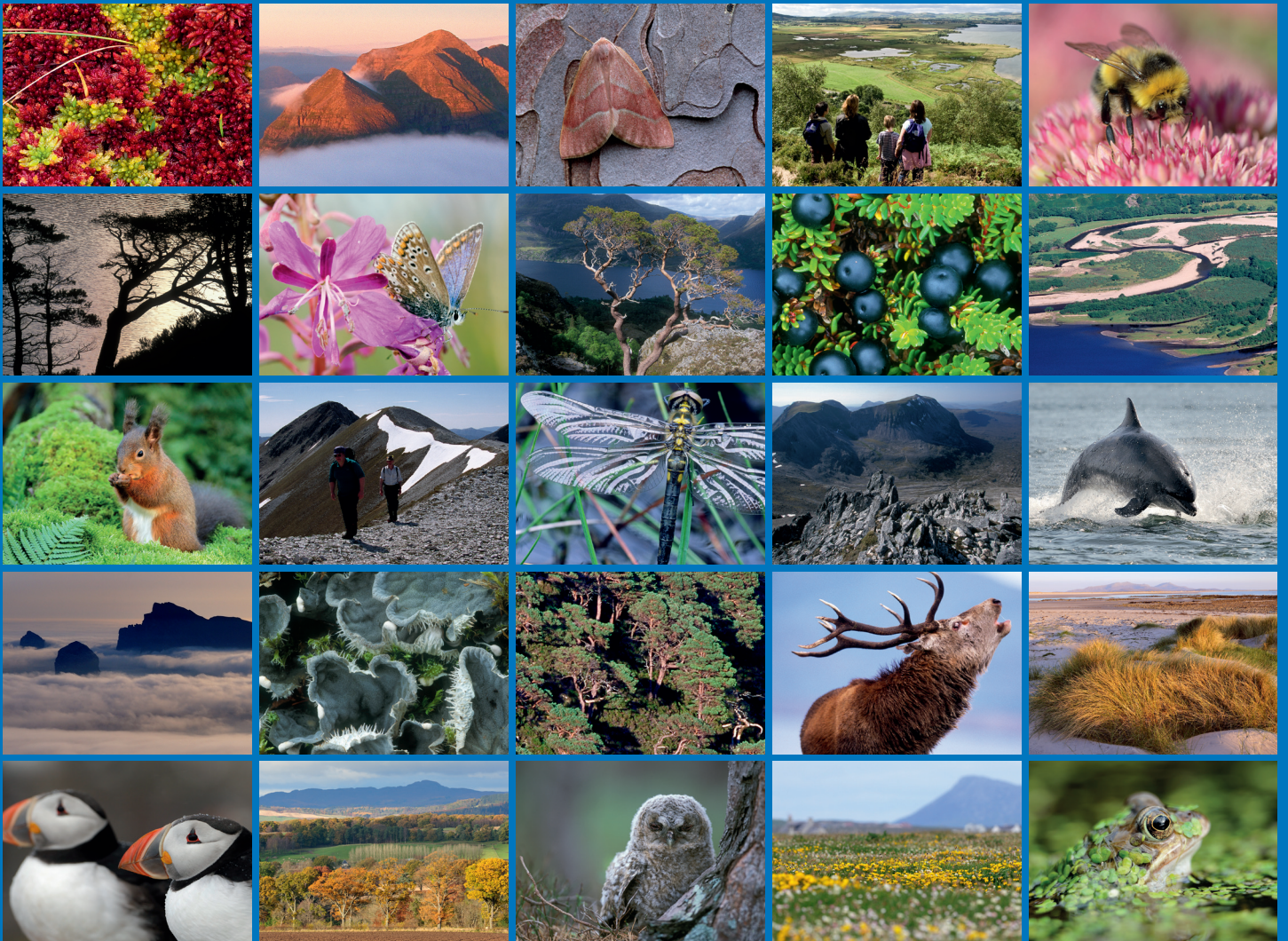


An assessment and evaluation of herbivore impacts on designated upland habitats within the Drumochter Hills SAC





COMMISSIONED REPORT

Commissioned Report No.261

An assessment and evaluation of herbivore impacts on the designated upland habitats within the Drumochter Hills Special Area of Conservation

(ROAME No. R06AC208)

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An assessment and evaluation of herbivore impacts on
the designated upland habitats within the Drumochter
Hills Special Area of Conservation

Commissioned Report No.261 (ROAME No. R06AC208)

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Background

The Site Condition Monitoring (SCM, JNCC 2006) assessment of the Drumochter Hills Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC) (based on Loizou 2005) indicated that many of the upland features were in unfavourable condition and potentially 'at risk' from herbivore impacts. On this basis, the site has been identified by the agencies (Scottish Natural Heritage, the Deer Commission for Scotland and the Scottish Government Rural Directorate) as one where Joint Agency Working could help to deliver sustainable deer/ herbivore management.

The grazing and trampling impact survey was intended to gather information in relation to the nature and distribution of herbivore impacts on a representative range of the qualifying interests of the site.

Summary

The assessment of grazing and trampling impacts in the Drumochter Hills SSSI and SAC found varying patterns of impacts on the habitats studied. Impacts were not evenly distributed around the site, but were quite specific to particular locations or vegetation types.

In the main extent of dry heath, blanket bog and alpine heath, grazing impacts were Low or Moderate to Low with any higher impacts concentrated along ridges, vantage points, alongside roads and tracks or in the sheltered corries. However, grazing was commonly Moderate or High in flushes that occur in association with areas of heath.

Trampling impacts were more pronounced than grazing impacts with 65% of blanket bog samples and 81% of flushes showing a High or Moderate trampling impact. Grazing and trampling impacts were locally High on areas of alpine heath with a high incidence of deer tracks, or co-incident within concentrations of mountain hare dung.

Impacts were attributed to a range of herbivore with; hares being frequent on alpine heaths leading to local grazing impacts, trampling by cattle being noted in one locality, deer and in places sheep, contributing to trampling impacts on flushes and the evidence from hoof-prints, dung and direct observations, suggesting that deer are largely responsible for the trampling impacts on high altitude blanket bog communities.

The level of grazing impacts *generally* encountered in the heaths and blanket bog communities are unlikely to be lead to habitat deterioration. The localised areas experiencing High or increasing grazing impacts, however, could be expected to undergo changes, with communities becoming increasingly dominated by grazing and trampling resistant grass species. The High (and to a lesser extent Moderate) trampling impacts experienced across the site in the blanket bog and flush communities in particular, are not compatible with favourable habitat condition. If continued they are expected to lead to the loss of structural variety, fragmentation and peat erosion, the possible loss of extent and loss of vascular plant species diversity.

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1. INTRODUCTION

1.1 Background

Individually the Deer Commission for Scotland (DCS), Scottish Natural Heritage (SNH), Forestry Commission Scotland (FCS) and the Scottish Government Rural Directorate (SGRD) have different grant giving and regulatory powers which they use to promote and ensure sustainable management of grazing animals. Recognising that there are many circumstances where, used together, these powers can deliver more effective solutions, the agencies have signed up to Strategic Principles for the use of incentives and regulation in dealing with adverse impacts to the natural heritage.

<http://www.scotland.gov.uk/Resource/Doc/931/0021957.pdf>

Joint Working is concerned with tackling adverse grazing and trampling impacts attributed to wild deer either on their own, or in combination with other herbivores. Joint Working involves the agencies working with local interests and identifying local solutions.

The Site Condition Monitoring (SCM) Assessment of the Drumochter Hills Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC) (based on Loizou 2005) indicated that many of the widespread upland features were in unfavourable condition and potentially 'at risk' from herbivore impacts. On this basis, the site has been identified by the agencies as one where Joint Agency Working could help to deliver sustainable deer/ herbivore management.

<http://www.scotland.gov.uk/Topics/Rural/JointAction/programme#top>

This grazing and trampling impact survey was intended to gather information in relation to the nature and distribution of herbivore impacts on a representative range of the designated interests.

This report covers the results of the Habitat Impact Assessment for trampling and grazing impacts which was carried out during June and July 2006 to gather more detailed and structured information on the nature of impacts. This was done in conjunction with surveys of muirburn impacts on extensive habitats and a repeat of the SCM survey using random points and covering the full range of features including 'upland assemblage'. The results of these other surveys are presented in separate reports (Dayton 2007a, 2007b).

1.2 Habitats and vegetation

The Drumochter Hills are a range of high hills including several over 900m rising steeply from the A9 and Loch Ericht to areas of extensive plateau moorland at about 7-800m. The plateaux are cut by some steep-sided corries and there are numerous small burns and flushes draining the slopes.

The steep slopes of the hills are dominated by dry heath with pockets of wet-heath and blanket bog where the gradient is less, e.g. around the lower slopes. At higher altitudes, generally around 7-800m, the dry heath vegetation is replaced by alpine heaths with *Carex bigelowii* and *Nardus*-rich (stiff sedge and mat-grass) alpine grasslands. Across the plateaux the main habitat is blanket bog, although alpine grasslands are common. These grasslands appear to occur in areas that might previously have supported blanket bog communities, but which appear to have been modified through long-term grazing and trampling impacts (N.Dayton *pers.obs*). In the corries, there are pockets of more calcareous vegetation including rocky outcrops

and scree, calcareous grasslands and flushes. There are also occasional patches of dwarf montane willows and tall-herb vegetation, where inaccessible to grazing animals. Siliceous scree is common on the steepest slopes throughout the site.

1.3 Designations

The Drumochter Hills SAC is designated under the European Habitats Directive for its range of upland vegetation. In addition, it is designated under the European Birds Directive as an SPA for its populations of breeding merlin and dotterel. The UK government has an obligation to avoid deterioration of the qualifying Natura features and to comply with the conservation objectives for the site as outlined below, i.e. to ensure the following are maintained:

- extent of the habitat on the site
- distribution of the habitat within the site
- structure and function of the habitat
- processes supporting the habitat
- distribution of typical species of the habitat
- viability of typical species as components of the habitat
- and that there is no significant disturbance of typical species of the habitat

Also, for the SPA features; to ensure that the qualifying species are maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of species within the site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

It is also designated as an SSSI under the Wildlife and Countryside Act for the assemblage of upland habitats, vascular plants and the breeding bird assemblage.

1.4 Geology

The bedrock of the Drumochter Hills is predominantly undifferentiated metamorphic quartz-granite with some intrusive porphyrite, rhyolite, felsite and allied types.

1.5 Management

The SAC is divided into six management units or Areas. These are described in this report and in the maps numerically (Section 3.5 and Map 1a). Note that Areas 2 and 3; Dalnacardoch and Gaick Estates were assessed together and are referred to as Area 3 in this report and accompanying Maps.

The assessment of Conservation Objectives relates to the designated habitats as they occur across the site as a whole, but impacts are described in this report separately for each management unit for the benefit of land managers.

All estates are managed for red deer stalking and grouse shooting. The more accessible slopes are regularly burnt, in rotation, to provide feeding for the grouse (see associated report Dayton, N. (2007a)).

There are some sheep and cattle on the lower slopes but sheep stocking densities appear to have been reduced during the last five years or so (Nikki Dayton and Estate keepers *pers comm.*).

This is also a popular area for hill-walkers owing to the presence of six major peaks over 900m (Munros) in the range including the highest Beinn Udlamain at 1011m, Geaul-charn, A'Mharconaich, Sgairneach Mhor, Meall a Chaorainn, Carn na Cairn and other peaks over 900m along the ridge lines and several other significant landmark peaks over 700m such as the Boar of Badenoch and the Sow of Atholl.

1.6 Logistics

The survey was carried out between the 20th June and 15th July 2006 with approximately ten points visited and assessed each field day. The surveyors were Nikki Dayton, Tim Rafferty, Kate Proctor and Ruth Maier.

2. METHODS

Grazing and trampling impact information was collected for the features; blanket bog, dry heath, alpine heath and flushes. The first three habitats are Natura qualifying features for the site and flushes form part of the upland assemblage SSSI feature and represent the key habitat for the SSSI vascular plant interests. All four widespread habitats were selected as representative of the altitudinal and geographical variation on the site (Map 1) and as those likely to be sensitive to grazing and trampling impacts, thus acting as indicators of impacts levels across all designated feature types.

Table 1: Summary of representation of surveyed habitats within the SAC (figures from EC dataforms, SNH).

Habitat	Area of coverage within SAC (ha)	Percentage coverage within SAC (%) (of a total of 9446ha)
Blanket bog	2168	23
Dry heath	2256	24
Alpine heath	1910	20
Flushes	Not Natura feature – not mapped on NVC	Not Natura feature – not mapped on NVC

SNH provided randomly generated survey points for each of the extensive features to be monitored: blanket bog, dry heath and alpine heath. The random points were selected from habitat polygons, based on previous NVC survey information (Map 1b). Thirty seven points were provided for each feature, on each of the six land-ownership units, of which up to 28 assessments were required from each set to provide a representative sample. This sampling procedure follows a standard derived for Site Condition Monitoring (JNCC 2006) and is based on the principle of being able to make an independent assessment of the condition of habitats on each management unit. Sampling was therefore not at a constant density on the different ownership units. This aids the description of the condition of habitats in each of the ownership units. However, the over-riding objective was to assess the findings against the Conservation Objectives at the site level.

Each point was visited in the course of carrying out the surveys, and located precisely using a hand-held GPS (Garmin etrex). An assessment was made

wherever the correct habitat, or another habitat requiring assessment was found at, or within 20m of the point (using the nearest location). Each impact assessment question was answered by reference to a 2x2m plot, the grid-referenced point forming the south-west corner. As far as possible, two photos were taken of each assessment plot from a point approximately 2.5 paces south of the plot, unless ground or weather conditions prevented this.

For the flushes which were not mapped separately on the existing NVC survey, assessments were made as they were encountered up to a maximum of 28 for each land-ownership area, and a grid reference taken from the GPS. Due to the often steep and awkward nature of these habitats, quadrats were located uphill from the grid-referenced point and arranged so as to include four square metres as far as possible (e.g. 1m x 4m). In most cases only one photo was taken for these assessments, uphill from a point 2 paces downhill from the grid-referenced point.

For each feature the relevant assessment of current impacts was made as per MacDonald *et al.* 1998 (see Appendix 1) and scored as High, Moderate or Low impact or intermediate classes, HM, ML where appropriate. For trends, the term 'chronic' is used in MacDonald *et al.* 1998 to refer to long standing impacts, whether High or Low. The assessment of long-term impact was then complemented by an assessment of whether impacts have increased, decreased or are stable relative to these historic impacts.

