSSI. The most widespread communities are H10 *Calluna vulgaris – Erica cinerea* heath and H12 *Calluna vulgaris – Vaccinium myrtillus* heath. There are also frequent stands of H21 *Calluna vulgaris – Vaccinium myrtillus – Sphagnum capillifolium* heath and H22 *Vaccinium myrtillus – Rubus chamaemorus* heath, largely on the east and north-facing slopes of the main ridge and within the eastern corries. Dry heaths are usually dominated by *Calluna vulgaris; Vaccinium myrtillus* – dominated H18 *Vaccinium myrtillus – Deschampsia flexuosa* heath was only found very rarely.

3.1.2.2 Grazing impacts

Map 5 (Appendix 3) shows the dry heath grazing impacts within Ben Hope SSSI. A single plot had High grazing impacts and another had High-Moderate impacts. Twenty-seven percent had Moderate grazing impacts and 59% Moderate-Low impacts. Ten percent had Low grazing impacts (see table 3).

The single High impact plot was situated near the waterfall above Alltnacaillich in an area of dry heath with variable impacts. At the sample location there was frequent tracking, fresh dung and recent signs of browsing on the current year's growth.

All indicators received High impact scores in at least one plot (see table 8). Browsing of *Calluna/Vaccinium myrtillus* had the highest impacts, with 14% of all plots being assessed as High impact for this indicator. Five percent of plots also had a High score for amount of flowering of *Calluna*. Browsing of unpalatable dwarf shrubs was Moderate-Low for 43 out of the 44 plots assessed for this indicator and High for only one plot.

Almost half of all the plots had Low browsing impacts for the palatable dwarf shrubs *Calluna vulgaris* and *Vaccinium myrtillus* and a further 39% had Moderate impacts. Evidence of summer browsing of *Calluna* was only found in a single plot; most plots scored Moderate-Low for this indicator. The type of shoot tip removed indicated Low impacts for 71% of plots, Moderate for 27% and High for two percent.

Table 8. The number of dry heath plots assigned to each grazing impact category for each field indicator. Percentages are given in brackets. *H – High, HM-High-Moderate, M-Moderate, ML-Moderate—Low, L-low, NA – Not applicable*

	Browsing of unpalatable dwarf shrubs	**Browsing of *Calluna/V. myrtillus***	**Flowering of *Calluna***	**Summer browsing on *Calluna***	**Shoot type removed**
H	1 (2)	8 (14)	3 (5)	1 (2)	1 (2)
HM	0	0	0	0	0
M	0	23 (39)	45 (76)	0	16 (27)
ML	43 (73)	0	0	57 (97)	0
L	0	28 (47)	11 (19)	0	42 (71)
TOTAL	44 (75)	59 (100)	59 (100)	58 (98)	59 (100)
NA	15 (25)	0	0	1 (2)	0

3.1.2.3 Trampling impacts

Map 6 (Appendix 3) shows the dry heath trampling impacts within Ben Hope SSSI. Two dry heath plots had High trampling impacts and one had High-Moderate impacts. Moderate-Low impacts were recorded for 47%, almost half of the plots and a further 37% had Low impacts. Ten percent had Moderate trampling impact scores (see table 3).

The three plots with High or High-Moderate trampling impacts were all found in the eastern part of the site in and around An Gorm-choire, where the highest blanket bog impacts were also found.

Table 9. The number of dry heath plots assigned to each trampling impact category for each field indicator. Percentages are given in brackets. *H – High, HM-High-Moderate, M-Moderate, ML-Moderate—Low, L-low, NA – Not applicable*

	Stem breakage due to Trampling	**Depth bryophyte/ lichen carpet**	**% trampled bare**
H	7 (12)	3 (5)	5 (8)
HM	0	0	0
M	0	31 (53)	0
ML	52 (88)	0	0
L	0	25 (42)	54 (92)
TOTAL	59 (100)	59	59
NA	0	0	0

Three main trampling indicators were used (see table 9). The fourth only applies to recently burnt areas which were not present within the site. All indicators had some plots with High impacts. Twelve percent had High impacts for stem breakage, 5% for the depth of the bryophyte carpet and 8% for the presence of trampled bare ground. More than half the plots had Moderate impacts for the depth of the bryophyte carpet and 42% had Low impacts for this. Bare trampled ground was absent or scarce in 92% of plots which received a Low impact score for this indicator.

3.1.2.4 Quantitative measures

The quantitative measures recorded for dry heath will largely be used for future comparisons and do not add any information to the impact results discussed in the previous sections.

3.1.2.5 Trends

Map 7 (Appendix 3) shows the dry heath impact trends within Ben Hope SSSI. Four different trend indicators were assessed and the summary of the trend result for each plot is listed in table 10. The majority of plots, 69%, were in the Chronic Moderate trend class, and 25% of these had a Decreasing trend. In total, 27% of plots had

Decreasing trends and only 7% had an Increasing trend. Fourteen percent of plots were in the Chronic High impact class, with single plots in each showing Increasing or Decreasing trends.

Three of the plots with Increasing impacts were located in An Garbh-choire. The remaining plot with Increasing impacts was in low-growing heath at the base of the steep cliffs leading up to the summit of Ben Hope.

Table 10. Trend indicator results for dry heath plots. *CH-Chronic High, CM-Chronic Moderate, CL-Chronic Low, D-Decreasing, I-Increasing.*

Category	CH	CM	CL	CH/D	CH/I	CM/D	CM/I	CL/D	CL/I	TOTAL
Total	6	21	10	1	1	15	3	2	0	59
Percent	10	36	17	2	2	25	5	3	0	100

The trend indicators differed in their usefulness. The growth form indicator was the most useful and it was applied to all plots. Obvious changes in growth form were less often observed and this indicator was only assessed for 20 plots. Most of these, 17 of the 20 assessed, showed a Decreasing trend for this indicator and three showed an Increasing trend. The presence of topiaried growth forms indicator was applied to 24 plots and showed a clearly Decreasing trend for 16 of these. Five were Chronic High and three Increasing. The final trend indicator, height and cover of dwarf shrubs versus graminoids, was only used for four plots and it was Chronic High for two of these, Decreasing for one and Increasing for one.

Table 11. The number of dry heath plots assigned to each impact trend category for each field indicator. Percentages are given in brackets. *CH-Chronic High, CM-Chronic Moderate, CL-Chronic Low, D-Decreasing, I-Increasing, NA-Not applicable.*

	Growth form of *Calluna/ Vaccinum myrtillus*	**Changes in growth-form within structure of dwarf shrubs**	**Presence of drumstick,topiary and carpet growth forms**	**Height and cover of dwarf shrubs versus graminoids**
CH	6 (10)	0	5 (8)	2 (3)
CM	41 (69)	0	0	0
CL	12 (20)	0	0	0
D	0	17 (29)	16 (27)	1 (2)
I	0	3 (5)	3 (5)	1 (2)
TOTAL	59 (100)	20 (34)	24 (41)	4 (7)
NA	0	39 (66)	35 (59)	56 (95)

3.1.3 Wet heath

3.1.3.1 Habitat description

Wet heath is abundant within Ben Hope SSSI. It is found on shallower, often rocky slopes in all parts of the site. At higher altitude there is a species-poor M15 *Scirpus cespitosus – Erica tetralix* wet heath type dominated by open *Trichophorum cespitosum* and *Calluna vulgaris* cover, on the lower wetter slopes more species-rich M15 types are also found. *Molinia caerulea* is found throughout but it is more

abundant on the northern and, especially, the western slopes where wet heath extends onto steeper terrain.

