Caldbeck

1. Introduction

Natural England (NE) and its predecessors has carried out a series of monitoring programmes on many upland sites in England that contain Priority Habitats, including dry and wet heath, blanket bog and calcareous grassland. These sites have been managed under agri-environment schemes for up to two decades or more, and some were formerly also subject to grazing restrictions under Environmental Cross Compliance (ECC) regulations. Monitoring focussed initially on the condition of heather (*Calluna vulgaris*) in relation to grazing pressure, and latterly also on the overall condition of the vegetation across the range of habitats present on a site.

The aim of this project was to re-survey a selection of these sites using standardised methods, and to provide a series of individual site reports describing their current and changing habitat condition, along with a separate overview of the findings from the complete set of sites. Data from the surveys have also been provided to NE to allow more detailed examination of individual sites to help guide local management inputs.

Each site comprised a whole moorland grazing unit and encompassed a range of vegetation types. A range of variables was recorded at 100 randomly located sample points in each site. Variables to be recorded were agreed with NE prior to the survey, to assess heather grazing and the condition of key habitats. The methodology was based on a modified version of the NE overgrazing surveillance methodology (including laboratory assessment of a heather Grazing Index) and the Common Standards Monitoring (CSM) Guidance for Upland Habitats. Full details of the project objectives and methodology are given in the main overview report. Defra, UK - Science Search

The Caldbeck site was surveyed during 10 – 15 April 2014. Results of the survey are presented in a standard format in the following sections. Management information (particularly grazing) is also summarised from reports provided by NE. An assessment is then made of change in vegetation since the previous surveys and this is considered in the context of current and past management practices.

2. Overview

2.1 General description

Caldbeck is located in the northern Lake District and covers 3300 ha. The extensive and moderately steep northern, eastern and western slopes of the Caldbeck Fells are largely covered by rough acid grassland (U5 *Nardus stricta* / U6 *Juncus squarrosus*), which is the most frequent vegetation type on the site (30% of sample points in 2014), and bent-fescue grassland (15%), although the observed patchy frequency of *Vaccinium myrtillis* suggests that much of this vegetation is largely derived from heather heath or damp heath (presence of occasional hummocks of *Sphagnum capillifolium*) through previous heavy grazing. What little remaining heather there was throughout this area appeared from casual observations to be highly fragmented (restricted to occasional small patches or sprigs), heavily grazed and suppressed.

Blanket bog (22% of sample points) and heather heath (14%) are the most frequent target vegetation types on the site, but both were rather localised in their distribution. The former (predominantly M19 *Calluna vulgaris – Eriophorum vaginatum*) includes an area on the rounded or flat spurs to the east of Carrock Fell and in the vicinity of Round Knott, which generally appeared to be in good condition. There is also a relatively small area of blanket bog on the gently sloping spurs

around Great Sca Fell, Little Lingy Hill and Great Lingy Hill and in the nearby low-lying Miller Moss in the central western part of the site. However, the blanket bog in these areas appeared to be relatively impoverished and largely dominated by *Eriophorum vaginatum* and pleurocarpous mosses with occasional patches of heather.

Much of the steep south and south-east facing slopes of the site in the valley of the River Caldew below Knott, Round Knott and Carrock Fell are covered in dense heather heath (predominantly H12 *Calluna vulgaris – Vaccinium myrtillis* with some H10 *Calluna vulgaris – Erica cinerea*). That on the steepest slopes below Round Knott and Carrock Fell in the Mosedale area was predominantly in the mature phase of growth (with topography probably restricting grazing by sheep) at the 2014 re-survey, and interspersed with boulder scree and Juniper scrub, some areas of which are relatively extensive (effectively forming small 'forests' in places) and included bushes of varying ages suggesting active regeneration. Heather heath around the summit of Carrock Fell, predominantly comprising *Calluna*, *Vaccinium* and *Empetrum nigrum,* appeared to be generally in good condition, but gives way to fragmented heath on the northern slopes of the fell.

Overall, heather was present in the building and mature growth phases in equal amounts across the parts of the site where it occurs (Figure 3c), but in places there was quite a uniformly high cover of heather in vegetation that is otherwise species-poor. On the lower slopes of the Caldew valley, which are more accessible to sheep, heather is more fragmented and some heather beetle damage was evident. No pioneer heather was recorded.

Nardus stricta was the most frequently dominant graminoid across the site (Figure 3h).