To make an overall assessment for each plot, High impact results were scored 3, Moderate to High impacts 2.5, Moderate impacts 2, Moderate to 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 to Low
1.75-2.249	Moderate
2.25-2.749	Moderate to High
2.75-3	High

An overall trend for each plot was obtained by averaging the trend indicators in the same way. The overall trend may be expected to differ from the assessments made for current impacts (grazing and trampling together or trampling separately) as the trend indicators tend to concentrate on attributes influenced by grazing impacts.

Grazing and trampling impacts were considered separately for dry heath, blanket bog and flushes. Combined assessments of grazing and trampling impacts are provided in Appendix 1 for comparison with other studies, but the figures in the text relate to the separate assessments of grazing and trampling impacts for these habitats. Indicators of grazing and trampling impacts were considered together for alpine heath since it was felt that there were insufficient indicators to separate them and still produce a robust assessment for this feature.

A system of weightings was used to inform the overall assessments for grazing and trampling (separately) on blanket bog and dry heath (MacDonald unpublished advice, Appendix 3). The weightings place more emphasis on the indicators which are more widely relevant and less ambiguous. For example, to assess trampling on blanket bog, greater weight was given to the indicators showing trampling of pool sides and *Sphagnum* (bog moss) damage (150) than to the extent of ground cover by bryophytes (25); moderate weight was given to number of hoof-prints in bare peat and the firmness of ground underfoot was treated as almost negligible. Within the

grazing indicators, a higher weighting was placed on observed grazing/browsing on *Calluna vulgaris* (heather) or *Vaccinium myrtillus* (blaeberry) and much lower multipliers on the amount of *Eriophorum vaginatum* (hare's-tail cotton-grass) flowering or the presence of herbivore dung.

No weightings have been derived for the indicators used to assess flushes or alpine heath. The overall assessments are therefore a straightforward numerical average.

Summary tables of all the overall assessments for grazing, trampling and trend indicators are given in Appendix 1.

All vascular species nomenclature is *per* Stace, (1997) and NVC classifications according to Rodwell (1991).

3. RESULTS BY HABITAT TYPE

3.1 Blanket Bog

3.1.1 Habitat description.

Blanket bog was found throughout the site, with large expanses present on the flatter ground across the plateau areas to the north-east of the site and to the far south, and as more limited patches on the lower slopes alongside the A9 and Loch Ericht. In the main, those patches on the lower slopes supported abundant heather and occurred in mosaics with wet and dry heath. On the plateau, the bog was often hagged with areas of bare peat and occurred in mosaic with siliceous alpine grasslands. The most abundant community was the M19 *Calluna vulgaris-Eriophorum vaginatum* community with all three sub-communities represented.

3.1.2 Indicators

All the indicators relating to trampling impacts were used as part of this assessment. Damage to the edges of pools was a reliable indicator but only valid at a small fraction of the assessment plots. Firmness of ground was a less reliable indicator of trampling as hardness of peat is also an indicator for burning intensity, but accordingly was given a low weighting. Damage to *Sphagnum* and feather mosses carried a higher weighting due to their greater reliability as an indicator of trampling.

Of the grazing indicators, grazing on *Betula nana* (dwarf birch) and *Myrica gale* (bog myrtle) were not informative as neither of these species were present in the survey points. *Rubus chamaemorus* (cloudberry) was present at a few plots on the plateau, but flowers and fruit were almost never present, despite other indicators suggesting a light grazing impact. Dung was a reliable indicator of the presence and type of herbivore, but its occurrence in a plot did not necessarily indicate that an animal had used the area for feeding. The presence and nature of grazing on heather, blaeberry and the less palatable species such as *Erica tetralix* (cross-leaved Heath), *Vaccinium vitis-idaea* (cowberry) and *Empetrum nigrum* sbsp. *nigrum* (crowberry) were reliable indicators of grazing and have been given a higher weighting accordingly. The amount of flowering of *Eriophorum vaginatum* was a fair indicator, though not always present and there may be other reasons why flowering heads are scarce.

Of the trend indicators, bog myrtle was not present and *Juncus squarrosus* (heath rush) was sparse. The presence of grasses and *Carex panicea* (carnation sedge) were good indicators of long-term or 'chronic' impacts and the growth form of heather

gave a strong indication of directional trends. However, these species, though common, were not present in every sample. Areas which may have been blanket bog historically, but which, following a long history of grazing and trampling impacts have become alpine grassland or other vegetation types (N.Dayton *pers. obs*), were not assessed as blanket bog, and hence may not give a complete picture of impact trends.

3.1.3 Overall assessment – grazing (Map 2a)

The indicators for blanket bog suggest that grazing and browsing impacts were Low to Moderate over most of the site with only three instances of a High grazing impact recorded and 58% of all impacts recorded as Low. Grazing impacts were almost all Low across the southern half of the site with most of the Moderate impacts recorded from the north-east plateau and northern boundary. In the areas of Moderate impact, few signs, such as prints, dung or sightings of herbivores, except red deer and, in a few distinct locations, mountain hare, were recorded.

3.1.4 Overall assessment – trampling (Map 3a)

Trampling impacts on blanket bog were not spread evenly around the site. Trampling was assessed as Low for 35% of assessments and these are mostly located on the slopes of the hills where the bog only occurs in patches within a mosaic of heathland. Where the blanket bog occurs in continuous swathes, however, more severe impacts were recorded; on the north-east plateau between Carn na Cairn and A'Bhuidheanach Bheag, on the southern plateau between an Sgulan and Mam Ban and on an area of flatter ground to the far north-west, to the north of Wade Bridge. The plateaux to the north-east and south have 27 of the 32 High impact plots recorded across the site and most of the Moderate impact plots (map 3a). In these areas there are also frequent areas of active haggling and large patches of bare peat outwith the sample plots.

3.1.5 Overall assessment – combined grazing/trampling (see summary tables, Appendix 1)

The weightings for blanket bog indicators are skewed towards the trampling indicators so there is little difference between a combined score for grazing and trampling and that of trampling alone, though as a general observation, when assessed together there are fewer High and fewer Low impact sites than for trampling alone. The separate grazing assessment shows a much lower impact from grazing than for trampling, with only 2% of plots assessed as High grazing impact (19% for trampling and 11% for grazing and trampling combined) and 41% as Moderate (46% trampling, 51% combined).

3.1.6 Overall assessment – trends (map 4a)

Trend indicators for blanket bog suggest that, in general impacts were Low and stable with 75% of all indicators in this category and only 5% classed as 'chronic High'. However, these assessments are not considered to accurately reflect current impacts largely because the indicators used reflect grazing impact trends rather than trampling impacts, which account for most of the Moderate and High impact assessments. The trend indicators are also unlikely to fully reflect changes in impacts over a longer timescale (decades) as the plateaux appear to have been subject to chronic impacts in the past which appear to have resulted in a loss of peatland habitat and the expansion of mat-grass dominated grassland, almost certainly as a result of past heavy grazing pressure. Those areas of blanket bog that were most

affected were not assessed as bog, but as grassland. In addition, the most reliable indicator for trends is the growth form of heather, but where chronic grazing impacts have occurred, this species is often not present and therefore not assessed.

Some areas of the blanket peat appear to have been subject to burning as well as grazing, especially to the far north-east of the main northern plateau by Meall Odhar Mor. However, there were no indicators of recent burning on the plateau other than the presence of bare peat, which in this case was considered attributable to natural erosion and trampling.

Low but apparently increasing impacts were scattered throughout the site with no particular pattern (map 4a), though generally the increasing impact noted was slight. Increasing impacts appear to coincide with areas where red deer hoof-prints and dung were recorded suggesting that they are the main herbivores.

3.2 Dry Heath

3.2.1 Habitat Description

Dry heath is very common on the slopes of the hills throughout Drumochter SAC. Dry heath is largely dominant on the steep slopes that surround the plateau to the north and across most of the southern hills. It is largely replaced by alpine heath along a cline at about 7-800m above which the influences of exposure favour species such as stiff sedge, *Racomitrium lanuginosum* (moss), *Empetrum nigrum subsp. hermaphroditum* (crowberry) and *Cladonia* spp (lichen).

In general the heaths are dominated by heather compared with other dwarf shrub species, though blaeberry is common and other sub-shrubs such as cowberry and crowberry are frequent. Blaeberry becomes dominant in places to give areas of the H18 *Vaccinium myrtillus-Deschampsia flexuosa* heath, but in general it is species-poor H12 *Calluna vulgaris-Vaccinium myrtillus* heath that predominates.

3.2.2 Indicators

The grazing and trampling indicators for dry heath have been separated to show where these impacts may vary. The indicators based on bog myrtle were not used as this species was absent from the area and the presence/absence of spiders webs was only used during that part of the survey that fell in July.

The other indicators were all straightforward and provided a reliable indication of impacts, though it was evident that the indicators for trampling such as stem breakage, uprooted seedlings, depth of moss and bare ground showed a typically lower impact than those for grazing. Also dung assessments did not always tie in with the grazing and trampling indicators at any one plot. The weightings for dry heath ensured that a greater significance was given to certain indicators such as browsing on heather or on unpalatable species such as *Erica tetralix* and less on dung or depth of moss reflecting their reliability as indicators.

The trend indicators were largely based on the shape and growth forms of heather which gave a reliable result except where heather was not present. In most cases the nature of sheep scars was not measured as these were largely absent.

3.2.3 Overall Assessment - Grazing (Map 5a)

Of the points assessed, over 54% were Low, 31% were Moderate and 15% High or Moderate to High. Of the heavier impacts, most were located in a strip alongside the A9 (north-east) or in the steep-sided corries. Most of the impacts to the south of the SAC were Low except for a few scattered locations and a group of plots assessed as of Moderate or High impact along the far, southern boundary with Corrievarkie Estate (Area 6).

In Area 4, to the north of the A9, some impacts may have been due to a small herd of about 40 cows that were present in this estate and which largely kept to the strip along the road-side between the Lodge House and the northern boundary of this ownership. Grazing and trampling impacts in the main corries, Cama Choire, Coire Chuirn, Coire Fhar and Coire Domhain were due to a combination of sheep and deer. Those along the southern boundary of the SAC below Mam Ban were attributable almost entirely to red deer.

3.2.4 Overall assessment – Trampling (Map 6a)

The trampling assessments were almost all Low or Moderate to Low (82%) with 15% Moderate and only 3% Moderate to High. Trampling was less evident on the areas of dry heath than on other features as this is a more robust habitat and tends to grow on steeper slopes that are less frequented than the plateau areas. This is not the case on stands of higher altitude heath near to the plateau which were crossed by frequent deer tracks, but many of these were assessed as alpine heaths. In addition, long heather appears to be less attractive to roaming herbivores than shorter vegetation such as along flushes, which tended to be heavily trampled.

3.2.5 Overall Assessment – Trends (Map 7a)

Out of all the assessments for dry heath, 83% were stable and 10% were increasing. Fifty nine percent were on habitat that had been subject to a light grazing impact for a long-time 'chronic Low', 25% to a Moderate impact 'chronic Moderate' and 4% a 'chronic High' impact.

3.3 Flushes

3.3.1 Habitat Description

Flushes are frequent over most of the site and widespread except for across the plateau, where they are largely replaced by bog-pools (M2). On the upper slopes, most of the flushes are of the 'spring-head' type, dominated by bryophytes such as *Philonotis fontana* (moss), *Cratoneuron commutatum* (moss) and *Aneura pinguis* (liverwort) (M32, M37, M38). They occur alongside the main burns, often below rock outcrops or other exposures. On the lower slopes, moss dominated flushes are partly replaced by short-sedges such as *Carex viridula ssp. oedocarpa* (common yellow sedge), carnation sedge and even, along the roadside, by *Carex rostrata* (bottle sedge). Typical communities on these slopes are M10 *Carex dioica* – *Pinguicula vulgaris* mire and M15a *Scirpus cespitosus* – *Erica tetralix* wet heath. In all areas, the bryophytes are an important component of the flushes accounting for 50% or more of the cover.

3.3.2 Indicators

For flush communities the indicators have been separated into discrete trampling and grazing indicators as the assessments identified a distinction between the two. The trampling indicators focus on disruption to the moss mats and hoof-prints and all are reliable direct indicators. The grazing indicators include vegetation height, percentage grazing on grass and sedge leaves and the proportion of sedge flower heads that have been bitten off, again all of which are reliable indicators. The other indicators require the presence of certain species, *Juncus* spp. (rush), *Cardamine* spp (group including cuckoo flower), *Crepis* spp. (hawkbeards) and *Armeria maritima* (thrift), which were absent from all but a few plots.

The only indicator which provided an indication of trends was the relative abundance of rushes *Juncus* spp. and grasses, although this reflected chronic impacts rather than current directional trends. The other trend indicator, height of bushes, was not applicable as these were absent.

3.3.3 Overall assessment –grazing (map 8a)

Of the grazing assessments 70% of plots were Low or Moderate to Low with the other 30% of plots assessed in the range from Moderate to High. Grazing has noticeable as slightly higher than in the surrounding ground with herbivores apparently preferring the more palatable herbs and grasses that grow alongside these wet areas. This was particularly true in the plateaux areas where palatable vegetation is more sparse.

3.3.4 Overall assessment – trampling (map 9a)

Of the plots assessed for trampling impacts, 19% were assessed as Low or Moderate to Low, 31% were Moderate, 31% were Moderate to High and 19% were High. The High trampling assessments were mainly across the plateau and around the hills above Corrie Varckie. They were largely due to trampling by red deer which appear to use the flushes as through routes across long heather, and whose impacts are exacerbated by the damp ground. In these areas grazing and trampling impacts on flush vegetation is severe and deer tracks have become broad swathes of churned up peat with almost no vegetation cover.

3.3.5 Overall assessment – trends (map 10a)

Over most of the site, long terms trends were either Moderate or High with few showing a chronic Low or decreasing impact.

3.4 Alpine Heath

3.4.1 Habitat Description

Alpine heath is common around the edges of the plateau and along steeper ridges and exposed areas above 800m. It is typically dominated by prostrate heather and other sub-shrubs such as cowberry, crowberry *subsp. hermaphroditum* and *Vaccinium uliginosum* (northern blaeberry) with frequent *Carex bigelowii*, grasses such as *Deschampsia flexuosa* (wavy hair-grass) and *Agrostis canina* (velvet bent grass) and abundant mosses and lichens. Stands were typically low-growing (5-15cm) with frequent areas of exposed rock and stones, or where exposed, small patches of bare ground. Deer tracks were generally frequent and appear persistent.