3.1.3.2 Grazing impacts

Map 8 (Appendix 3) shows the wet heath grazing impacts within Ben Hope SSSI. Grazing impacts for wet heath are mostly Low or Moderate with only 6% of plots recording an impact score of High -Moderate or High. Forty-four percent had a grazing impact score of Moderate, 39% of Moderate-Low and 11% had Low grazing impacts (see table 3).

Three of the higher impact plots were in the southern part of the site where there is also frequently some trampling on rocky slopes. The remaining one was close to the top of a rock outcrop near Dubh-loch na Beinne where there was some localised tracking.

Wetter types of wet heath were assessed using blanket bog indicators and drier types using dwarf shrub heath indicators. While the respective field indicators for the wetter M15b plots and drier M15c plots were summarised separately, they are amalgamated in table 12 to enable comparison of plots across the site as far as possible. The indicators combined include 'browsing on unpalatable dwarf shrub species' which is the same in both assessment tables. 'Browsing on *Calluna/V. myrtillus'* is also found in both assessment tables, but they do differ in the way they are assessed. For M15b plots, any obvious sign of browsing is assessed as High-Moderate, whereas for M15c browsing is only recorded as High if it is above 33%.

Table 12. The number of wet heath plots assigned to each browsing impact category for each field indicator. Amalgamated indicators list values for both blanket bog assessed plots and dwarf shrub heath assessed plots (BB/DSH). Percentages are given in brackets. The first three indicators are summarised for all 66 wet heath plots, blanket bog indicators are summarised for 28 plots and dwarf shrub heath indicators for 38 plots. *H – High, HM-High-Moderate, M-moderate, ML-Moderate—Low, L-low, NA – Not applicable*

	Browsing on unpalatable dwarf shrubs	**% *Calluna, V.myrtillus* browsed**	**Growth-form & browsing on *Myrica***	**Amount flowering on *Eriophorum* species (BB)**	**Calluna, V. myrtillus flowers, fruits (DSH)**	**Summer browsing of *Calluna* (DSH)**	***Calluna, V. myrtillus* shoot type removed (DSH)**
H	1+2 (5)	0+5 (8)	0	0	15 (39)	0	1 (3)
HM	0	15+0 (23)	0	0	0	0	0
M	0	0+23 (35)	7 (11)	0	21 (55)	0	13 (34)
ML	23+15 (58)	0	0	0	0	38 (100)	0
L	0	13+10 (35)	1 (2)	8 (29)	2 (5)	0	24 (63)
TOTAL	41 (62)	66 (100)	8 (12)	8 (29)	38 (100)	38 (100)	38 (100)
NA	25 (38)	0	58 (88)	20 (71)	0	0	0

High browsing impacts on unpalatable dwarf shrubs were recorded for 3 of the 41 plots where this indicator was assessed, while 38 had Moderate-Low impacts. Eight percent of all plots had High impacts for browsing on palatable dwarf shrubs and 23% had High-Moderate impacts. Fifteen out of 38 plots had High impacts for the

lack of summer flowering and 1 out of 38 had High impacts for the type of shoot removed.

Sixty-three percent of plots had Low impact scores for type of shoot removed, showing that grazing was mostly concentrated on the shoot tips. Flowering of *Calluna vulgaris* was often sparse and only two out of 38 plots had Low impact scores for summer flowering. Twenty-one out of 38 plots had Moderate impact scores for summer flowering.

Flowering of *Eriophorum spp* had Low impacts in the 8 plots where it was assessed. *Myrica gale* was also only present in 8 plots, all M15b. A Moderate impact score for browsing on *Myrica gale* was recorded for 7 of these while 1 was Low.

3.1.3.3 Trampling impacts

Map 9 (Appendix 3) shows the wet heath trampling impacts within Ben Hope SSSI. Trampling impacts in wet heath were more noticeable than grazing impacts, with 43% of plots having High or High-Moderate impacts. Twenty-three percent had Moderate impacts, 20% had Moderate-Low and 15% had Low trampling impacts (see table 3).

Wet heath plots with higher impacts are scattered across the site but many of them are situated in the south-eastern part. Herds of deer were frequent in this part of the site.

The trampling indicators for M15b and M15c were amalgamated for comparison (see table 13). 'Bryophytes/lichens cover' includes assessments for 'depth of bryophyte carpet' and 'Hoof prints' includes 'trampled bare ground'. No equivalent indicators exist for pool edge trampling and *Sphagnum* trampling which were only assessed for wet M15b plots and stem breakage which was only assessed for dry M15c plots.

Table 13. The number of wet heath plots assigned to each trampling impact category for each field indicator. Amalgamated indicators list values for both blanket bog assessed plots and dwarf shrub heath assessed plots (BB+DSH). Percentages are given in brackets. *H – High, HM-High-moderate, M-moderate, ML-Moderate—low, L-low, NA – Not applicable*

	Bryopytes/ lichens cover (BB+DSH)	**Hoof prints (BB+DSH)**	**Pool system /water tracks trampling (BB)**	***Sphagnum* trampling (BB)**	**Stem breakage (DSH)**
H	7+26 (50)	1+23 (36)	1 (4)	4 (14)	9 (24)
HM	0	0	0	0	0
M	12+9 (32)	8+1 (14)	2 (7)	8 (29)	0
ML	0	0	0	0	29 (76)
L	9+3 (18)	12+14 (39)	0	11 (39)	0
TOTAL	66 (100)	59 (89)	3 (11)	23 (82)	38 (100)
NA	0	7 (11)	25 (89)	5 (18)	0

High impact scores were received for all indicators, though their frequency varied. Twenty-four out of 59 plots had High impacts for hoofprints and trampled bare ground and half of all plots were in the High impact class for bryophyte and lichen cover.

The majority of these were dry M15c plots. The wetter M15b plots had fewer High trampling impacts and also only had High *Sphagnum* trampling impacts in 4 out of 23 plots. Only 3 plots were assessed for trampling of water tracks. Two of these had Moderate impacts and one had High impacts. Stem breakage due to trampling was only assessed for dry M15c plots and 9 out of 38 of these had High impacts, while the remaining 29 had Low impacts.

3.1.3.4 Quantitative measures

The cover of intact *Spagnum*, disturbance by hoof prints, bare peat and re-vegetating peat was recorded for the 28 plots assessed using the blanket bog indicators. The average intact *Sphagnum* cover was 17%. Eight plots had no *Sphagnum* and 7 had a *Sphagnum* cover above 25%. Disturbance by hoof prints was 5% on average and more than 25% disturbance was only recorded for 1 plot. Bare or re-vegetating peat was scarce. Bare peat was present in 5 plots and re-vegetating peat in 3 plots.

3.1.3.5 Trends

Map 10 (Appendix 3) shows the wet heath impact trends within Ben Hope SSSI. Thirty-eight percent of wet heath plots showed Chronic High impact trends, 14% had Chronic Medium impact trends and 2% had Chronic Low impacts (see table 14). Twenty percent had clearly Decreasing impacts and 14% had Increasing impacts.

Six of the 9 plots with Increasing impact trends are located in the south-eastern part of the site, the other 3 are scattered.

Twenty percent of plots assessed using the dwarf shrub heath indicators had conflicting trend impacts, with different field indicators receiving both Chronic High and Chronic Moderate or Chronic Low assessments for different indicators for the same plot. No attempt was made to average these and they were considered to have indeterminate impact trends.

Table 14. Trend indicator results for wet heath plots. *CH-Chronic High, Chronic-Moderate, CL-Chronic Low, D-Decreasing, I-Increasing, IND-indeterminate.*

Category	CH	CM	CL	CH/D	CH/I	IND	D	I	NA	TOTAL
Total	14	9	1	7	4	13	6	5	7	66
Percent	21	14	2	11	6	20	9	8	11	100

Different trend indicators were used for wet heaths assessed using the blanket bog indicators and those assessed using the dwarf shrub heath indicators. Both are combined in table 15 including the results for those indicators only assessed for one wet heath type.