2.2 Site management

Prior to the foot and mouth disease outbreak in 2001, Caldbeck had been subjected to high levels of grazing. Flock sizes were substantially reduced in 2001 during the foot and mouth disease outbreak and then new flocks were hefted on to the site during 2002 – 2005. During this period, overall stocking rates rose gradually from *c*. 0.045 LU ha^{-1} to 0.065 (0.6 to 0.8 ewes ha^{-1} equivalent), but with substantially fewer in winter (0.035 – 0.04 LU ha^{-1}; 0.4 – 0.5 ewes ha^{-1}) than in summer (0.06 – 0.105 LU ha^{-1}; 0.75 – 1.3 ewes ha^{-1}). Summer stocking rates then levelled out to 2008, although they declined in winter to 2002 levels. An amendment to the Wildlife Enhancement Scheme agreement in 2008 and removal of one flock reduced stocking rates to *c.* 0.05 LU ha^{-1} (0.6 ewes ha^{-1} equivalent) overall (0.025 LU ha^{-1} in winter and 0.09 LU ha^{-1} in summer; 0.3 ewes ha^{-1} and 1.1 ewes ha^{-1}) by 2010. Most of this reduction occurred in the low fells, where stocking rates had been greater than the high fells. The site was entered into a Higher Level Stewardship (HLS) agreement in 2011, with separate requirements for high and low fells. The HLS requirements are complex but overall annual targets are 0.054 LU ha^{-1} and 0.075 LU ha^{-1} respectively, which are similar to, or just below the actual levels in 2010.

A number of surveys have taken place over the last 20 or so years, and are summarised in table 1. Early ESA Monitoring surveys focussed on grazing pressure on dwarf shrub, deriving a heather grazing index (GI) from shoots collected in the field, which was converted to a measure of Biomass Utilisation (BU) using a mathematical function. Later overgrazing surveys (not carried out here) reverted to the more objective measure of GI. The surveys in 2001 and 2004 did not measure GI, possibly due to the limited extent of dwarf shrub and the wider coverage of these surveys in terms of vegetation types, but recorded sward heights in a range of vegetation types and a number of heather variables, including features indicative of heavy grazing (HGF) as a precursor to the surveillance survey methods used in the current re-survey. Surveillance surveys were often carried out on land where overgrazing measures had been implemented, but has subsequently entered an agri-environment agreement. The various types of grazing assessment survey undertaken on Caldbeck are set out in Table 1.

Table 1: Past surveys of grazing pressure and impacts on Calbeck, with the type of survey and sampling strategy followed.

Years	Survey type	Main variables	Sampling Strategy	Sample numbers
1993, 1996	ESA monitoring	GI, BU	Random clusters	150
2001, 2004	Vegetation and grazing evaluation	Sward heights, HGF, subjective grazing assessment	grid	400, 188

2.3 Condition and grazing pressure in 2014

There was evidence of high levels of grazing in a small percentage of sample points on both blanket bog and heather heath. The mean GI was low in heather heath (8.9%) and slightly higher in blanket bog (16.3%) (Table 2). Of samples with heather present, 12.5% had GI values that failed to meet the CSM target of less than 33%, above which level grazing is likely to be damaging (Figure 2, Table 2, Map 1), with the highest level recorded near the summit of Knott. Sheep droppings were relatively widespread at 18% of points (Figure 3f). Heather beetle damage was also evident in both blanket bog and heather heath at 16% of points with heather overall (Figure 3d). Heavily grazed features were recorded at 8% of points with heather (Figure 3d, Map 2), on the slopes of Longdale and Birk Moss. Only 4% of sample points had a mean graminoid sward height that indicated heavy grazing (Map 2), mainly found on the southern edge of the site along the River Caldew.

A small percentage (8%) of sample points in blanket bog had been burnt in the last 12 months, but no recent burning was recorded in any other vegetation types.

The mires habitat failed to meet all condition assessment thresholds (targets to be passed at 90% of sample points) relating to species composition, apart from the number of *Sphagnum* species. This might be due to past burning management and high levels of grazing. The dry heath habitat failed to reach the thresholds for diversity of group (i) indicators and current levels of browsing on dwarf shrubs. If the measure of dwarf shrub cover is taken as indicator species cover this threshold is similarly not met, with 68% of dry heath points meeting the cover target. The non dwarf-shrub indicator species *Racomitrium lanuginosum* was recorded in one quadrat, but even if this species achieves high cover here it will have little effect on the result. Condition assessment thresholds for dwarf shrub composition, in terms of group (i) and group (ii) species are however met.