3.4.2 Indicators

Of the indicators used for trampling and grazing, grazing impacts on *Agrostis capillaris* (common bent grass) and other palatable grasses and grazing on thrift, *Arctostaphylos uva-ursi* (bearberry) and *Sibbaldia procumbens* (least cinquefoil) were rarely assessed due to the absence of these species. Evidence of grazing on *Carex bigelowii* was a very reliable indicator and the presence of bare ground away from exposed areas and browsing on shrubs also gave good indications of impact levels. Dung was assessed but did not correspond closely with the other indicators, suggesting that though animals were present, they did not necessarily use these areas for feeding.

Trends were assessed based on the cover and presence of fine and palatable grasses. These gave a good indication of chronic or long-term impacts, but not of more recent changes in impact levels.

3.4.3. Overall assessment – grazing and trampling (map 11a)

Out of all the points, grazing and trampling were assessed as Low on 47% of points, as Moderate to Low on 37%, Moderate on 14% and with 3% assessed as Moderate to High and none as High. Of those points assessed as Moderate or Moderate to High, almost all were on the upper slopes of the northern half of the site, above the A9, with the heaviest impacts recorded from the edges of steep slopes, e.g. above the Cama Choire and on top of the Boar, possibly on sites used as look-outs.

Generally the heaths were wind-clipped rather than grazed or browsed, though there were signs of some browsing on blaeberry in places. Deer tracks were frequent and the main reason for areas of bare ground other than natural exposure due to wind and weather. *Deschampsia flexuosa* was the main grass identified and palatable grasses were scarce.

3.4.4 Overall assessment – trends (map 12a)

The main indicators of change focussed on the percent cover of fine and palatable grasses, all of which tended to suggest a chronic Low impact from grazing over most of the site, including 78% of all plots, although eight plots showed an increasing impact. Of the 21% of points that indicated a chronic High impact, almost all of these were to the far north and far south of the site, with two of these points showing an increasing impact, the others being stable or declining.

3.5 RESULTS BY OWNERSHIP UNIT

The results are described here by ownership unit for the benefit of the land-managers of the individual estates, however, the Conservation Objectives relate to the features as they occur across the whole site.

3.5.1 Area 1 - Phones Estate

Area 1 lies to the north of the site and includes a strip of hillside rising from the A9 at the top of Loch Ericht to the summit of Carn na Cairn and north to include the two corries, Coire Carn and Coire Chais. Immediately adjacent to the road is an area of gently sloping ground supporting blanket bog (M19 *Calluna vulgaris-Eriophorum vaginatum*) rising steeply to Carn na Cairn over heather covered slopes dominated by dry heath (H12 *Calluna vulgaris-Vaccinium myrtillus*) and towards the top by alpine heath (H13 *Calluna vulgaris-Cladonia arbuscula*, H14 *Calluna vulgaris-Racomitrium lanuginosum*). Carn na Cairn summit is broadly rounded and forms part of an extensive upland plateau that runs into Dalnacardoch and Gaick Estates. The vegetation here is dominated by alpine heath and siliceous grassland (U7 *Nardus stricta-Carex bigelowii*) around the summit with blanket bog across the flatter ground to the east (M19 *Calluna vulgaris-Eriophorum vaginatum*).

Grazing impacts on blanket bog within Phones Estate were generally higher than elsewhere in the SAC with 14% of assessments classed as Low impact and 86% as Moderate, compared to the overall average of 58% Low and 41% Moderate, although no samples on Phones Estate were classed as having a High impact.

Trampling impacts had a similar percentage of plots with a Low impact, mainly on the steeper slopes where they form part of a heath/bog mosaic (18%) but of the rest, 57% showed a Moderate impact and 25% a High impact. Of the two main areas of bog within Phones Estate, most of the High impact plots were located on the plateau, around and to the east of Carn na Cairn. Only one was found in the valley, just north of Wade Bridge.

Areas with High trampling impacts coincided with the large areas of bare peat highlighted in the burning impact study (Dayton 2007a) (which looked wider than the random sample locations). Since there were no other signs of burning on the plateau it seems more likely that these are the result of a combination of natural erosion and trampling, and that both grazing and trampling are exacerbating the rate of natural haggling and restricting the rate of re-vegetation.

Grazing and trampling impact trends on blanket bog are all classed as having been Low for a long time 'chronic Low' and are currently stable in this ownership unit. However, due to the reasons put forward in 3.1.5, this assessment may not fully reflect the changes in habitats that have taken place.

Dry heath plots were predominantly classed as Low for grazing impacts (75%) with 25% classed as Moderate. Trampling impacts were mainly Moderate to low (71%) with 18% Low and 11% Moderate. The Moderate impact plots for both grazing and trampling were almost all within the lower part of the plateau where the heath exists in mosaic with blanket bog and the assessments were influenced by locally high dung counts, areas of bare ground and some grazing on *Erica tetralix* and *Empetrum nigrum* subsp. *nigrum*. The latter may be partially attributable to cattle. Impact trends for this area were generally chronic Low and Stable (79%) with two plots showing a chronic Moderate impact, which is either stable or decreasing. These plots are also within the lower slopes near to the road.

The assessment of current impacts on alpine heath within this area were all Low or Moderate to Low. Most of the Moderate impacts observed on alpine heath were on the plateau and can be attributed to areas of bare peat with the notable presence of deer tracks. Grazing impacts were scarce except in a couple of locations where there was evident grazing on *Carex bigelowii* and, at one location, where local impacts were due to mountain hare.

Trend indicators on alpine heath mostly showed a chronic or long term High impact (76% of plots), mainly due to the abundance of fine grasses within the heath. The other plots showed a chronic Low impact. All current impact trends, where discernable, were stable.

Flushes across the Area showed a strong disparity in the impacts for grazing and trampling (measured separately). Grazing impacts were almost all Low or Moderate to Low (92%) with 8% assessed as Moderate. The Moderate to Low impacts were found across the plateau and the steep heath-covered slopes, with the Low impacts across the more gentle slopes at the base of the hill. In contrast, trampling impacts were more evident, with 60% of assessments in the range from Moderate to High. Trampling impacts on flushes were similar to those throughout the site, to locally slightly higher than the average. Trend indicators in Phones Estate showed a chronic Moderate impact that is currently stable.

The main herbivores present in Phones Estate were red deer; their dung, hoof-prints and tracks were present across the slopes and plateau. There are also a small number of sheep that appeared to graze preferentially across the lower part of the hillside and only occasionally on the plateau (*pers obs* & dung). Mountain hare were only found to be present on the plateau and appeared to mainly frequent areas of alpine heath, creating occasional, locally-High grazing impacts.

The most prominent impacts in this area were focussed on the blanket bog and flush habitats and were largely attributable to trampling impacts. This was indicated by hoof-prints, dung, large areas of bare peat, tracks and disruption of moss mats and stem breakage. The damage to flushes was quite specific to this sensitive habitat with High trampling impacts on this habitat directly adjacent to Low trampling impacts on dry and alpine heaths.

Impacts due to sheep and mountain hare were generally Low, local and stable and considered unlikely to cause a deterioration in habitat condition. The trampling impacts on the plateau and on flushes were severe in places and appeared to be increasing (N.Dayton, *pers.obs*) despite the trend indicators (which focus on grazing impacts) suggesting otherwise. Flush and blanket bog communities in this management unit seem, therefore to be subject to ongoing impacts which are unlikely to result in improvements in habitat condition.

3.5.2 Areas 2 & 3 – Dalnacardoch and Gaick Estates

Area 3 covers the western part of Dalnacardoch estate and part of Gaick Estate, from the Coire Mac-Sith and including the top of the deep Cama Coire. These two land-ownerships were assessed together as historically they have been managed as one unit, although they are now under different ownerships. This area rises from the A9 in the south to a broad and extensive plateau that extends from Carn na Cairn to Glas Mheall Mor and split by the Cama Coire which bisects the plateau from the east. The southern slopes are covered in a mosaic of dry heath (H12 *Calluna vulgaris-Vaccinium myrtillus*) and blanket bog (M19 *Calluna vulgaris-Eriophorum vaginatum*) over undulating ground with frequent *Sphagnum*-rich flushes. The plateau is

predominantly blanket bog (M19) and siliceous *Nardus stricta* grassland (U7 *Nardus stricta*-*Carex bigelowii*) with alpine heaths on the ridges and around the edge of the plateau.

Grazing impacts on blanket bog were mostly Moderate (67%) with 33% of plots classed as Low impact and none as High. Low impacts were concentrated alongside the A9 and the slopes above and Moderate impacts on the upper slopes and plateau. Trampling impacts were similar to grazing impacts across the southern half of this land-ownership area, but across the northern part of the plateau and around the Cama Choire, there were 9 plots assessed as having High impacts (27% of plots) with heavy trampling noted around pool edges, the presence of hoofprints and disruption of *Sphagnum* mats.

Areas with High impacts coincided with the large areas of bare peat highlighted in the burning impact study (Dayton 2007a). Since there were no other signs of burning on the plateau it seems more likely that these are the result of a combination of natural erosion and trampling, and that both grazing and trampling are exacerbating the rate of natural haggling and restricting re-vegetation.

Trends on blanket bog were all chronic Low or Moderate to Low, but this assessment only includes those areas currently assessed as blanket bog (see 3.1.5).

Dry heath is localised in Area 3 with all plots taken from the lower slopes above the road or from the steep sides of the Choire Cama. Outside the corrie, all but six plots showed a Moderate grazing impact but within the corrie there were six that showed a High impact (20%). Across the area 17% were assessed as having a Low impact.

Trampling impacts were mainly Low (30%) or Moderate to low (33%) with 27% Moderate and 10% Moderate to High. This suggests that the main part of the impact was due to grazing with browsing on long shoots and damage such as stem breakage to *Calluna* bushes both contributing to the trampling assessment score. Of note here is that the weightings used to make the grazing assessment produced a greater number of High assessments (from 1 to 6) than would have been the case from an unweighted assessment, where the results from the more reliable indicators would have been swamped by the less reliable indicators.

Trends showed a generally Moderate chronic impact across the lower slopes and Moderate or Low chronic impacts in the Cama Choire with one chronic Low, increasing impact. This suggests a largely stable situation.

Alpine heath habitat is largely situated around the upper part of the southern slope and around the top of the corrie. Impacts were almost all Low or Moderate to Low (78%) with 22% in the range from Moderate to High. The two areas of greatest impact were situated at the break of slope, the southern one was due to red deer concentrating feeding at a vantage point and the other was local browsing due to mountain hare. Trends showed that there has been a generally Low impact over the last few years and that the current situation is stable.

Flushes were affected by grazing and trampling impacts throughout the area, both on the plateau and on the steeper ground to the south and in the corrie. This was mainly due to trampling by deer which appear to use flushes as preferred routes through long heather. Seventy three percent of trampling impacts were in the range from High or Moderate compared to 61% of grazing impacts, which was close to the average across the site.

The dominant herbivores on this site were red deer although some sheep were also present. Mountain hare were present on the plateau in good numbers.

The main issues in Dalnacardoch and Gaick Estates were trampling on blanket bog and flushes on the plateau and trampling and grazing to flushes on the southern slopes. High grazing impacts on alpine heath were due to localised impacts due to deer and hare. On dry heath, High impacts due to grazing were all located in the Cama Corrie.

The trampling impacts on the plateau and on flushes throughout this area were quite severe in places and appeared to be increasing despite the trend indicators suggesting otherwise. There is unlikely to be any improvement in the condition of blanket bog or flush vegetation under existing impact levels.

3.5.3 Area 4 – Ralia Estate

This is the largest ownership unit within the SAC and consequently the assessment plots were more spread out. To the north of the A9 it comprises a long slope cut by frequent burns that rises to a thin strip of the plateau (largely in Area 3). To the south of the road the SAC covers the western flanks of the hills to Loch Ericht as far as the ridge between Creagan Mor and Beinn Udlamain. The habitat in this area is largely dry and wet heath (H12, M15 *Erica-Sphagnum*) on the lower slopes with pockets of blanket bog (M19) and alpine heath (H13, H14) on the upper slopes, often in mosaic with siliceous *Nardus stricta* grassland (U7).

Blanket bog is fairly sparse, largely occurring in mosaic with dry and wet heaths except alongside the A9. Grazing was mostly Low (76% of assessments) with Moderate impacts largely scattered through the lower ground and along burns. Trampling impacts were either Low (56%) or Moderate (40%) with one High assessment. Trends suggested a chronic Low impact but with 28% of plots showing an increasing impact (assessed on growth form of *Calluna*).

Dry heath showed a largely Low grazing impact throughout this estate (59% of plots), with local concentrations of heavier impacts (22% High and 4% Moderate to High). These were mainly along the road to the north of the A9 and are due to a small herd of cows that are grazed in this area (NN 264 782). Trampling impacts were mostly Low (59%) or Moderate to Low (37%) with only one sample in the Cailleach Coire Chuim in the north that was Moderate for both grazing and trampling impacts by red deer, indicated by browsing on long-shoots, bare-ground and frequent hoofprints.

Trends for dry heath indicated that past impacts were largely Low (71%) except for those plots taken along the A9 corridor. Many of these trends showed an increasing impact from both chronic Low and chronic High past levels. This is considered to be due to the impact of the cows alongside the road and to red deer on the upper slopes.

Thirty out of 31 alpine heath assessments were made to the north of the A9 road, partly because the main areas of alpine heath were to the north, but also because, in the northern part surveyed first, many of the assessment plots intended as dry heaths (from an interpretation of earlier survey data) were in fact alpine heaths. The plots were fairly evenly split between Low and Moderate impacts and the main impacts observed were areas of bare ground due to deer tracks. Ninety percent of all assessments on Ralia Estate were classed as having had a chronic Low impact which is currently stable. The only assessment showing a chronic High impact indicated current impact levels were declining.

Impacts on flushes were variable but mostly Moderate to High for trampling (33%), with 11% as High, and Low or Moderate to Low for grazing (61%). Fifty percent of plots had been subject to a chronic Moderate to High impact and there were nine plots that showed an increasing impact.

The dominant herbivores on this site were red deer although there were some sheep and a small herd of cows that grazed around the lower slopes. Mountain hare were present on the plateau in good numbers.