Table 15. The number of wet heath plots assigned to each impact trend category for each field indicator. Percentages are given in brackets. Amalgamated indicators list values for both plots assessed as blanket bog and plots assessed as dwarf shrub heath (BB+DSH). Percentages are given in brackets. *CH-Chronic High, CL-Chronic Low, D-Decreasing, I-Increasing, NA-Not applicable.*

	Changes in growth form of dwarf shrubs (BB+DSH)	Height of *Myrica gale* (BB)	Height & cover of dwarf shrubs versus graminoidss (BB+DSH)	Abundance *Juncus squarrosus* (BB)	Growth-form of Calluna and V myrtillus (DSH)	Presence of drumstick, topiary, carpet growth forms (DSH)
CH	0	7 (25)	5+28 (50)	0	13 (34)	10
CM	0	0	0	0	23 (61)	0
CL	0	1 (4)	0	0	2 (5)	0
I	4+5 (14)	0	0	0	0	2
D	2+2 (6)	0	8+1 (14)	1 (4)	0	1
TOTAL	13 (20)	8 (29)	42 (64)	1 (4)	38 (100)	13 (34)
NA	53 (80)	20 (71)	24 (36)	27 (96)	0	25 (66)

Thirty-three out of 42 plots had Chronic High impacts for height and cover of dwarf shrubs versus graminoids; the remaining 9 plots had Decreasing impacts. This reflects the fact that dwarf shrub cover was often sparse and many plots were graminoid-dominated. Seven out of 8 plots had Chronic High impacts for height of *Myrica gale* and 13 out of 38 plots had Chronic High impacts for growth form of *Calluna/V.myrtillus*. Four out of 13 plots had Decreasing impacts for the changes in dwarf shrub growth form and 9 had Increasing impacts. A single plot also had a Decreasing impact for 'presence of *Juncus squarrosus'*.

3.1.4 Montane

3.1.4.1 Habitat description

The montane feature was found on exposed ridges and escarpments above 450 metres. It encompasses a wide range of different alpine heath and montane acid grassland habitat types. H14 *Calluna vulgaris – Racomitrium lanuginosum* heath and H17 *Calluna vulgaris – Arctostaphylos alpinus* heath were locally abundant on exposed knolls at lower altitudes, U10 *Carex bigelowii – Racomitrium lanuginosum* moss-heath was predominant on ridges at higher altitude. In more sheltered parts of the ridges U7 *Nardus stricta – Carex bigelowii* grass-heath was abundant. Small cushion herbs such as *Silene acaulis, Armeria maritima* and *Minuartia sedoides* were locally frequent, especially in stands of U10.

3.1.4.2 Grazing impacts

Map 11 (Appendix 3) shows the montane grazing impacts within Ben Hope SSSI. Grazing impacts for this feature were all Low or Moderate, with no plots receiving a High or High-Moderate score. Fifty-two percent had Low impacts, 31% had Moderate-Low impacts and 17% Moderate impacts (see table 3).

Table 16. The number of montane plots assigned to each grazing impact category for each field indicator. The first three indicators are amalgamated from the U7 grass-dominated snowbed assessment and the wind-clipped summit heath assessment used for the different types of montane vegetation. Percentages are given in brackets. *H – High, HM-High-Moderate, M-Moderate, ML-Moderate—low, L-low, NA – Not applicable*

	Grazing on *Carex bigelowii, Juncus trifidus, Deschampsia flexuosa*	Grazing on cushion plants	Browsing on dwarf shrubs	Grazing on broad-leaved grasses (wind-clipped only)	signs of grazing on *Nardus* tussocks – sheep/deer (U7 only)
H	0+2 (7)	0+2 (7)	1+11 (41)	0	0
HM	0	0	0	0	0
M	0	0	0	0	0
ML	0	0	0	0	10 (100)
L	10+15 (86)	1+3 (14)	8+8 (55)	17 (89)	0
TOTAL	27 (93)	6 (21)	28 (97)	17 (89)	10 (100)
NA	2 (7)	23 (79)	1 (3)	2 (11)	0

Grazing impacts were mostly Low on *Carex bigelowii, Juncus trifidus* and *Deschampsia flexuosa,* but more noticeable on dwarf shrubs with 12 out of 28 plots recording a High impact for this indicator. The remaining 16 plots had Low impacts. A Moderate impact category does not exist for this indicator. Grazing on cushion plants was High for 2 out of the 6 plots where this indicator was assessed.

Grazing on *Carex bigelowii, Juncus trifidus* and *Deschampsia flexuosa* was assessed for both types of montane vegetation, but the category limits are different. For grass-dominated snowbeds, High impacts require grazing levels of 66% or more, for wind-clipped summit heath, levels above 10% are classed as High. Both plots which received a High impact score for this indicator were wind-clipped summit heaths.

3.1.4.3 Trampling impacts

Map 12 (Appendix 3) shows the montane trampling impacts within Ben Hope SSSI. Trampling impacts were high on some parts of the ridges and High impacts were recorded for 24% of plots. Thirty-one percent had Moderate impacts and 45% had Low impacts (see table 3).

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The 7 plots with High impacts were found in different parts of the site. One was close to the summit of Ben Hope, two were in An Gorm-Choire, two on Creag Riabach Mhor and two on Sail Romascaig.

Table 17. The number of montane plots assigned to each trampling impact category for each field indicator. The first indicator is for U7 plots, the second and third for U10 and alpine heaths. Percentages are based on the number of plots recorded for each vegetation type. *H – High, HM-High-Moderate, M-Moderate, ML-Moderate—Low, L-low, NA – Not applicable*

	Amount of surface poached (U7 only)	Bare ground in sheltered locations (wind-clipped only)	Bare ground on terraces (wind-clipped only)
H	1 (10)	6 (32)	3 (16)
HM	0	0	0
M	9 (90)	0	0
ML	0	0	0
L	0	13 (68)	11 (58)
TOTAL	10 (100)	19 (100)	14 (74)
NA	0	0	5 (26)

There is only a single trampling indicator for grass-dominated snowbeds. U7 plots are rarely wet enough to be poached and the indicator was considered to include trampled bare dry ground. Nine of the 10 U7 plots had a Moderate trampling impact and the remaining one had a High trampling impact. For wind-clipped heaths, 32% of all plots had a High impact for presence of bare ground in sheltered locations, while 68% had Low impacts. Bare ground on terraces was assessed for 14 plots and had a High impact in 3 of these.

3.1.4.4 Trends

Map 13 (Appendix 3) shows the montane impact trends within Ben Hope SSSI. No trend indicators were assessed for the U7 plots. For wind-clipped heaths there were two trend indicators, both based upon the abundance of grasses. They were assessed for all the plots and are summarised in table 18.

Almost half of the 19 plots assessed had a combined impact class of Chronic Low, with a further quarter showing Decreasing impacts. Three plots had impacts that were both Chronic Low and Decreasing and two had conflicting impacts and were classed as indeterminate.

Table 18. Summary of trend indicators for wind-clipped summit heath plots

	Percentage of broad-leaved grasses	Percentage of fine-leaved grasses	Combined
Decreasing	7 (37)	6 (32)	5 (26)
Chronic Low	12 (63)	11 (58)	9 (47)
Chronic High	0	2 (11)	0
Chronic Low/decreasing	0	0	3 (16)
Indeterminate	0	0	2 (11)
TOTAL	19 (100)	19 (100)	19 (100)

All the plots with Decreasing impacts were on the slopes south of the Ben Hope summit and all but two were above 700 metres. Plots at this altitude had higher levels of graminoids while having Low current impacts.