2.4 Change since previous surveys

Previous surveys of the site used a different sampling regime from that in 2014 and only included the high fells area. Formal analysis of change is not possible and it is only possible to speculate on comparisons with the previous surveys. Using a heather biomass utilisation calculation based on the GI, during the period 1993 – 1996 it was estimated that heather growth was suppressed by grazing in 17% of the sample. Due to methodological problems, no conclusions about change in the condition of heather could be made during that period, although it is worth noting that the GI in 1996 (23%) was substantially higher than in 2014 (Table 2). Assessments between 2001 and 2004 concluded that grazing pressure had been largely reduced in all habitats except bracken and rough rank grassland. Significant changes in grazing pressure had been recorded in rough acid grassland and bent-fescue grassland together with an increase in sward heights in these habitats. Dwarf shrub cover had increased in heath and blanket mire while heavily grazed features on heather in these habitats were reduced. Heather was most heavily grazed in grass/heath mosaics and in areas regenerating after fire.

From descriptions in the previous reports, it appears that moderate grazing levels have been maintained on the site. Browsing levels on heather in dry heath are still higher than optimum but the

structure might have shown a shift towards more in the mature growth phase. The lack of characteristic species in mire habitats is likely to be a legacy of previously high grazing levels and is only likely to recover over much longer timescales.

The major challenge for this site will be to manage stocking levels over the large areas currently dominated by rough acid grassland (and bent-fescue grassland) to allow restoration of heather heath, and around the periphery of remaining areas of heath on steeper southern slopes to prevent further fragmentation and deterioration. Longer-term targeted and stratified monitoring is probably required at this site to form a clearer picture of changes in the vegetation.

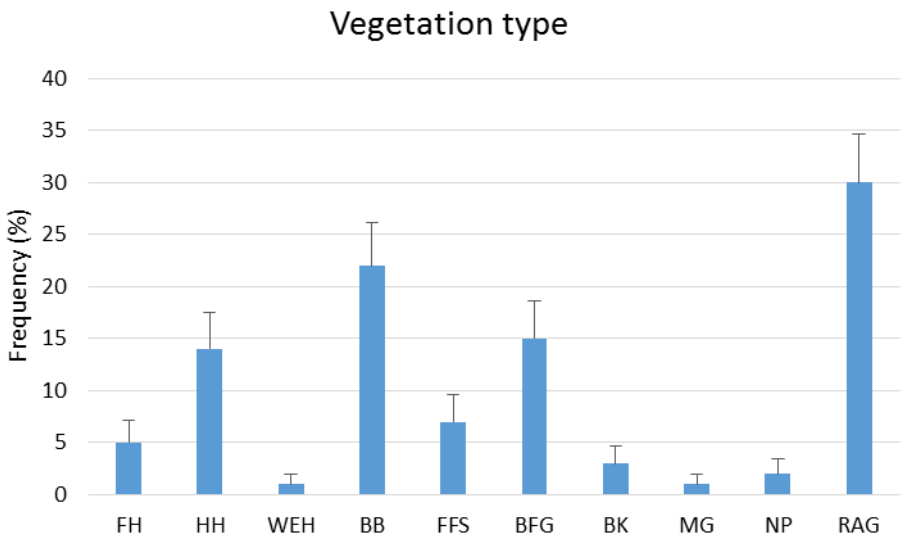

Figure 1. Frequency of vegetation types across the site in 2014. Bars are standard deviations. FH – fragmented heath; HH – heather heath; WEH – wet heath; BB – blanket bog; FFS – flush, fen, & swamp; BFG – bent-fescue grassland; BK – bracken; MG – mesotrophic grassland; NP – non-productive; RAG – rough acid grassland.

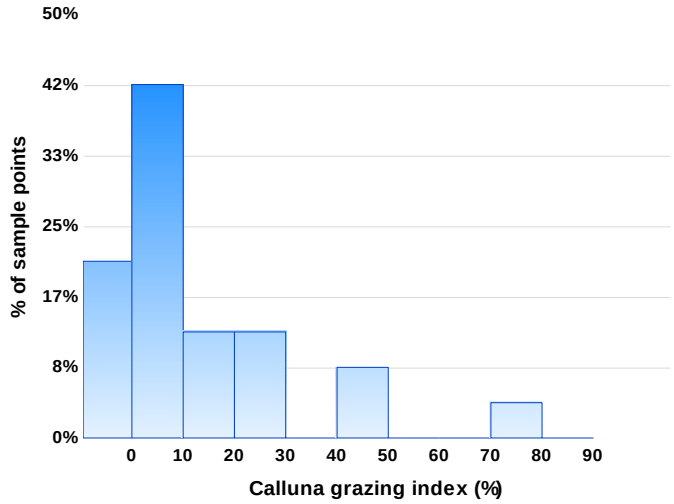

Figure 2. Frequency distribution of heather Grazing Index from sample points containing heather at whole site level in 2014.