In Ralia Estate the main impacts were trampling on flushes and, to a lesser extent on alpine heaths. Deer tracks were present in both these habitats apparently contributing to areas of bare ground and the disruption of lower plants. A further cause of more local trampling impacts were the cows that grazed the lower slopes to the north-east of the A9; mainly on dry heath and flushes.

There were some local impacts attributed to cattle which were assessed as increasing (based on the trend indicators), alongside the north of the A9, but otherwise impacts to heath and bog habitats appeared unlikely to increase under current conditions. The trampling impacts on the flushes were locally quite severe and are likely to result in further degradation of this feature and species loss over time.

3.5.4 Area 5 – Dalnaspidal Estate

Area 5 extends from the A9 along Coire Domhain to the plateau above Sgainneach Mhor. It comprises largely very steep ground covered in dry heath (H12) and alpine heath (H13, H14) with some blanket bog (M19) in the saddles between the hills, alongside the A9 and along Corrie Domhain.

Impacts on blanket bog were typically Low, with 82% of all grazing assessments and 50% of trampling assessments classed as Low. The five grazing assessments showing a Moderate impact were on the lower slopes near to the access track along Coire Domhain. These impacts were due to sheep and red deer in this area. The Moderate (39%) and High (11%) trampling impacts are all concentrated in the saddle between the Sow of Atholl and Sgainneach Mhor, above the Corrie. Trends on the blanket bog were mostly chronic Low and stable though there were four that suggest a chronic High impact within the saddle and alongside the road. In the area currently described as having a Moderate level of grazing impact around the saddle and track, there were also five plots that showed an increasing grazing impact.

The dry heath assessments showed that most plots were experiencing Low impacts from grazing (69%) but that scattered plots showed a Moderate (21%) or Moderate to High impact (10%). These higher impacts were largely due to evidence of browsing on long shoots, summer browsing and browsing on heather flowers. Trampling impacts were less with 76% Low or Moderate to Low, 21% Moderate and only one sample (3%) Moderate to High. Trampling impacts were mainly attributable to areas of bare ground from deer and sheep tracks. Trends showed that all assessments were currently stable and with 76% showing Low chronic impacts.

Impact assessments for grazing and trampling on alpine heath were mostly Low or Moderate to Low (74%) but the exceptions include 11% of plots assessed as Moderate to High. These were largely concentrated along the high ridges at the boundary with Dalnaspidal Estate and were largely due to areas of bare peat with deer tracks. Trends for alpine heath all showed a chronic Low result but three plots (11%) showed an increasing impact trend in the same areas as the High

grazing/trampling impacts were recorded. This trend is probably due to deer trampling being concentrated along the ridges due to their accessibility and good vantages.

Across this part of the SAC, flushes were predominantly stony and open with running water between mossy hummocks. Grazing impacts on flushes within this area were mostly Low or Moderate to Low (83%) with the rest Moderate (14%) and 3% Moderate to High. The Moderate to High and Moderate impacts were all recorded from plots taken on the upper slopes and ridges. Trampling impacts on flushes within this area were quite severe, however, with 58% of plots having a High or Moderate to High impact and 38% Moderate. These impacts were spread throughout this area with only one plot having a Moderate to Low impact and that falling on an almost vertical slope that is unlikely to be easily accessible.

The main herbivores in this area were sheep and red deer, with the deer predominantly on the plateau and upper slopes and the sheep more frequent on the lower slopes and at the base of the corrie, although there is considerable overlap. Mountain hare were occasional on the plateau and ridges.

The main impacts within Dalnaspidal Estate were trampling impacts on flushes with more localised trampling impacts on blanket bog, dry heath and alpine heath. The flushes showed a trampling impact in the range from High to Moderate throughout the whole area (97%) with disrupted mosses and bare ground frequent. Blanket bog to the north of the saddle between the Sow of Atholl and Sgainneach Mhor had been affected by Moderate to High trampling impacts and there was a small area of High grazing and trampling impact below the summit of Sgainneach Mhor. Areas of Moderate to High grazing and trampling impact were predominantly sited along the high ridges between Areas 4&5.

For the most part, impacts on the habitats in this land ownership area were local and due to the preferential congregation of herbivores at particular sites, e.g. deer and sheep at good vantage points. Trampling impacts on flushes were High throughout this area and are likely to result in further degradation of this feature and species loss over time.

3.5.5 Area 6. Craiganour Estate

Area 6 is a small area in the far south-west corner of the SAC that is largely plateau moorland dominated by alpine heath (H13, H14) and siliceous grassland (U7) on the high ridge, with an area of blanket bog (M19) on the slope to the east of this Area.

The blanket bog is present in a very small area but all impact levels were encountered within this area including 36% of plots with Low trampling impacts, 43% Moderate and 21% High impacts. Impacts were not spread evenly throughout this area but tended to be High around pools and areas of bare peat. Grazing impacts were 54% Low and 39% Moderate with two samples showing a High impact. Trends are likewise varied though 82% suggested a chronic Low impact and only 18% chronic High. However, of the Low impact plots, over half showed an increasing impact.

Dry heath is scarce within this land-ownership unit but pockets to the far south are present and showed a largely Moderate (40%) or Moderate to High (60%) impact for grazing. Trends suggested impacts have been Moderate over a long period 'chronic Moderate' but are currently stable. These impact scores were largely due to browsing

on heather rather than to trampling impacts which were all assessed as Moderate to Low.

Alpine heath along the ridge between Areas 6&7 had been mostly lightly grazed with Low impact scores accounting for 50% of plots and Moderate to Low for 29%. Twenty one percent of plots showed a Moderate impact and these were all towards the north of this land-ownership area. In general, impact trends were stable, though 32% of plots showed a chronic High impact for grazing and trampling. In 11% of plots, all located to the north of this area, an increasing impact was noted.

Flushes on the plateau were largely peat depressions and soaks filled with *Sphagnum* and other mosses. Sixty nine percent of plots showed a High or Moderate to High trampling impact with frequent hoof-prints and disrupted moss mats, 30% showed a Moderate impact and none were Low. Grazing on these flushes was less severe with 52% of plots Low or Moderate to Low, though there were a few plots (4%) showing High impacts to the north and south of this area.

Red deer and their tracks and dung were frequent within this area, sheep were not seen and signs of mountain hare were only occasional. In general, impacts within this area were varied with a mixture of impact levels. The most severe impacts were trampling impacts on flushes and some local grazing and trampling impacts on other habitats, especially blanket bog.

Impacts on the plateau appeared to be due to the combined impacts of natural erosion (peat hags are regarded as a natural characteristic of blanket bog) and trampling by red deer. Erosion/hagging is likely to continue under current impact levels and could increase.

3.5.6 Area 7 – Corrievarkie Estate

Area 7 runs from Loch Ericht up to a broad area of plateau moorland between An Sgulan and Mam Ban. On the lower slopes above the loch the hillside is predominantly wet heath (M15) and blanket bog (M19) in mosaic with patches of dry heath (H12) which becomes dominant on the steeper areas. The upper part of the slope and the summit and ridge of An Sgulan are largely alpine heath (H13, H14). Blanket bog (M19) covers most of the flat to undulating plateau between An Sgulan and Mam Ban in Craiganour Estate.

Blanket bog vegetation is found in two parts of Corrievarkie Estate. On the lower slopes it occurs quite frequently in mosaic with wet and dry heath, especially alongside the main burns that drain the plateau. Apart from one sample, all these plots showed a Low grazing impact and a Low or Moderate trampling impact. A further, more extensive area of blanket bog occurs on the plateau between An Sgulan and Mam Ban. Grazing impacts here were also Low (93%) but only 36% of trampling impacts were Low. Six of the trampling impact assessments on the plateau were High which accounted for 21% of the assessments from this area.

There were also large areas of bare peat in this area that were picked up in the burning assessment study (Dayton 2007a), but are not considered to be the result of burning. It is most likely that these are the result of a combination of natural erosion and trampling by red deer.

Dry heath is predominantly found on the slopes below the plateau. Of the plots studied, all the trampling indicators were in the Low to Moderate range. Grazing impacts were similar (96% in the Moderate to Low range) with one sample assessed

as Moderate to High. The number of Low trend indicators (82%) also suggests a chronic Low impact from grazing and trampling that is largely stable, though increasing impacts were noted around the upper part of the slope (28% of assessments). The increasing trend was largely due to browsing on heather both current and longer-term, although trampling impacts (deer tracks) were also noted running around the hillside.

Alpine heath has not been adversely affected by grazing or trampling with 100% of all plots showing a Low or Moderate to Low impacts. Any impacts recorded were due to the trampling indicators such as bare ground and dung, with some locally high populations of mountain hare noted. Trend indicators suggest the impacts have been Low for a time 'chronic Low' except for three plots around the plateau area (10%) which were chronic High but decreasing impact. Current trends were all stable or decreasing.

Trampling impacts on flushes were typical of the whole site with most falling into the Moderate, Moderate to High or High classes (79%) and only six plots out of 28 assessed as Moderate to Low. Grazing impacts were almost all Moderate to Low or Low (82%) and only a few (3) showing a Moderate to High impact on the plateau. Trend indicators suggested that impacts on flushes have been Moderate or High over a long time 'chronic Moderate or chronic High', though most appear stable under current conditions.

The dominant herbivore in this area was red deer, with sheep at very low density. Mountain hare were present on the plateau, largely within areas of alpine heath, and were locally numerous.

Impacts were generally Low across the slopes although there were local trampling impacts from deer with frequent tracks running around the side of the hill. Trampling was also largely in the range from Moderate to High on the flushes running down the hill-side with disrupted moss mats and hoof-prints frequent. Impacts from grazing and trampling on all habitats were higher on the plateau than elsewhere on the estate and, especially on blanket bog and flushes. These impacts were mainly due to trampling by red deer, including the areas of bare peat that were noted in the broader scale muirburn assessments.

4. CONCLUSIONS

The assessment of grazing and trampling impacts throughout the Drumochter Hills SSSI and SAC found varying patterns of impacts on the different habitats studied. In particular, it has shown that the impacts observed were not evenly distributed across the site or between habitats, but were quite specific to particular locations or vegetation types.

The most widespread and severe impacts were the trampling impacts on flushes. These were found throughout the site and 50% of all assessments showed a High or Moderate to High impact. These impacts were largely attributed to deer trampling; although the other large herbivores (sheep) would cause a similar impact, the evidence of hoof-prints, dung and direct observation suggest deer are largely responsible. Hooves tend to make a High impact when they cross flushes and springheads due to the soft ground. However, they are easier to walk along than the long heather on the steep slopes and flushes often have a range of palatable grasses and herbs growing alongside. Consequently grazing impacts tended to be locally higher than on adjacent habitats.

The other main impacts were trampling impacts on blanket bog where it occurred on the plateau areas of the site. These impacts were not so marked around the skirts and lower areas of the hill range (Map 3b). The most severe impacts observed were at the northern end of the site between Choire Cama and Carn na Cairn within Areas 1&3 and to the south between An Sgulan and Mam Ban, within Areas 6&7.

In these areas natural erosion and concentrated summer populations of red deer, combined with evidence of chronic impacts from past grazing, appear to have combined to create areas of bare peat with the concurrent loss of the bog surface structure. In both these areas, grazing impacts were generally Low, but it is evident that the large herds of deer within Drumochter Hills SAC spend much of their time in these habitats. Deer tracks were frequent as areas of bare peat are frequently used for warmth and shelter, the black peat absorbing the sun's rays more readily than the surrounding vegetation.

The trend indicators generally suggest that impacts are not increasing but, for the reasons given below, this result may not adequately reflect vegetation changes that have already taken place or current trampling impacts.

- The indicators used largely reflect grazing impact trends rather than trampling impact trends, which account for most of the Moderate and High impact assessments.
- The plateaux have been subject to chronic impacts in the past that have resulted in a loss of peat-land habitat and the expansion of *Nardus stricta* dominated grassland, almost certainly as a result of past heavy grazing pressure. Grassland communities appear to occur in locations and on soils that indicate they are likely to have formerly supported blanket bog communities. These areas, which are likely to have been subject to the greatest changes were not assessed as blanket bog.
- The most reliable indicator for trends is the growth-form of heather but where chronic grazing impacts have occurred this species is often not present and therefore not assessed.
- Large areas of bare peat outwith the sample plots are assessed as an indicator of burning impacts (Dayton 2007a as per MacDonald *et al.* 1998) but were not assessed here for trampling impacts other than where they coincided with sample plots.

The other main impacts observed on the site were largely local and due to particular conditions. For example, there were specific areas of High grazing impacts on dry and alpine heath on several of the estates that were located at popular vantage points or sites of shelter that would be expected to be heavily impacted even under reduced herbivore densities.

Further impacts were due to use by particular animals. The herd of cattle in Ralia Estate, alongside the A9 has created some very local impacts with trampling around the lower margin of the SAC. These are mostly Low or occasionally Moderate, although there is some indication of an increasing impact at the south of Ralia Estate which should be monitored.

Mountain hare were frequent across the plateau and were predominantly found within the areas of alpine heath. Some local Moderate and High grazing impacts in these areas have been attributed to mountain hare and dung is ubiquitous. At current

levels it is unlikely that this impact would lead to degradation of the heath but these impacts should be monitored.

In summary, most areas of the Drumochter Hills are subject to generally Low to Moderate grazing impacts, but some particular areas and habitats are experiencing heavier trampling than grazing impacts. These trampling impacts appear to be largely due to red deer and are concentrated on the blanket bog on the plateaux and at particular vantage points across all ownerships throughout the site. Flushes appear to be used as preferred through-routes by deer and sheep and, consequently, are experiencing higher levels of trampling and grazing impacts compared to the surrounding habitats.

The level of grazing impacts *generally* encountered in the heaths and blanket bog communities are unlikely to lead to deterioration (notwithstanding currently unfavourable Site Condition Monitoring assessments for these features as a whole (Dayton 2007b); (towards which there are a number of contributing factors; including muirburn and historic impacts). The localised areas experiencing High or increasing grazing impacts, however, could be expected to undergo changes with communities becoming increasingly dominated by grazing resistant grass species. The High (and to a lesser extent Moderate) trampling impacts experienced in the blanket bog and flush communities in particular, across the site are if continued, expected to lead to the loss of structural variety, fragmentation and erosion of the substrate, the possible loss of extent and loss of vascular plant species diversity.