3.2 Results for each ownership unit

3.2.1 Strathmore

Almost three quarters of all plots recorded within Strathmore had Low or Moderate-Low grazing impacts. Most of the remaining plots had Moderate grazing impacts.

Two plots had High or High-Moderate grazing impacts. One of these was a dry heath plot in the southernmost part of the site along the Allt na Caillich. This was the only plot showing clear summer browsing, as well as browsing on more than just shoot tips. A wet heath plot with High-Moderate grazing impacts, also with signs of browsing on woody parts of heather shoots, was present on a rocky knoll near the Dubh-loch na Beinne.

Trampling impacts were more noticeable, especially for wet heath and blanket bog plots, but two thirds of all plots still had trampling impact scores of Low or Moderate-Low. Nineteen percent had Moderate trampling impact scores. Fifteen percent of plots had trampling impacts that were above Moderate. Thirteen wet heath plots and 3 blanket bog plots had High-Moderate or High trampling impacts, as did a single montane plot. The 3 blanket bog plots with High-Moderate impacts were clustered in the northern part of the area where there is some localised tracking towards Loch na Seilg, and around the base of the steep cliffs leading to the summit of Ben Hope. The wet heath plots with higher impacts are more scattered across the site with no obvious pattern. Trampling was lowest in dry heath plots, which is probably partly due to the steepness of most dry heath slopes at this site.

3.2.2 Kinloch

Kinloch Estate had Low or Moderate-Low grazing impacts for 59% of all plots recorded. A further third had Moderate grazing impacts and the remaining 4 plots had High-Moderate or High grazing impacts. One of these was a dry heath plot in An Gorm-choire, the other 3 were wet heath plots in the south-eastern part of the site. All these plots had High browsing impacts on non-palatable dwarf shrubs which increased their overall grazing impact class.

Trampling was higher within Kinloch than in the other parts of the Ben Hope SSSI. Only half the plots had Low or Moderate-low trampling impacts. A further 15% had Moderate trampling impacts and the remaining 34% had trampling impacts in excess of Moderate. Trampling impacts were highest in An Gorm-choire, on Creag Riabach Mhor and in the wet heaths in the south-eastern part of the site where deer were observed during the survey.

3.2.3 Hope

Fourteen opportunistic plots were recorded for Hope Estate, ten wet heath and four blanket bog plots. Impacts were mostly Moderate-Low or Moderate in this part of the site, though trampling impacts were High-Moderate for one wet heath and one blanket bog plot. Both plots with the High-Moderate trampling impacts were situated close to the southern boundary fence.

Though the vegetation was often lush with few signs of current grazing, the bryophyte layer was sparse to absent for large parts of the area. This was especially noticeable in the wet blanket bog in the highest, eastern part of the area, but bryophytes were also absent from large tracts of wet heath on the middle and upper slopes. Blanket bog and wet heath on the lower slopes and flatter ground close to the road was in better condition and had a more intact bryophyte layer, though none of it was deep enough to indicate a Low impact for bryophyte layer depth.

The absence of bryophytes is likely to be due to high intensity burning in the past. The blanket bog in the eastern part of the area is showing some signs of *Sphagnum* re-colonisation, but cracked, bare peat is still widespread in both blanket bog and wet heath areas.

No herbivores were observed within the SSSI part of Hope Estate, though deer were present just east of the SSSI boundary.

3.3 Comparison with previous survey

3.3.1 Grazing and trampling impacts

The level of impacts differed between 2004 and 2011. Figure 1 illustrates grazing and trampling impacts for all habitats recorded in both years as a percentage. The data tables are shown in Appendix 2**.** The data were converted to percentages as the number of plots recorded for different habitats differed between the surveys.