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APPENDIX 1 - SUMMARY TABLES

Blanket Bog, Grazing & Trampling Impacts (combined)

	L	M	H	Total No.	%L	%M	%H	Total %
A1	4	18	6	28	14	64	21	100
A3	5	22	6	33	15	67	18	100
A4	17	7	1	25	68	28	4	100
A5	15	12	1	28	54	43	4	100
A6	10	14	4	28	36	50	14	100
A7	14	14	0	28	50	50	0	100
Total	65	87	18	170	38	51	11	100

Blanket Bog, Trampling Impacts

	L	M	H	Total No.	%L	%M	%H	Total %
A1	5	16	7	28	18	57	25	100
A3	5	19	9	33	15	58	27	100
A4	14	10	1	25	56	40	4	100
A5	14	11	3	28	50	39	11	100
A6	12	10	6	28	43	36	21	100
A7	10	12	6	28	36	43	21	100
Total	60	78	32	170	35	46	19	100

Blanket Bog, Grazing Impacts

	L	M	H	Total No	%L	%M	%H	Total %
A1	4	24	0	28	14	86	0	100
A3	11	22	0	33	33	67	0	100
A4	19	6	0	25	76	24	0	100
A5	23	5	0	28	82	18	0	100
A6	15	11	2	28	54	39	7	100
A7	26	1	1	28	93	4	4	100
Total	98	69	3	170	58	41	2	100

Blanket Bog, Grazing/Trampling Impact trends

	CL S	CL I	CH S	CH I	Total No	%CL S	%CL I	%CH S	%CH I	Total %
A1	28	0	0	0	28	100	0	0	0	100
A3	30	3	0	0	33	91	9	0	0	100
A4	18	7	0	0	25	72	28	0	0	100
A5	20	4	3	1	28	71	14	11	4	100
A6	10	13	4	1	28	36	46	14	4	100
A7	21	7	0	0	28	75	25	0	0	100
Total	127	34	7	2	170	75	20	4	1	100

Dry Heath, Grazing/Trampling Impacts (combined)

	L	M-L	M	H-M	H	Total	%L	%M-L	%M	%H-M	%H	Total
A1	21	0	7	0	0	28	75	0	25	0	0	100
A3	4	1	19	4	2	30	13	3	63	13	7	100
A4	16	0	5	4	2	27	59	0	19	15	7	100
A5	18	2	6	3	0	29	62	7	21	10	0	100
A6	0	0	2	3	0	5	0	0	40	60	0	100
A7	14	0	7	1	0	22	64	0	32	5	0	100
Total	73	3	46	15	4	141	52	2	33	11	3	100

Dry Heath, Trampling Impacts

	L	M-L	M	H-M	H	Total	%L	%M-L	%M	%H-M	%H	Total
A1	5	20	3	0	0	28	18	71	11	0	0	100
A3	9	10	8	3	0	30	30	33	27	10	0	100
A4	16	10	1	0	0	27	59	37	4	0	0	100
A5	8	14	6	1	0	29	28	48	21	3	0	100
A6	0	5	0	0	0	5	0	100	0	0	0	100
A7	9	10	3	0	0	22	41	45	14	0	0	100
Total	47	69	21	4	0	141	33	49	15	3	0	100

Dry Heath, Grazing Impacts

	L	M-L	M	H-M	H	Total	%L	%M-L	%M	%H-M	%H	Total
A1	21	0	7	0	0	28	75	0	25	0	0	100
A3	5	0	18	1	6	30	17	0	60	3	20	100
A4	16	0	4	1	6	27	59	0	15	4	22	100
A5	20	0	6	3	0	29	69	0	21	10	0	100
A6	0	0	2	3	0	5	0	0	40	60	0	100
A7	14	0	7	1	0	22	64	0	32	5	0	100
Total	76	0	44	9	12	141	54	0	31	6	9	100

Dry Heath, Grazing/Trampling Impact trends

	CL S	CL I	CM D	CM S	CM I	CH S	CH I	No trend	Total No	%CL S	%CL I	%CM D	%CM S	%CM I	%CH S	%CH I	Total %
A1	22	0	1	1	0	0	0	4	28	79	0	4	0	0	0	0	100
A3	10	1	0	18	0	0	0	1	30	33	3	0	60	0	0	0	100
A4	15	4	0	2	2	2	2	0	27	56	15	0	7	7	7	7	100
A5	22	0	0	3	0	1	0	3	29	76	0	0	10	0	3	0	100
A6	0	0	0	5	0	0	0	0	5	0	0	0	100	0	0	0	100
A7	14	4	0	2	1	0	1	0	22	64	18	0	9	5	0	5	100
Total	83	9	1	31	3	3	3	8	141	59	6	1	22	2	2	2	100

Alpine Heath, Grazing/Trampling Impacts

	L	ML	M	HM	Total	%L	%ML	%M	%HM	Total
A1	11	18	0	0	29	38	62	0	0	100
A3	7	11	3	2	23	30	48	13	9	100
A4	14	7	10	0	31	45	23	32	0	100
A5	10	10	4	3	27	37	37	15	11	100
A6	14	8	6	0	28	50	29	21	0	100
A7	22	7	0	0	29	76	24	0	0	100
Total	78	61	23	5	167	47	37	14	3	100

Alpine Heath, Grazing/Trampling Impact trends

	CL S	CL I	CH D	CH S	CH I	Total No	%CL S	%CL I	%CH D	%CH S	%CH I	Total %
A1	7	0	0	22	0	29	24	0	0	76	0	100
A3	18	2	0	3	0	23	78	9	0	13	0	100
A4	28	2	1	0	0	31	90	6	3	0	0	100
A5	24	3	0	0	0	27	89	11	0	0	0	100
A6	18	1	5	2	2	28	64	4	18	7	7	100
A7	26	0	3	0	0	29	90	0	10	0	0	100
Total	121	8	9	27	2	167	72	5	5	16	1	100

Flush, Grazing & Trampling Impacts (combined)

	L	LM	M	HM	H	Total	%L	%LM	%M	%MH	%H	Total
A1	0	15	9	1	0	25	0	60	36	4	0	100
A3	0	4	10	7	2	23	0	17	43	30	9	100
A4	2	4	8	3	1	18	11	22	44	17	6	100
A5	0	9	16	4	0	29	0	31	55	14	0	100
A6	0	1	16	5	1	23	0	4	70	22	4	100
A7	0	10	16	2	0	28	0	36	57	7	0	100
Total	2	43	75	22	4	146	1	29	51	15	3	100

Flush, Trampling Impacts

	L	LM	M	HM	H	Total	%L	%LM	%M	%MH	%H	Total
A1	0	10	10	4	1	25	0	40	40	16	4	100
A3	0	6	7	6	4	23	0	26	30	26	17	100
A4	1	4	5	6	2	18	6	22	28	33	11	100
A5	0	1	11	10	7	29	0	3	38	34	24	100
A6	0	0	7	7	9	23	0	0	30	30	39	100
A7	0	6	5	12	5	28	0	21	18	43	18	100
Total	1	27	45	45	28	146	1	18	31	31	19	100

Flush, Grazing impacts

	L	LM	M	HM	H	Total	%L	%LM	%M	%HM	%H	Total
A1	8	15	2	0	0	25	32	60	8	0	0	100
A3	0	9	5	6	3	23	0	39	22	26	13	100
A4	5	6	2	4	1	18	28	33	11	22	6	100
A5	5	19	4	1	0	29	17	66	14	3	0	100
A6	3	9	6	4	1	23	13	39	26	17	4	100
A7	5	18	2	3	0	28	18	64	7	11	0	100
Total	26	76	21	18	5	146	18	52	14	12	3	100

Flush Trends

	S/D	CL I	CM S	CH D	CH/I	Total No	% S/D	%CL I	%CM S	%CH D	%CH/I	Total %
A1	25	0	0	0	0	25	100	0	0	0	0	100
A3	7	0	1	0	15	23	30	0	4	0	65	100
A4	9	0	0	0	9	18	50	0	0	0	50	100
A5	5	3	3	1	17	29	17	10	10	3	59	100
A6	1	3	2	1	16	23	4	13	9	4	70	100
A7	10	1	5	0	12	28	36	4	18	0	43	100
Total	57	7	11	2	69	146	39	5	8	1	47	100

APPENDIX 2. Index of common species names

List of species mentioned in this report with their common names

Scientific name	Common Name
<i>Agrostis capillaris</i>	Brown bent
<i>Agrostis canina</i>	Velvet Bent
<i>Aneura pinguis</i>	Liverwort
<i>Anthoxanthum odoratum</i>	Sweet vernal-grass
<i>Betula nana</i>	Dwarf birch
<i>Calluna vulgaris</i>	Ling
<i>Campylopus atrovirens</i>	Moss
<i>Cardamine pratensis</i>	Cuckooflower
<i>Carex bigelowii</i>	Stiff sedge
<i>Carex echinata</i>	Star sedge
<i>Carex nigra</i>	Common sedge
<i>Carex panicea</i>	Carnation sedge
<i>Carex rostrata</i>	Bottle sedge
<i>Carex viridula ssp. oedocarpa</i>	Common yellow sedge
<i>Cladonia arbuscula</i>	Lichen
<i>Cladonia portentosa</i>	Lichen
<i>Cratoneuron commutatum</i>	Moss
<i>Deschampsia flexuosa</i>	Wavy hair-grass
<i>Dicranum scoparium</i>	Moss
<i>Drosera rotundifolia</i>	Round-leaved sundew
<i>Dryopteris dilatata</i>	Broad-buckler fern
<i>Empetrum nigrum sbsp. nigrum</i>	Crowberry
<i>Erica tetralix</i>	Cross-leaved heath
<i>Eriophorum angustifolium</i>	Broad-leaved cotton-grass
<i>Eriophorum vaginatum</i>	Hare's-foot cotton-grass
<i>Festuca ovina</i>	Sheep's fescue
<i>Festuca rubra</i>	Red fescue
<i>Galium saxatile</i>	Heath bedstraw
<i>Hypnum cupressiforme/jutlandicum</i>	Moss
<i>Juncus effusus</i>	Soft rush
<i>Juncus squarrosus</i>	Heath rush
<i>Luzula multiflora</i>	Many-flowered wood-rush
<i>Luzula sylvatica</i>	Greater woodrush
<i>Molinia caerulea</i>	Purple moor-grass
<i>Myrica gale</i>	Bog myrtle
<i>Nardus stricta</i>	Mat grass
<i>Narthecium ossifragum</i>	Bog asphodel
<i>Philonotis fontana</i>	Moss
<i>Pinguicula vulgaris</i>	Common butterwort
<i>Pleurozium schreberi</i>	Moss
<i>Polygala serpyllifolia</i>	Common milkwort
<i>Polytrichum commune</i>	Moss
<i>Potentilla erecta</i>	Tormentil
<i>Prunella vulgaris</i>	Selfheal
<i>Pteridium aquilinum</i>	Bracken
<i>Racomitrium lanuginosum</i>	Bryophyte
<i>Ranunculus repens</i>	Creeping buttercup
<i>Rhytidiadelphus squarrosus</i>	Moss

<i>Rhytidiadelphus loreus</i>	Moss
<i>Rubus chamaemorus</i>	Cloudberry
<i>Sphagnum auriculatum</i>	Bog moss
<i>Sphagnum capillifolium</i>	Bog moss
<i>Sphagnum cuspidatum</i>	Bog moss
<i>Sphagnum palustre</i>	Bog moss
<i>Sphagnum papillosum</i>	Bog moss
<i>Sphagnum recurvum</i>	Bog moss
<i>Succisa pratensis</i>	Devil's-bit scabious
<i>Thuidium tamariscinum</i>	Moss
<i>Trichophorum cespitosum</i>	Deer grass
<i>Vaccinium myrtillus</i>	Blaeberry
<i>Vaccinium uliginosum</i>	Northern Blaeberry
<i>Vaccinium vitis-idaea</i>	Cowberry

APPENDIX 3. Weightings applied to Blanket bog and Dry heath assessments

Advice from : Angus MacDonald
Uplands & Peatlands Group, SNH, 15/7/05

DWARF SHRUB HEATH

In deriving an overall impact assessment at a location the following procedure should be followed.

First, each indicator should be assessed as H, M or L. These should then be converted to numerical scores H=3, M=2, and L=1. To form an overall average, multiply each of these scores by the relevant weight for all the indicators that are applicable and then total all these weighted scores. Next, divide this sum by the total of the weights used. This will provide a weighted average score which can be compared to 3=H, 2=M and 1=L.

<i>Indicator</i>	<i>Weighting in overall assessment of impact</i>
Signs of browsing on <i>Arctostaphylos uva-ursi</i> , <i>Empetrum nigrum</i> , <i>Erica tetralix</i> or <i>Vaccinium vitis-idaea</i> (or associated <i>Nardus stricta</i>).	2
The average proportion of long-shoots of <i>Calluna vulgaris</i> and/or <i>Vaccinium myrtillus</i> showing signs of having been browsed.	50
Amount of flower or fruit on <i>Calluna vulgaris</i> and/or <i>Vaccinium myrtillus</i> .	1
Summer browsing of <i>Calluna vulgaris</i> .	1
Type of shoot material removed from <i>Calluna vulgaris</i> and/or <i>Vaccinium myrtillus</i> .	3
Growth-form and evidence of browsed shoots on <i>Myrica</i> gale bushes.	1
Uprooting of dwarf-shrub seedlings in recently burnt patches.	2
Stem breakage as a result of trampling by larger herbivores (check for hoof prints).	3
Depth of carpet of mosses and liverworts, or "bushy" <i>Cladonia</i> lichens, under and between the dwarf-shrubs.	1
Amount of trampled, bare ground.	2
Amount of herbivore dung present.	1
Presence of spiders' webs in vegetation during July and August.	1
Sum of weights for all indicators	68

This weighting will ensure that the % of shoot browsed is the determining factor in the overall assessment of impact. I think this is desirable because all the other indicators are often of patchy occurrence and may not occur even when there is heavy impact. When these other indicators are present they may provide a useful role in corroborating the assessment based on % of shoots browsed, but their absence may not be reliably informative of lack of impact.

To take account of the reappraisal of the consequences of different offtake rates on *Calluna* I would reinterpret the proportion of long-shoots browsed so that there are 4 classes but no distinction according to growth rate. This would then give:

Criteria	Class	Score
66% or more shoots browsed	VH (Very Heavy)	4
33% - <66% shoots browsed	H	3
16% - <33% shoots browsed	M	2
< 16% shoots browsed	L	1

This would be incorporated into the scoring and weighting described above.