Figure 1a) Blanket bog grazing impacts in 2004 and 2011

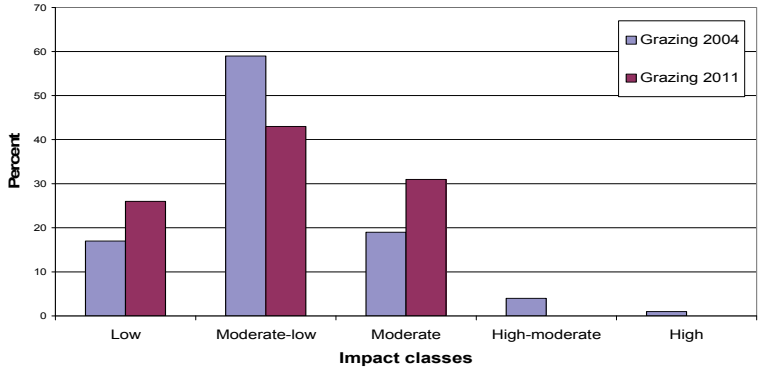

Figure 1b) Blanket bog trampling impacts in 2004 and 2011

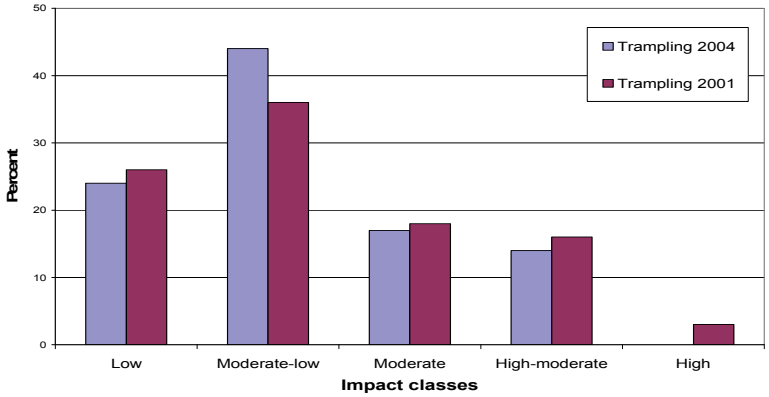

Figure 1c) Dry heath grazing impacts in 2004 and 2011

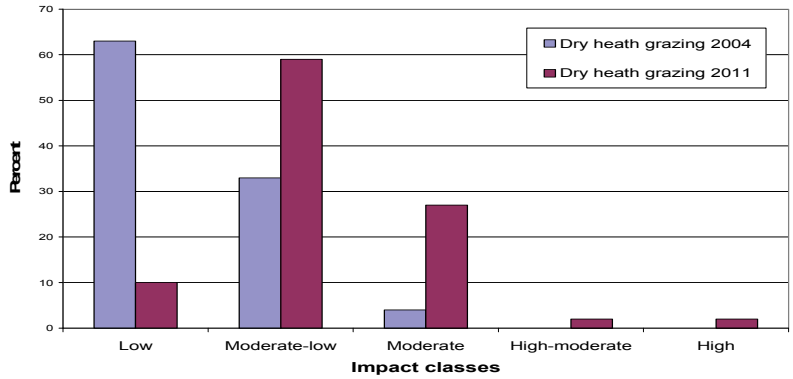

Figure 1d) Dry heath trampling impacts in 2004 and 2011

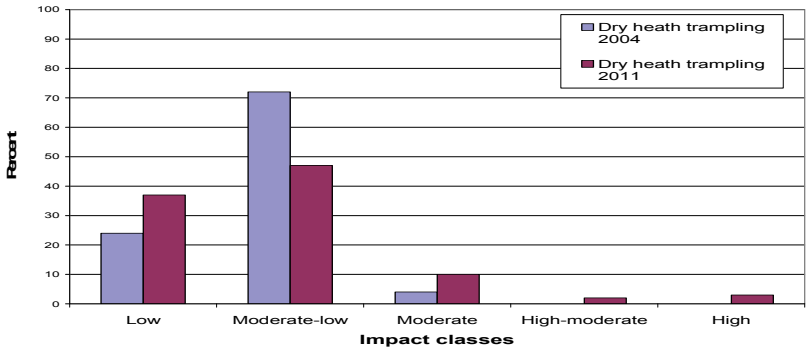

Figure 1e) Wet heath grazing impacts in 2004 and 2011

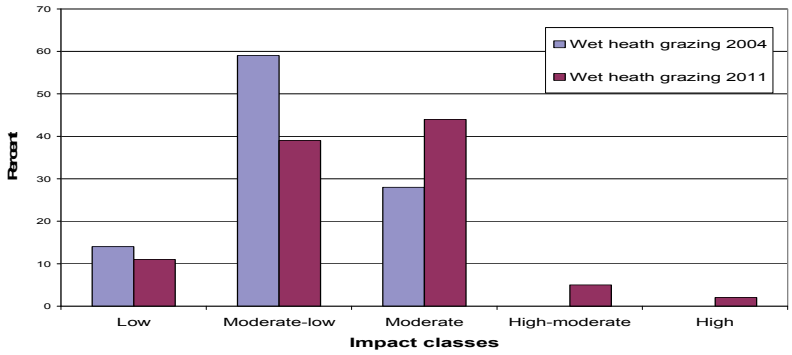

Figure 1f) Wet heath trampling impacts in 2004 and 2011

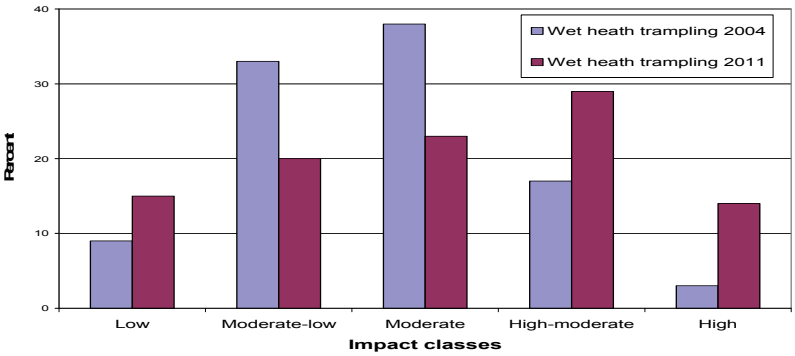

Figure 1g) Montane grazing impacts in 2004 and 2011

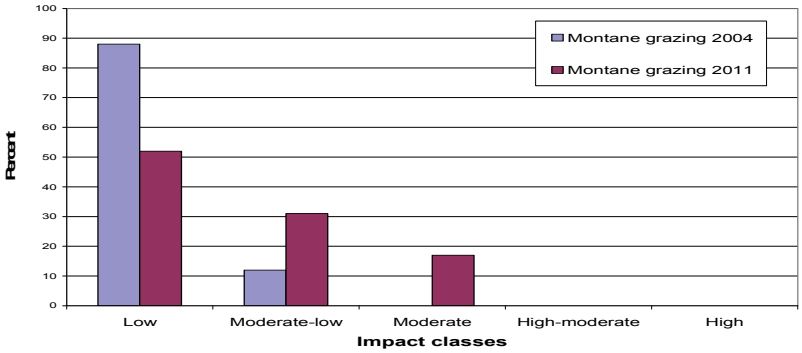

Figure 1h) Montane trampling impacts in 2004 and 2011

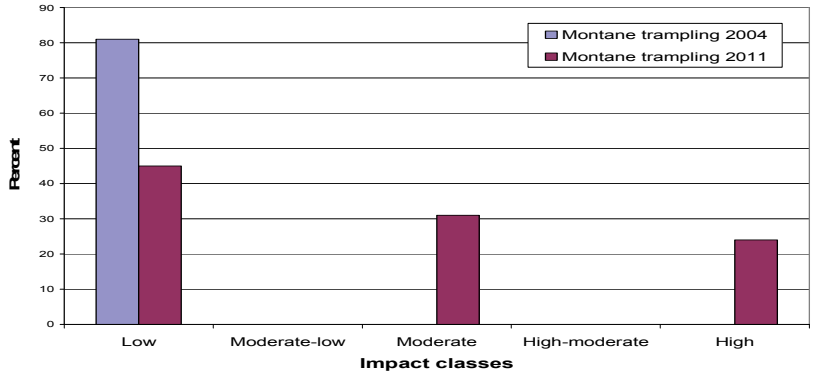

Figure 1a shows that grazing has decreased for blanket bogs with more plots showing Low grazing impacts in 2011 and none showing High or High-moderate grazing impacts in 2011 as compared to 2004. There has been an increase in Moderate impacts, though, and most of these are small increases from Moderate-Low impacts recorded in 2004. The proportion of blanket bog plots in the Moderate, High –Moderate and High categories has increased (see figure1b).

Grazing impacts for dry heath increased from 2004 to 2011 (figure 1c). In 2004 more than 60% of plots were in the Low impact class but in 2011 this had dropped to 10%. There has also been a change in dry heath trampling impacts (see figure 1d). Low trampling impacts have increased from 24% to 37%, but High-Moderate and Moderate impacts have also increased from zero to five percent.

Grazing impacts for wet heath have also increased since 2011 (figure 1e). In 2004 there were no plots with High-Moderate or Moderate wet heath grazing impacts but in 2011 7% of plots were in either of those two impact classes. Less than 30% of plots were in the Moderate impact class compared to more than 40% in 2011. Wet heath trampling has also increased (see figure 1f). In 2011 there were almost 30% of plots in the High-Moderate impact class while in 2004 there were less than 20%. The percentage of plots in the High impact class has increased from 3% to 14%.

Montane grazing and trampling impacts have also increased (figures 1g, 1h). Almost 90% of plots had Low grazing impacts in 2004, but in 2011 this had dropped to just over 50%. Only 81% of montane plots were assessed for trampling in 2004 but they all had a Low impact score. In 2011, 31% had a Moderate score and 24% a High impact score.

3.3.2 Impact trends

Data assessed in both 2004 and 2011 can be used to look for more general trends for the different habitats (see table 22), as well as illustrating the changes for each individual plot that was assessed (see maps 14-21). Almost half of wet heath plots and two thirds of dry heath plots showed an increase in grazing, and half the montane plots had increases in trampling. Few montane plots showed decreases in any impacts and those without increases had stayed the same.

Table 22. Changes in the current impact classes recorded for plots assessed in both 2004 and 2011; assessments are relative to the 2004 assessment. *No trampling impact data is available for four montane plots for 2004 so only eighteen montane plots are included for the trampling comparison.*

	BB		**WH**		**DH**		**MONTANE**	
	G	**T**	**G**	**T**	**G**	**T**	**G**	**T**
Increase total	**16**	**16**	**25**	**23**	**24**	**9**	**9**	**9**
Increase in %	*30*	*30*	*49*	*45*	*67*	*25*	*41*	*50*
Decrease total	**21**	**16**	**10**	**13**	**1**	**11**	**1**	**0**
Decrease in %	*39*	*30*	*20*	*25*	*3*	*31*	*5*	*0*
Unchanged total	**17**	**22**	**16**	**15**	**11**	**16**	**12**	**9**
Unchanged %	*31*	*41*	*31*	*29*	*31*	*44*	*55*	*50*
Total	**54**	**54**	**51**	**51**	**36**	**36**	**22**	**18**

For blanket bogs there was no clear trend, with a similar number of plots showing increases, decreases or no change in grazing or trampling impact category for the site.

The comparison of the two data sets from 2004 and 2011 showed different trends to those recorded with the trend indicators applied in 2011. The 2011 trend indicators suggested that many of the plots now have decreasing impact trends but the two sets of data of current impacts show that there have been more increases in impacts than decreases since 2004 for all habitats apart from blanket bog. It is possible that impacts have increased over the period and are now decreasing. The difference could also be partly due to differences in impact recording between the years. In 2004 all wet heath plots were assessed using the blanket bog form and all montane plots were assessed with the wind-clipped summit community form. In addition, assessments were carried out by different surveyors. Differences between surveyors' assessments of habitat impacts are to be expected (MacDonald 2010), however, the extremes of High and Low impacts are normally consistent between surveyors.

3.3.3 Dung

The amount of dung recorded for all habitats in both years has increased (see map 22, Appendix 3). In 2004 only seven plots had dung impact levels above Low, whereas in 2011 there were 72. Moderate, High-Moderate and High dung impacts were found in all parts of the Ben Hope SSSI, but they were clustered on the Ben Hope summit ridge and in the eastern corries, especially An Garbh-Choire and An Gorm-Choire.

4. DISCUSSION

4.1 Changes in herbivore impacts since 2004

Herbivore impacts vary across the site. Trampling impacts are mostly higher than grazing impacts but both types of impacts have increased in varying proportions since 2004. This was especially noticeable in the eastern corries, especially in An Gorm-choire and in the wet heath and blanket bog in the south-eastern part of the site. Many of the impacts recorded in plots in this part of the site have increased or remained unchanged from the previous survey, although a few have decreased.

The picture is less clear cut for the rest of the site. On the lower slopes many of the impacts recorded in plots have remained unchanged or decreased, but there have been more increases in impacts above 300 metres. Herbivore impacts in montane habitats were almost all recorded as Low in 2004, so decreases in impacts were rarely possible for this feature.

Impacts on the lower, west-facing slopes have decreased the most, and current herbivore impacts in this area are now mostly Low, apart from some localised trampling.

4.2 Herbivores

The changes in herbivore impacts recorded reflect observed herbivore patterns within the site. The highest number of deer was seen in the south-eastern part of the site, at lower altitude during cold, wet and windy conditions. Deer were also seen on Sail Romascaig and Creag Riabhach and there were small numbers grazing the grassland patches below Leitir Mhuiseil.

Sheep were only observed at higher altitude in small numbers and there were none along the roadside to the west. The reduction of grazing on the western slopes is very noticeable and the grassland is now quite rank on the road verges. This reduction in grazing on the lower western slopes is documented by two photos from 2004 (photos BH42 and BH51) which show a much more clearly grazed sward. A photo taken in 2011 shows lower grazing impacts in the same area as photo B51 (see photos 1 and 2).

Photo 1. Grazing on lower west-facing slopes in 2004. Grazing obvious between *Juncus effuses* tussocks.(Photo B51 from Morris 2005; taken at NC46266 46836 on 5/8/04).

Photo 2. Grazing on lower west-facing slope in 2011. Grazing not obvious on grasses between *Juncus* tussocks. Photo taken at NC46271 46872 on 28/7/11.

The increased impacts in montane habitats on the Ben Hope summit are likely to be due to the presence of sheep as well as deer in this area. Hill walkers regularly use the footpath across this area as access to the summit and this is likely to reduce deer numbers in this part of the site at least during the summer months. During the survey deer were seen on lower parts of the ridge, especially Sail Romascaig but none were present near the main summit. Impacts in other parts of the site are largely attributable to deer, even though small numbers of sheep present near the Moine path and near Loch a'Ghobha Dubh will have contributed to impacts in these areas.

4.3 Future prognosis for habitats

4.3.1 Blanket bog

Blanket bog in the northern and western part of the site is mostly showing Low impacts and is unlikely to deteriorate with the current level of herbivore impacts. Low trampling impacts are likely to encourage an increase in bryophytes, particularly *Sphagnum*, dwarf shrubs and sedges, resulting in a varied micro-topography with *Sphagnum* hummocks and lawns as well as well-vegetated small pools where conditions are suitable.

Moderate trampling impacts were most frequently recorded in the southern part of the site as well as locally close to Loch na Seilg and along the An Garbh-allt. Such Moderate impacts could lead to a reduction in bryophyte cover and diversity, especially of *Sphagnum* spp and could potentially cause localised microerosion. Impacts are likely to be more uniform and rapid on slopes.

The High impact levels concentrated in An Gorm-choire are of most concern. High herbivore impacts could damage pools and water tracks and lead to a reduction in the cover, abundance and diversity of bryophytes, further resulting in a loss of structural diversity. If herbivore impacts continue at current levels in this part of the site a deterioration of blanket bog is likely and there will be an increased risk of peat erosion.

Blanket bog peat depth is often shallow in the southern part of the site where there are many gullies with rocks and exposed mineral soil. Peat building species such as *Sphagnum papillosum* or *Eriophorum vaginatum* are often sparse in these blanket bogs and some of these areas might revert to wet heath vegetation in the future, if trampling impacts continue to increase, thus preventing the formation of deeper bryophyte layers.

Within Hope estate, there are still large areas of blanket bog lacking a bryophyte layer. There are signs of re-vegetating with *Sphagnum* and with the current low herbivore impacts recorded for this part of the site the blanket bog is likely to recover in time.

4.3.2 Wet heath

Wet heath had the highest trampling impacts at this site and it is also the feature which recorded fewer Low herbivore impacts than any of the others. Wet heath at this site is already mostly species-poor and dominated by *Trichophorum cespitosum*. Continued Moderate or High trampling levels could lead to a reduction in bryophyte depth and diversity and a loss of structural diversity. If trampling levels continue to increase, the lichen and bryophyte layer is likely to become more fragmented. A decrease in impacts may, in time, lead to an increase in the cover of dwarf shrubs. Past damage to the underlying peat layer by heavy trampling or past burning is likely to slow down any wet heath recovery at the site. For example, the wet heath on Hope Estate shows little sign of bryophyte re-colonisation even though current grazing impacts and hoof prints on bare soil are low.

Blanket bog and wet heaths at this site are mostly graminoid-dominated and dwarf shrubs, especially *Calluna vulgaris* are often sparse. While current levels of dwarf shrub browsing probably contribute to the scarcity of *Calluna* at this site, the

graminoid dominance is also likely to be due to other factors such as past management and climatic conditions.

4.3.3 Dry heath

Grazing impacts on dry heath have increased in most areas, but trampling impacts have only increased very locally. Despite the increases, current grazing impacts are still largely Moderate or lower, and trampling has actually decreased to Low in some areas, especially in An Garbh-choire and the southern part of the site

Dry heath is restricted to steeper slopes within the Ben Hope SSSI and any trampling or grazing impacts are usually found in the more accessible parts where the survey plots are located. Tracking through steeper areas of dry heath is localised and does not affect large areas. The long-term prognosis for dry heath at this site is therefore good.

Calluna was often greying or browning, sometimes over large areas. There was no sign of any insect attack in such stands and the discolouration was considered to be due to severe weather conditions. Long shoots were often lacking from discoloured *Calluna* but this was not attributed to herbivore browsing.

More dry heath plots were moved, discarded and replaced with opportunistic waypoints than for any of the other features. Many of the replaced waypoints were located in the eastern corries where the vegetation present was *Calluna*-dominated blanket bog with a deep bryophyte layer, frequent *Rubus chamaemorus* and a constant presence of *Eriophorum vaginatum*. It is possible that this vegetation was classified as H22 during the previous survey, especially if there was less *Eriophorum vaginatum* present in 2004.