BLANKET BOG

In deriving an overall impact assessment at a location the following procedure should be followed.

First, each indicator should be assessed as H, M or L. These should then be converted to numerical scores H=3, M=2, and L=1. For those indicators where the levels are amalgamated as ML or HM, the numerical scores should be 1.5 and 2.5 respectively. To form an overall average, multiply each of these scores by the relevant weight for all the indicators that are applicable and then total all these weighted scores. Next, divide this sum by the total of the weights used. This will provide a weighted average score which can be compared to 3=H, 2=M and 1=L.

<i>Indicator</i>	<i>Weighting in overall assessment of impact</i>
• Trampling and grazing of pool systems and water tracks.	150
• Trampling of <i>Sphagnum</i> moss hummock and lawns.	150
• Extent of ground cover by bryophytes and/or lichens among and between dwarf-shrub, sedge and grass plants.	25
• Abundance of hoof prints in bare peat over the assessment unit.	75
• Firmness of ground underfoot.	1
• Browsing of <i>Betula nana</i> .	2
• Signs of browsing on <i>Arctostaphylos uva-ursi</i> , <i>Empetrum nigrum</i> , <i>Erica tetralix</i> and <i>Vaccinium vitis-idaea</i> .	3
• Amount of flower and fruit on <i>Rubus chamaemorus</i> .	1
• Amount of flowering of <i>Eriophorum</i> spp.	3
• Growth-form and evidence of browsed shoots on <i>Myrica gale</i> bushes.	2
• Conspicuousness of browsing on <i>Calluna vulgaris</i> or <i>Vaccinium myrtillus</i> .	75
• Amount of herbivore dung present.	1
Sum of weights for all indicators	488

This weighting will ensure that current trampling is the determining factor in the overall assessment of impact. I think this is desirable because all the other indicators are often of patchy and somewhat unpredictable occurrence in time or space or are also affected by factors other than herbivore impacts.

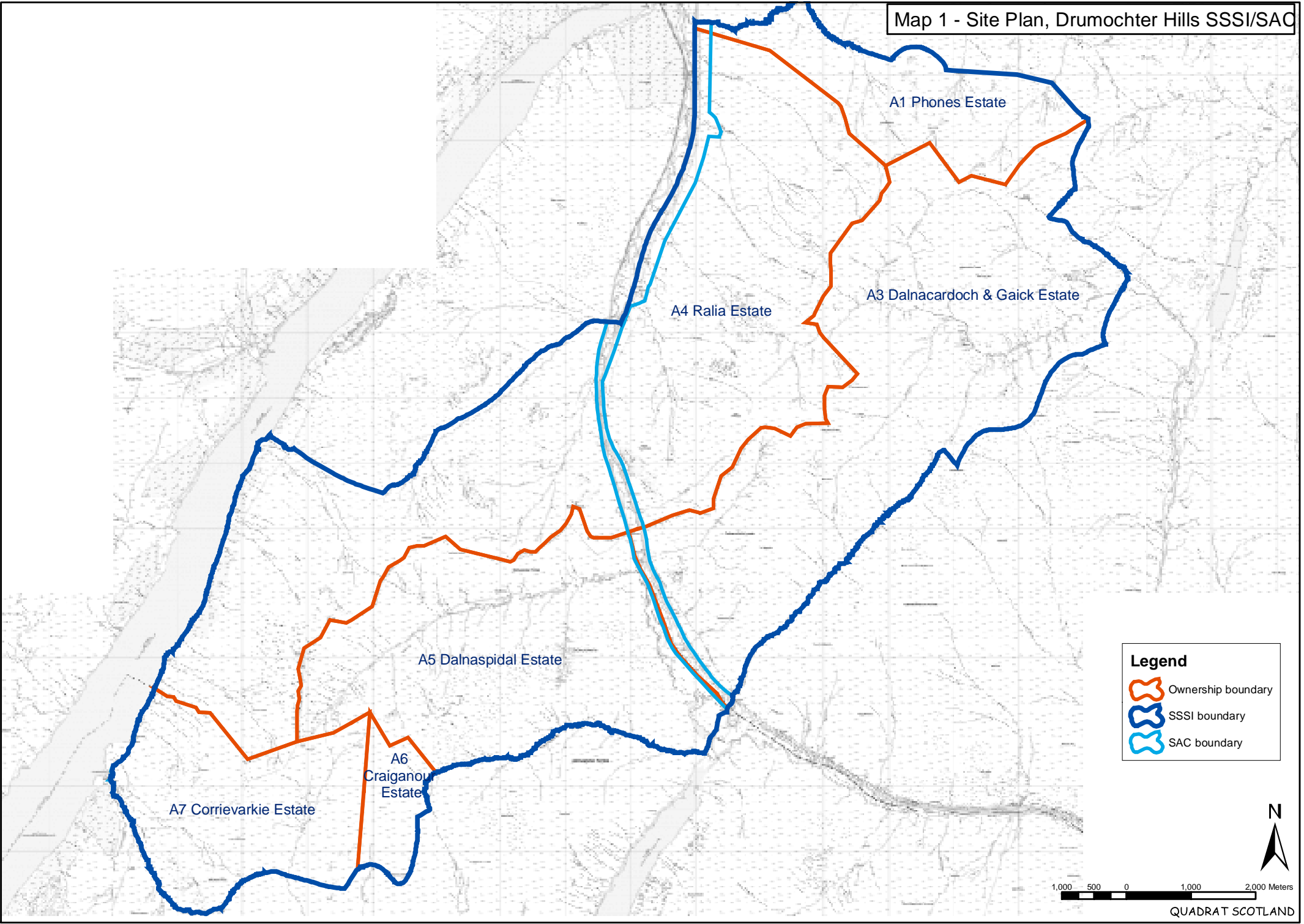
I think browsing and grazing should not be completely overwhelmed by the weight given to trampling, although it seems unlikely that if there is heavy browsing and grazing there will not also be evidence of at least moderate trampling. For this reason, I have given a moderately high weight to the indicator for browsing of *Calluna* and *Vaccinium myrtillus*. I have given more weight to this indicator not because it is necessarily the most important aspect of browsing and grazing on bogs, but because it is likely to be more widely relevant and less ambiguous than the other browsing and grazing indicators. For example, the flowering of *Eriophorum* spp. is an important aspect of the bog habitat but this is also affected by factors such as reduced *Eriophorum* cover after drainage, increased flowering after burning, or year to year variation in the weather.

Some indicators, such as browsing on *Myrica* or *Betula nana*, may show high impacts, especially when these species are of low abundance on an area of bog, even when all other indicators suggest low herbivore impacts. In this circumstance, it seems unreasonable to attribute high impact to the whole bog. The indicators for browsing on these species have, therefore, been given a low weight. Also, the browsing of *Betula nana* is only likely to be sporadically relevant. *Myrica* and *Betula nana* are most indicative the plants are conspicuous (and not hidden among the heather) and are also *not* browsed. This is a good indicator that

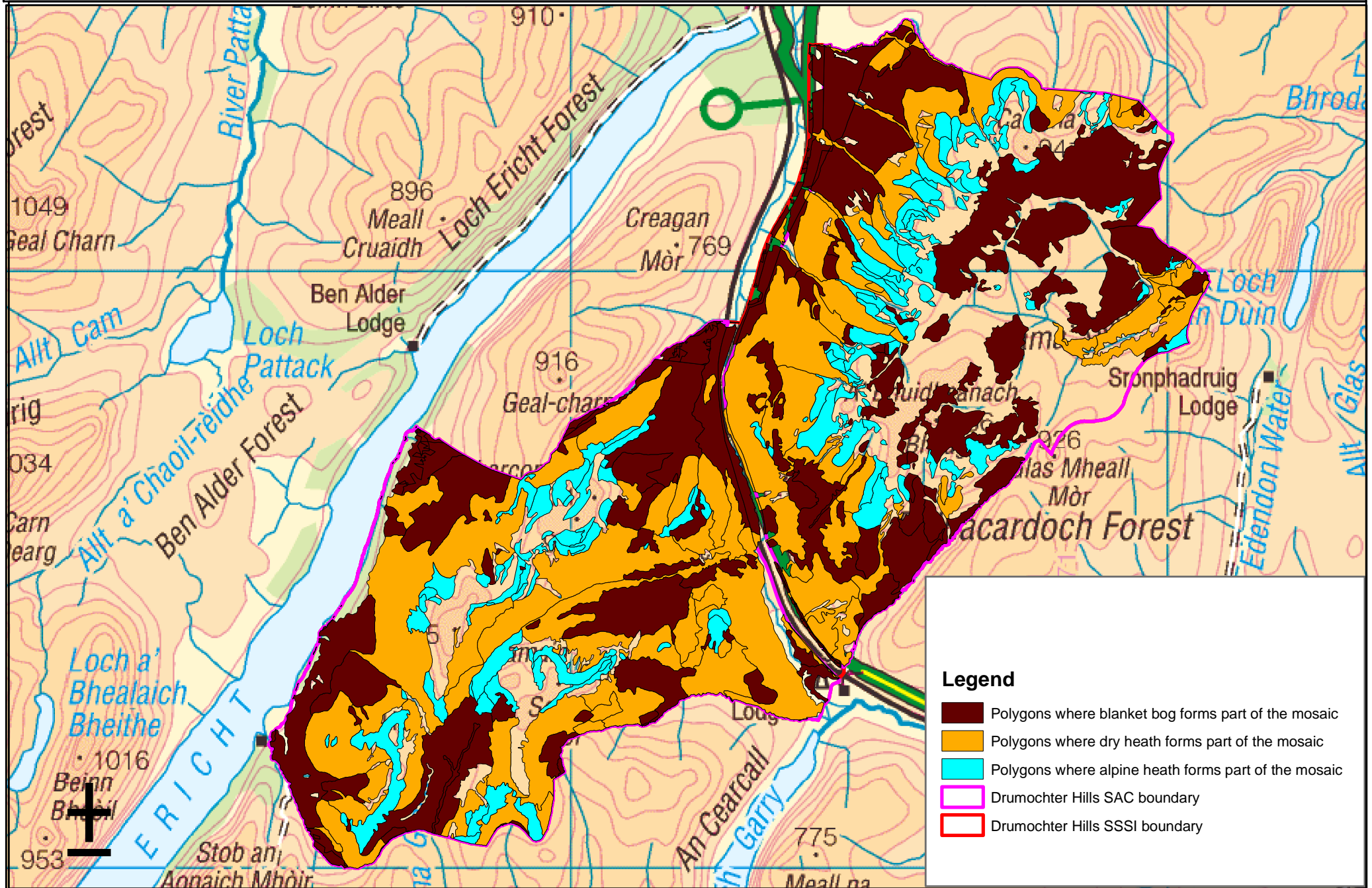
few or no herbivores are using the immediate area. However, *Betula nana* and *Myrica* (to a lesser extent) are very frequently browsed *wherever* they occur outside exclosures.

I have also tended to downweight indicators according to two additional criteria. First, I have downweighted those indicators that seem less precisely specified, and that might therefore give more observer variation. Second, I have given less weight to those indicators that may also indicate historical carry-over effects, making them less good as indicators of current impact. Firmness of ground underfoot might be used as an example of both these considerations.

Map 1 - Site Plan, Drumochter Hills SSSI/SAC



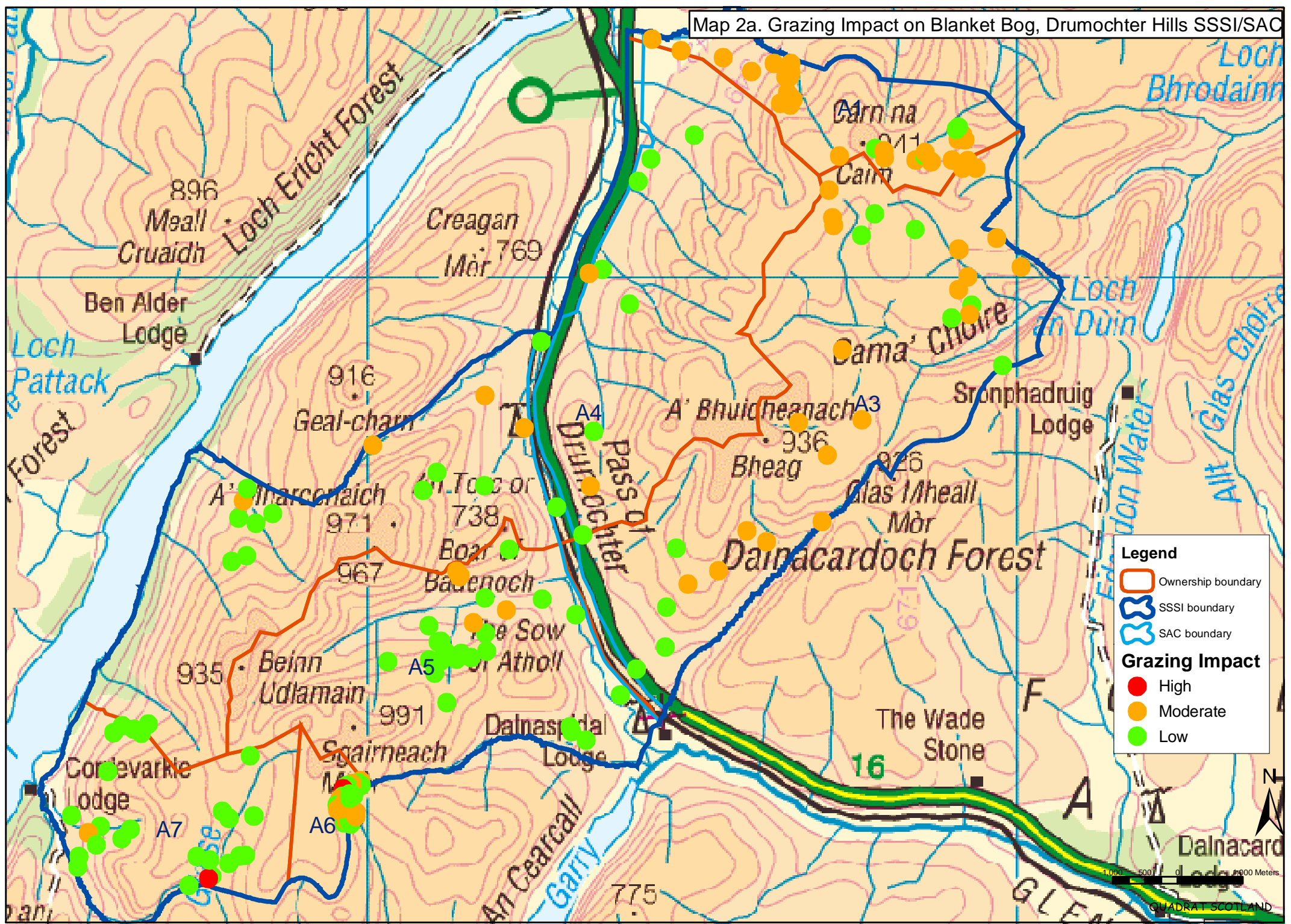
Map 1b - Distribution of Natura habitats in Drumochter Hills SAC survey area (N.B. map indicates potential coverage where habitats occur as part of a mosaic, hence there is some overlap between the three habitats - blanket bog is shown as uppermost).