4.3.4 Montane

For montane communities, trampling impacts have increased on the slopes to the south of the Ben Hope summit. Almost all the plots with an increase in trampling were U7 plots which were assessed differently in 2004 and 2011. This should not have made a difference as both methods record presence of disturbed bare ground. Such disturbed bare ground appears to be higher now than it was in 2004, at least for montane acid grassland plots. Trampling impacts were also high in the two opportunistic plots recorded on Creag Riabach Mhor where the alpine heath feature was scuffed and there was frequent tracking across the ridge from the blanket bog below. Grazing impacts have also increased in a few locations but less so than trampling. Any increase in herbivore impacts in montane communities is likely to lead to an increase in the presence of bare ground. This could lead to increased erosion of the thin, exposed soils where such communities are usually found.

If impacts remain at current levels, the High trampling impacts recorded on Creag Riabach Mhor, An Gorm-Coire and Sail Romascaig are likely to cause a reduction in the extent of the moss and lichen mat and an increase in graminoids and herbs. The Low trampling impacts recorded for 13 of the plots are likely to encourage a high diversity of arctic-alpine species adapted to such exposed locations. Moderate trampling impacts were only recorded for U7 plots. These usually contain a higher cover of graminoids than other wind-clipped communities, but if trampling continues at current levels the amount of bare ground is likely to increase.

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Site Condition Monitoring Survey of Upland and Peatland Notified Features on Designated Sites: Ben Hope SSSI, Ruth Maier, January 2011

Appendix 1. Impact summary for all plots in 2011

Estates: 1 – Strathmore, 2 – Kinloch, 3 – Hope.

Blanket bog impacts

ID	Estate	Eastings	Northings	Grazing	Trampling	Trend
1	1	*247685*	*952298*	M	HM	I
2	1	246626	945746	ML	ML	D
3	1	248374	952437	ML	ML	CH
4	1	247796	952232	L	L	D
6	1	247210	947236	ML	M	CH
8	1	248444	952778	ML	L	NA
9	1	248156	946982	L	ML	D
10	1	247593	946430	M	M	NA
11	1	248076	947184	L	ML	CH/D
12	1	247487	947424	M	ML	NA
15	1	247882	951662	L	ML	NA
16	1	247104	946366	ML	L	D
18	1	248420	952156	ML	L	NA
20	1	246711	951331	M	L	CH
21	1	248281	946945	L	L	NA
22	1	246982	951802	ML	L	CH
23	1	248786	952356	ML	M	NA
24	1	*247176*	*952286*	L	L	CH/D
25	1	247206	952419	ML	L	CH/D
27	1	247268	947388	M	ML	NA
28	1	248499	952534	L	L	CH
29	1	248559	952348	ML	M	CH
30	1	246596	951412	M	L	CH
31	1	246773	946287	ML	ML	D
32	1	246036	950270	L	L	NA
33	1	246944	947257	L	ML	D
34	1	248670	951928	ML	HM	NA
35	1	246924	951702	M	L	CH/I
36	1	248661	952306	ML	HM	CH
1	2	248850	946595	L	ML	D
2	2	248960	946885	M	M	CH
3	2	248908	946604	M	M	CH/D
4	2	249786	949272	M	H	CH/D
5	2	*249170*	*949050*	ML	ML	CH
6	2	248892	947264	M	M	CH/D
7	2	248968	951231	L	ML	NA
8	2	249706	948741	ML	HM	D
10	2	249175	948776	ML	HM	CH/I
11	2	248717	947072	ML	M	CH
12	2	249321	948934	M	H	CH/I
15	2	249387	948643	ML	L	D
19	2	248741	947327	ML	ML	NA
20	2	248680	950669	ML	ML	CH
21	2	249795	949128	M	M	NA
24	2	250313	947542	L	L	NA
25	2	249481	948564	ML	HM	NA

ID	Estate	Eastings	Northings	Grazing	Trampling	Trend
26	2	249095	949056	M	HM	CH/I
27	2	248788	946440	L	ML	CH
28	2	*249275*	*949072*	ML	HM	CH
30	2	248692	950750	M	L	D
33	2	248929	951284	L	M	NA
34	2	248789	950622	ML	M	NA
35	2	249850	947053	M	ML	NA
36	2	248709	946417	L	ML	NA
329	2	250143	950896	L	ML	CH/D
330	2	250267	951554	M	ML	CH/D
331	2	249787	951535	ML	HM	NA
332	3	247310	953381	M	HM	CH
333	3	247290	953448	ML	ML	CH
334	3	247278	953619	M	ML	CH
335	3	246900	953546	ML	ML	CH

Dry heath impacts

ID	Estate	Eastings	Northings	Grazing	Trampling	Trend
37	1	246318	945363	H	ML	CM
39	1	247769	946691	ML	M	CM/D
40	1	246894	949869	M	ML	CH
44	1	247566	951155	M	ML	CH/I
45	1	246928	950031	M	ML	CH
46	1	248039	951427	ML	ML	CM
48	1	247135	950625	ML	ML	CM
49	1	*247702*	*946837*	ML	L	CL/D
51	1	248597	951459	ML	ML	CM
52	1	246881	949942	ML	ML	CM
57	1	247396	948641	ML	L	CM/D
61	1	248121	951411	ML	ML	CM
64	1	*247742*	*948750*	ML	L	CM/D
66	1	246576	950739	ML	ML	CL
68	1	246565	950981	ML	ML	CL
71	1	247755	946917	ML	L	CM/D
73	1	247738	947559	ML	L	CL
303	1	249252	950707	L	ML	CM
304	1	249261	950556	M	M	CM
305	1	249252	950403	ML	ML	CL
306	1	250506	951440	M	M	CM
307	1	250272	951706	ML	ML	CM
309	1	247206	951613	ML	ML	CM
310	1	248254	951463	ML	ML	CM
311	1	247030	950474	M	ML	CH
317	1	*247263*	*948670*	ML	L	CM/D
318	1	*247087*	*948359*	ML	L	CM/D
319	1	*247270*	*948573*	M	L	CH/D
320	1	*247818*	*947591*	ML	L	CM/D
321	1	*247754*	*947505*	ML	L	CL
38	2	249308	950740	L	ML	CL
39	2	249037	949400	M	ML	CL
40	2	248822	949843	M	L	CM

ID	Estate	Eastings	Northings	Grazing	Trampling	Trend
41	2	248500	951065	L	M	CM
42	2	249369	948312	ML	ML	CM
43	2	248931	949600	M	HM	CM/I
46	2	249416	949802	ML	L	CM/D
47	2	248987	950921	ML	ML	CH
51	2	249465	949319	ML	L	CM/D
53	2	249447	948372	ML	ML	CM
55	2	248147	950412	ML	ML	CL
56	2	*249434*	*949793*	ML	L	CM/D
59	2	249192	950535	L	ML	CL
60	2	248853	949896	M	L	CM/I
61	2	*249008*	*949155*	M	H	CM/I
62	2	249888	948452	M	M	CM
63	2	248326	950640	ML	M	CH
69	2	249456	948271	ML	ML	CL/D
72	2	*249455*	*949694*	ML	L	CM/D
73	2	248920	949766	M	L	CH
300	2	246875	948341	M	ML	CM
301	2	246859	948577	ML	ML	CM
302	2	246314	948844	M	ML	CM
308	2	249955	948458	L	L	CL
312	2	249223	948637	HM	H	CM
313	2	*249357*	*949407*	ML	L	CM/D
314	2	*249603*	*949254*	ML	L	CM/D
315	2	*249625*	*949246*	ML	L	CM/D
316	2	246404	951716	L	L	CM/D