Legend

- Polygons where blanket bog forms part of the mosaic
- Polygons where dry heath forms part of the mosaic
- Polygons where alpine heath forms part of the mosaic
- Drumochter Hills SAC boundary
- Drumochter Hills SSSI boundary

Map 2a. Grazing Impact on Blanket Bog, Drumochter Hills SSSI/SAC



Legend

- Ownership boundary
- SSSI boundary
- SAC boundary

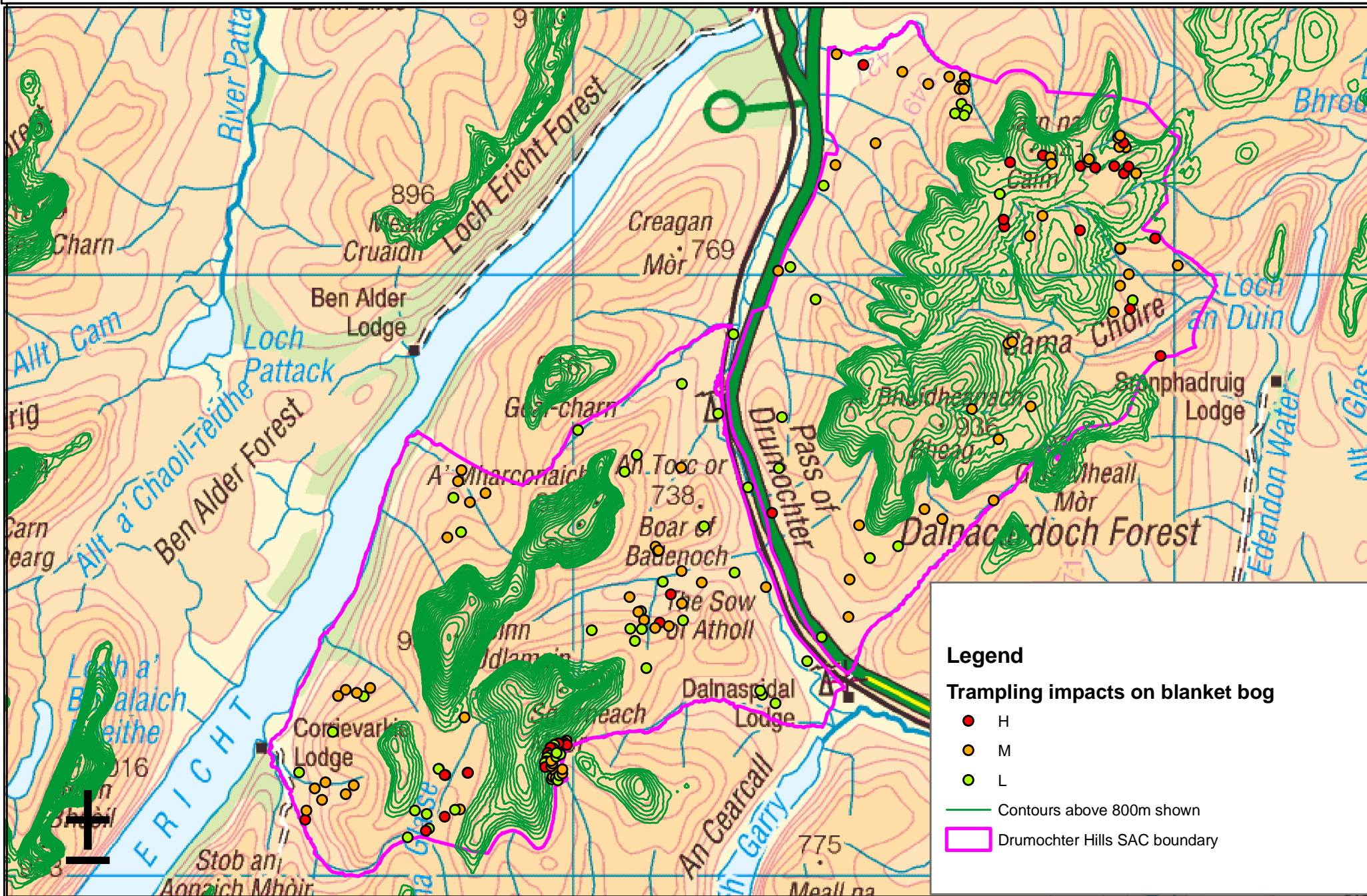
Grazing Impact

- High
- Moderate
- Low

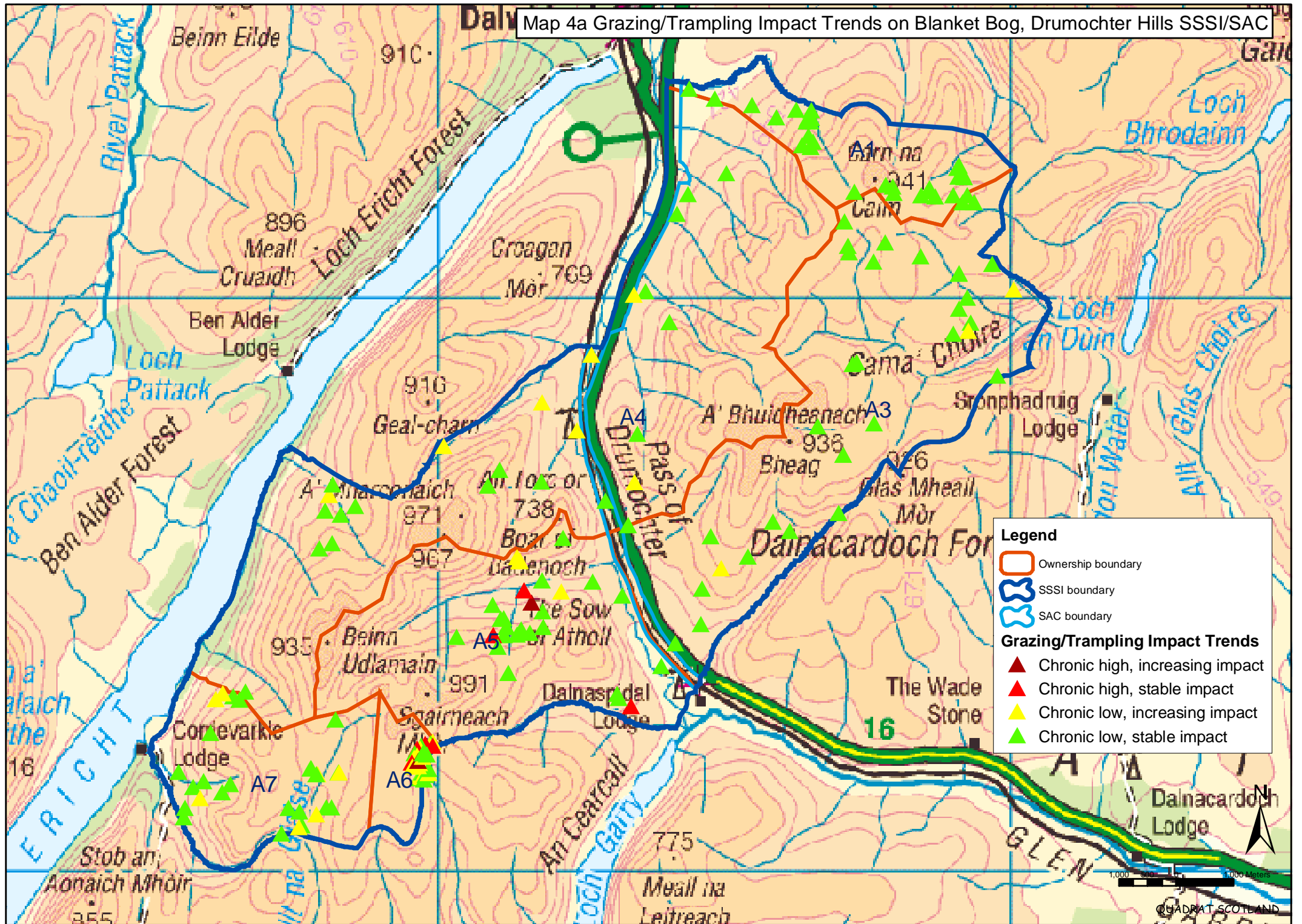
Scale: 0, 500, 1000 Meters

QUADRAT SCOTLAND

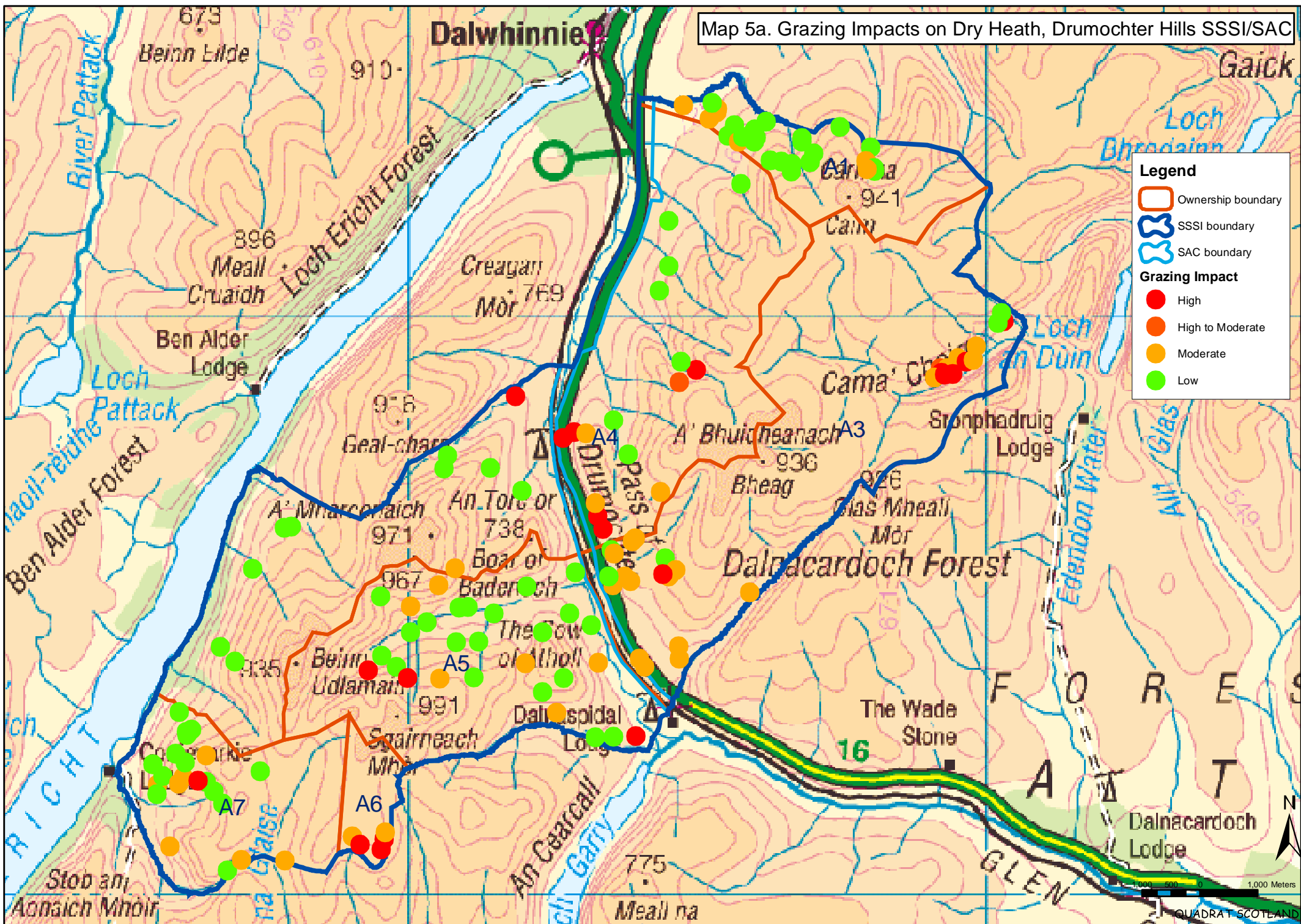
Map 3b. Trampling impacts on Blanket bog with reference to the 800m contour