Wet heath impacts

ID	Estate	Eastings	Northings	Grazing	Trampling	Trend
222	1	246723	949171	M	M	NA
223	1	248902	951642	M	H	CH
224	1	247439	951657	L	ML	NA
225	1	246607	950260	HM	H	CH/I
226	1	247721	951561	M	M	CM
229	1	247003	948153	L	HM	CH
230	1	248876	951706	M	HM	CH
233	1	246756	952172	ML	L	D
235	1	246455	947344	M	M	CH/D
236	1	246375	948555	M	ML	CM
238	1	246308	948994	M	HM	CH
239	1	*247715*	*952121*	L	L	D
240	1	246903	948491	M	HM	IND
241	1	246384	948273	M	ML	CM
243	1	246539	948133	M	M	D
244	1	246349	947980	M	L	NA
245	1	246881	952301	ML	L	D
246	1	246304	946785	L	L	D
247	1	246831	952206	ML	L	NA
248	1	247165	951616	M	ML	NA
249	1	247635	951499	ML	HM	IND
252	1	246805	948754	M	M	NA

ID	Estate	Eastings	Northings	Grazing	Trampling	Trend
254	1	247493	952151	L	L	D
255	1	246281	946313	ML	L	CH/D
256	1	246615	950497	ML	ML	IND
257	1	246162	951083	M	HM	CL
258	1	247144	951844	ML	ML	I
350	1	248898	951773	M	H	CH
185	2	249585	947427	M	HM	IND
186	2	250266	947632	ML	ML	CH/I
187	2	249454	949903	M	HM	I
188	2	249887	947785	ML	M	CH
190	2	250175	947499	ML	HM	CM
191	2	250382	947617	ML	ML	CH/I
193	2	249289	947208	M	HM	CH
194	2	249167	947154	M	HM	CH/D
195	2	250481	947709	ML	HM	CH
196	2	249682	950383	M	ML	CM
197	2	249640	950185	M	H	CH
198	2	249865	948029	L	ML	I
200	2	250082	948053	ML	HM	NA
201	2	249734	947925	M	HM	I
202	2	250299	948048	ML	H	I
206	2	249283	946982	HM	ML	IND
207	2	249934	947264	M	L	IND
211	2	250189	947903	ML	M	CM
213	2	249903	947867	M	H	CH/I
214	2	249839	947393	HM	M	CH
215	2	249494	947274	M	HM	IND
217	2	249632	947115	M	HM	CH
218	2	249955	947935	ML	HM	CM
221	2	249440	947047	H	L	CH
342	2	249896	950806	ML	H	CM
343	2	250380	951035	ML	H	IND
344	2	249405	951616	ML	HM	IND
349	2	250286	948009	M	H	CM
336	3	246290	952952	ML	M	CH/D
337	3	246269	952751	L	ML	CH/D
338	3	246494	952831	ML	M	CH/D
339	3	246727	953076	ML	M	CH/D
340	3	247141	953729	ML	ML	CH
341	3	246482	953248	M	M	CH
345	3	246904	953041	ML	HM	IND
346	3	247207	953620	ML	M	IND
347	3	246669	953528	ML	M	IND
348	3	246593	953219	M	M	IND

Montane impacts

ID	Estate	Eastings	Northings	G	T	Trend
0	1	247802	949858	M	H	NA
4	1	247800	949986	ML	L	D
6	1	248192	949306	L	M	NA
7	1	247717	949320	L	L	D

ID	Estate	Eastings	Northings	G	T	Trend
8	1	248044	949477	L	M	NA
9	1	247813	949478	L	M	NA
10	1	247592	948184	L	M	NA
11	1	248126	949455	ML	L	CL/D
13	1	247996	949679	M	L	D
17	1	248270	248270	L	M	NA
18	1	248015	947725	L	L	CL
21	1	247953	949695	L	M	NA
22	1	247964	949271	L	M	NA
24	1	247474	948961	ML	M	NA
31	1	247890	948917	L	M	NA
33	1	247766	949649	L	L	D
35	1	248053	947145	L	L	CL
36	1	247804	949658	L	L	D
327	1	*247811*	*948751*	ML	L	CL/D
328	1	*247792*	*948778*	ML	L	CL/D
12	2	248804	950037	M	L	CL
15	2	249160	947905	M	L	CL
20	2	248959	947808	ML	H	CL
27	2	248813	947865	M	L	CL
322	2	250498	951431	L	H	CL
323	2	250389	951509	L	H	CL
324	2	248829	947271	ML	H	CL
325	2	249213	948661	ML	H	IND
326	2	249250	949056	ML	H	IND

Appendix 2. Differences in impact results in 2004 and 2011

2a)Summary of impact results for all plots recorded in 2004 and 2011 in percent. *H – High, HM-High-moderate, M-moderate, ML-Moderate—low, L-low, NA – Not applicable*

		BB		DH		WH		Montane	
Impact		**G**	**T**	**G**	**T**	**G**	**T**	**G**	**T**
2004	**L**	17	24	63	24	14	9	88	81
	ML	59	44	33	72	59	33	12	0
	M	19	17	4	4	28	38	0	0
	HM	4	14	0	0	0	17	0	0
	H	1	0	0	0	0	3	0	0
	TOTAL	100	100	100	100	100	100	100	100
	NA	0	0	0	0	0	0	0	21
2011	**L**	26	26	10	37	11	15	52	45
	ML	43	36	59	47	39	20	31	0
	M	31	18	27	10	44	23	17	31
	HM	0	16	2	2	5	29	0	0
	H	0	3	2	3	2	14	0	24
	TOTAL	100	100	100	100	100	100	100	100

2b) Changes in impact results from 2004 to 2011 in percent. *Positive changes denote increases in an impact category, negative changes denote decreases.*

	BB		DH		WH		Montane	
	G	**T**	**G**	**T**	**G**	**T**	**G**	**T**
Changes in L impacts	9	2	-53	13	-3	7	-37	-36
Changes in ML impacts	-16	-8	27	-24	-19	-13	19	0
Changes in M impacts	13	1	23	6	16	-15	17	31
Changes in HM impacts	-4	2	2	2	5	12	0	0
Changes in H impacts	-1	3	2	3	2	10	0	24

Appendix 3 Maps

Maps are available to download separately as below.

Map 1 - SSSI and ownership
Map 2 - Blanket bog grazing impacts
Map 3 - Blanket bog trampling impacts
Map 4 - Blanket bog impact trends
Map 5 - Dry heath grazing impacts
Map 6 - Dry heath trampling impacts
Map 7 - Dry heath impact trends
Map 8 - Wet heath grazing impacts
Map 9 - Wet heath trampling impacts
Map 10 - Wet heath impact trends
Map 11 - Montane grazing impacts
Map 12 - Montane trampling impacts
Map 13 - Montane impact trends
Map 14 - Blanket bog grazing changes since 2004
Map 15 - Blanket bog trampling changes since 2004
Map 16 - Dry heath grazing changes since 2004
Map 17 - Dry heath trampling changes since 2004
Map 18 - Wet heath grazing changes since 2004
Map 19 - Wet heath trampling changes since 2004
Map 20 - Montane grazing impacts since 2004
Map 21 - Montane trampling impacts since 2004
Map 22 - Dung changes since 2004

Appendix 4 Data tables

The full tables of results and calculations are held separately to this report as Excel spreadsheets.

Appendix 4a - Spreadsheet of 2011 results
Appendix 4b - Calculations spreadsheet with trend changes
Appendix 4c - Spreadsheet of trampling and grazing results per point 2004 and 2011 for comparison

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