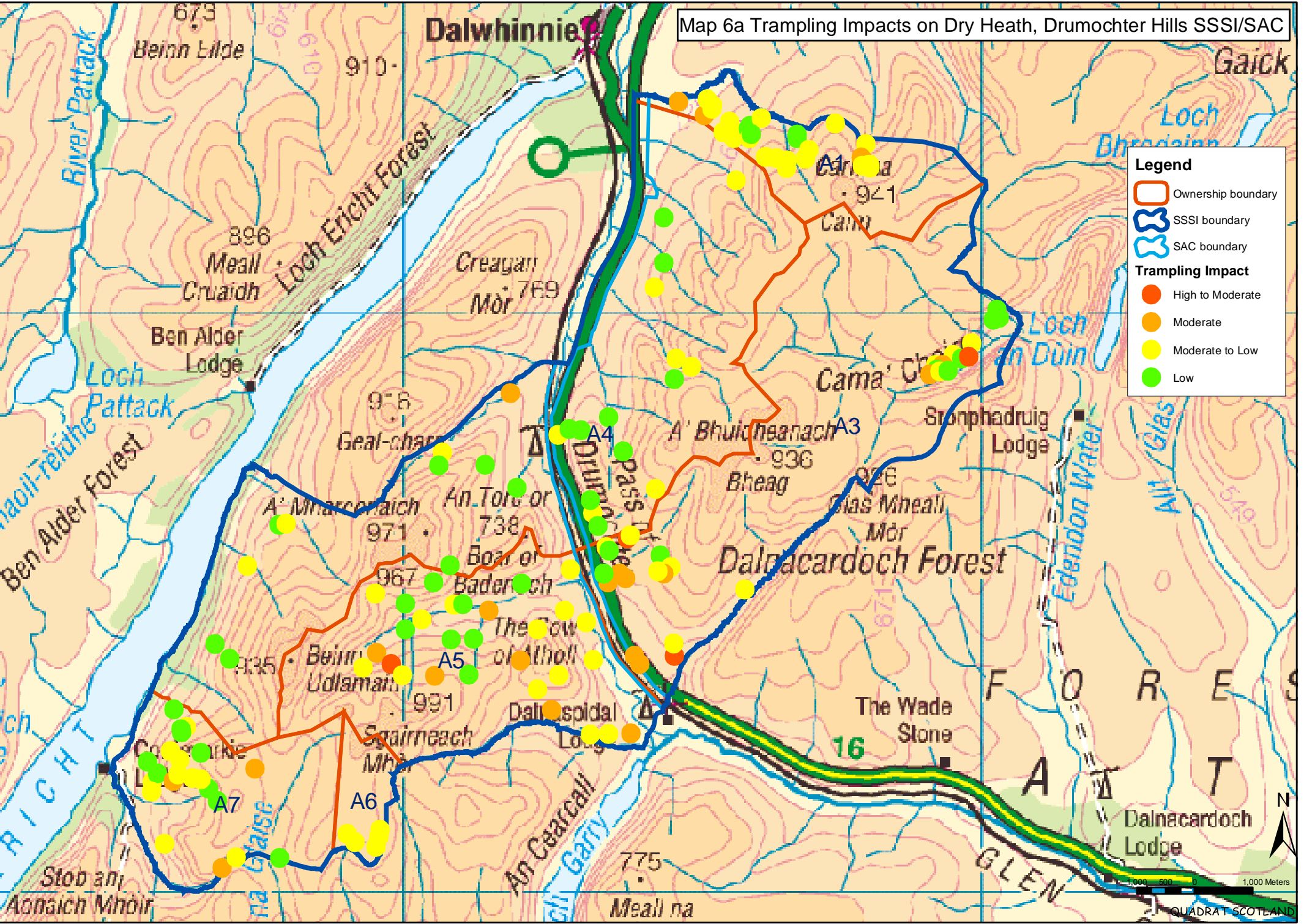
Map 4a Grazing/Trampling Impact Trends on Blanket Bog, Drumochter Hills SSSI/SAC



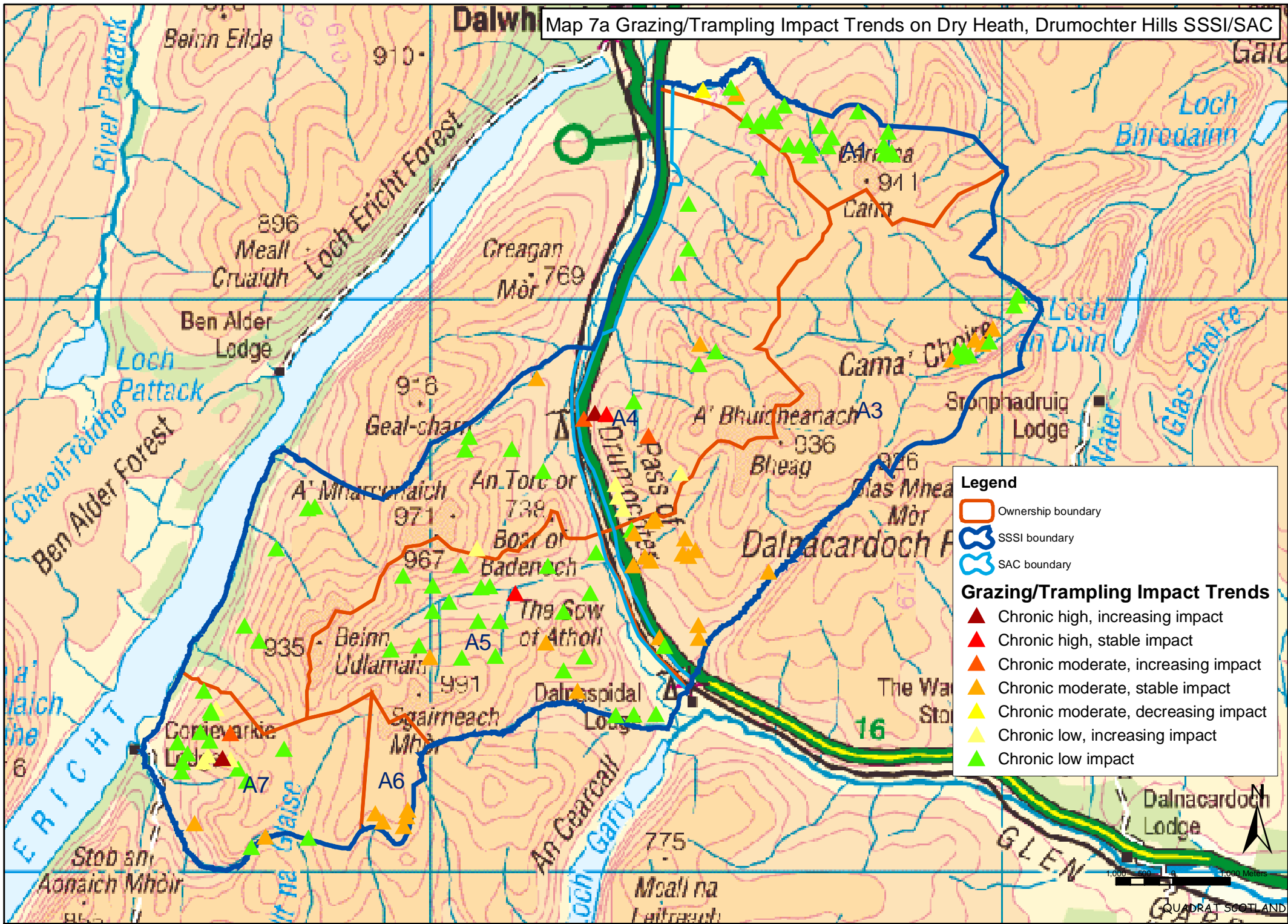
Map 5a. Grazing Impacts on Dry Heath, Drumochter Hills SSSI/SAC



Map 6a Trampling Impacts on Dry Heath, Drumochter Hills SSSI/SAC



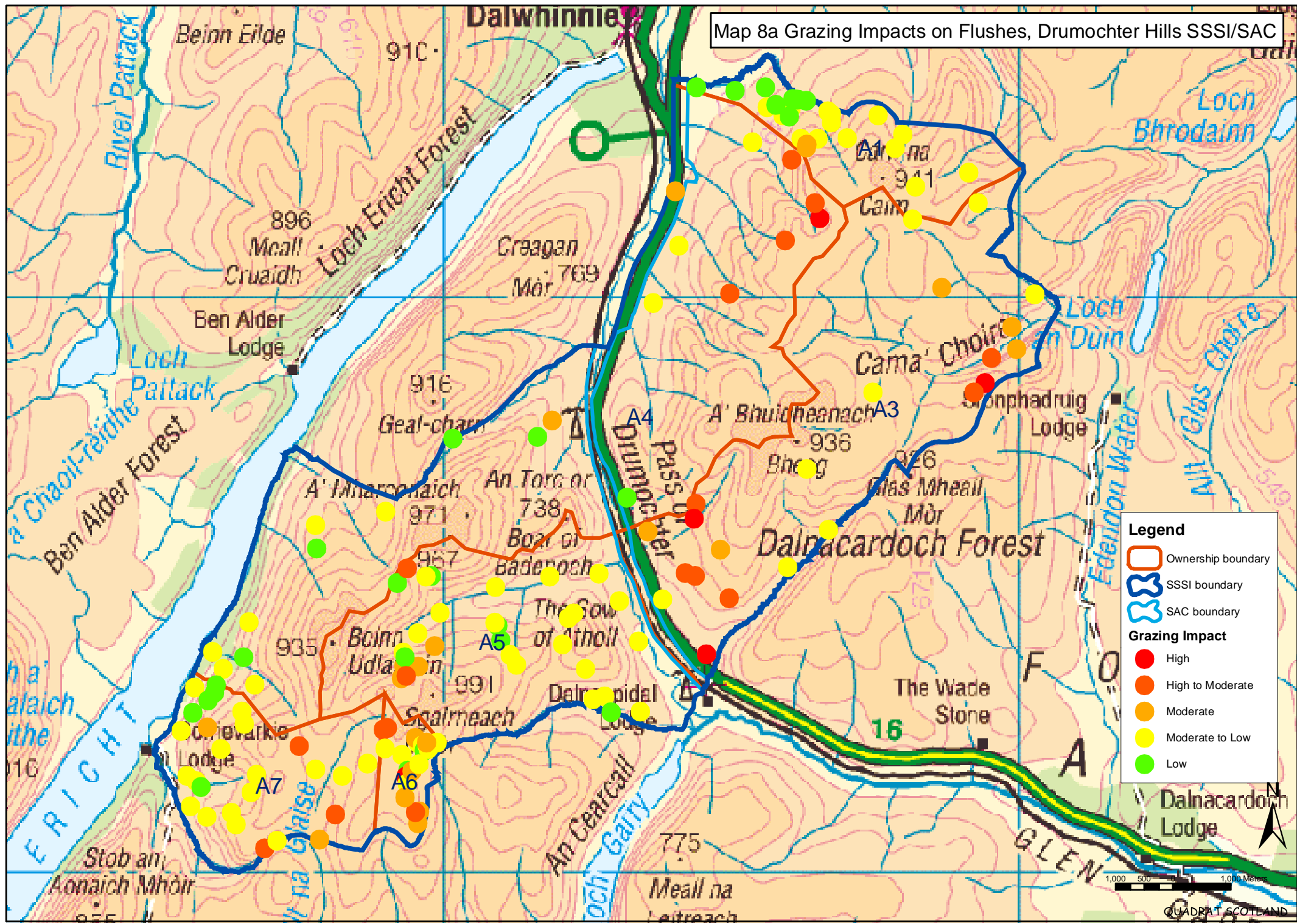
Map 7a Grazing/Trampling Impact Trends on Dry Heath, Drumochter Hills SSSI/SAC



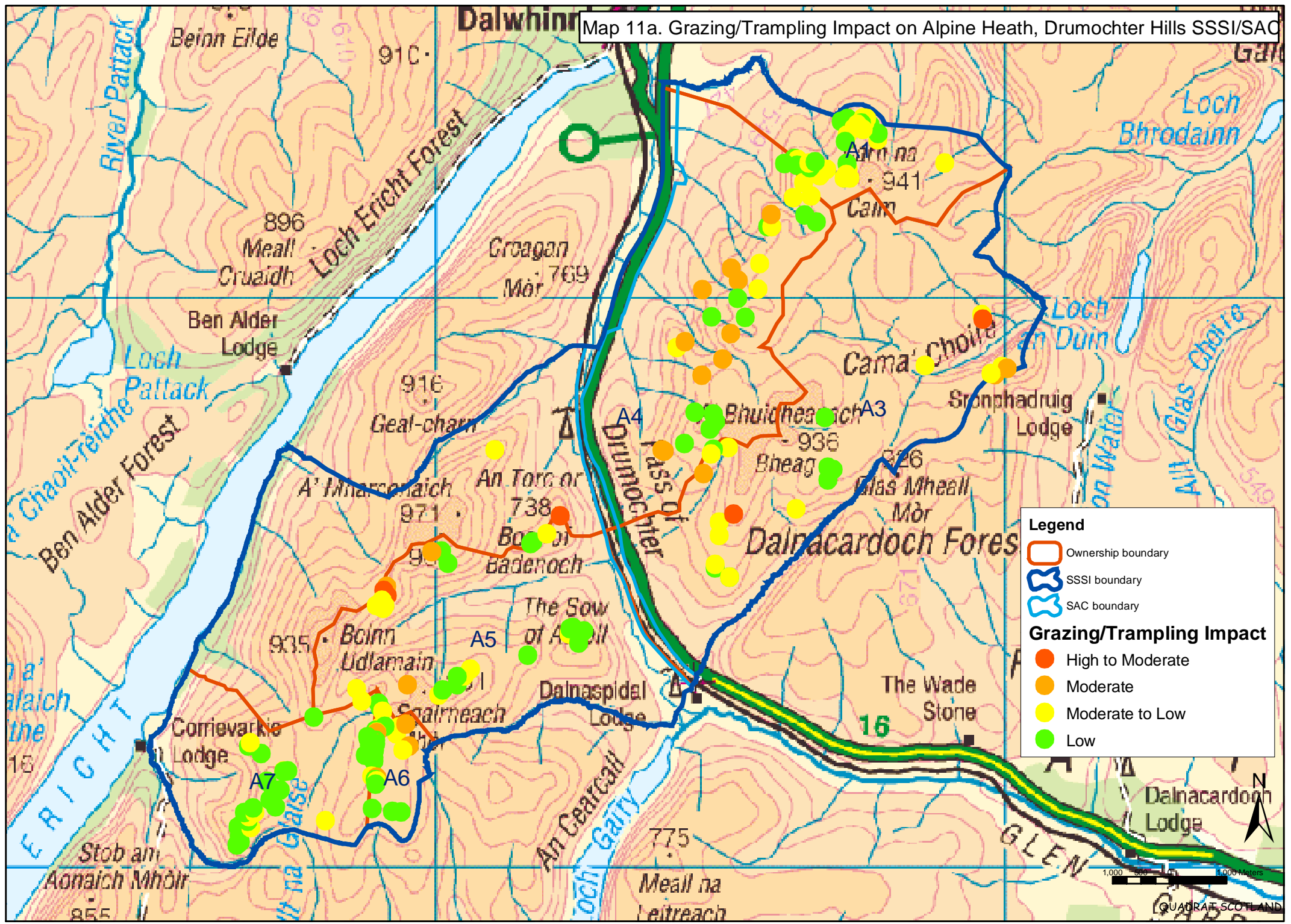
1,000 500 0 500 1,000 Meters

QUADRAT SCOTLAND

Map 8a Grazing Impacts on Flushes, Drumochter Hills SSSI/SAC



Map 11a. Grazing/Trampling Impact on Alpine Heath, Drumochter Hills SSSI/SAC



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