Table 2. Heather Grazing Index at site level and by target vegetation type in 2014 (mean ± standard deviation; *n* is number of sample points with heather stems).

	Overall* (*n* = 24)	Heather Heath (*n* = 11)	Blanket Bog (*n* = 12)
Grazing Index	14.0 ±18.30	8.9 ±14.15	16.3 ±20.42
Samples ≥ 33.3%	12.5%	9.1%	8.3%
Samples ≥ 66.6%	4.2%	0.0%	8.3%

* fragmented heath *n* = 1

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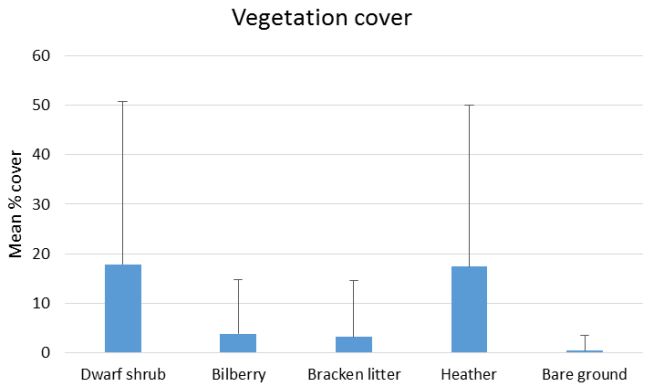

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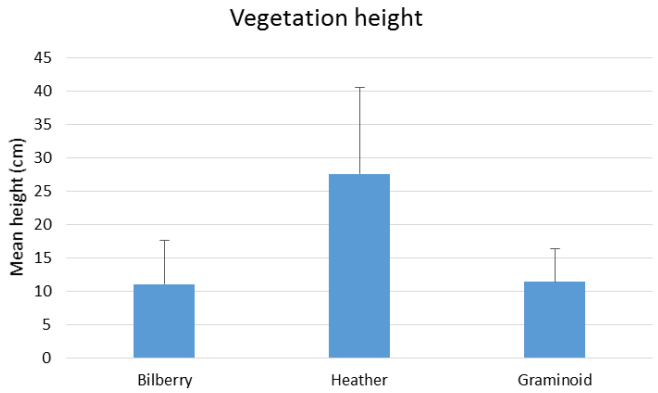

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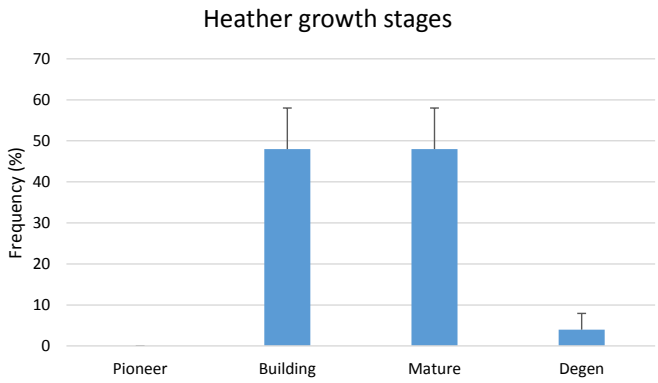

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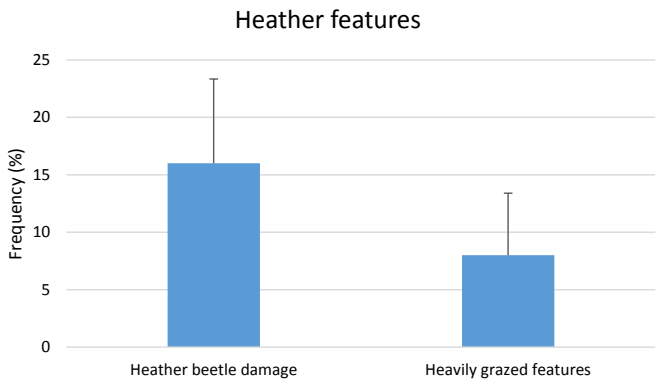

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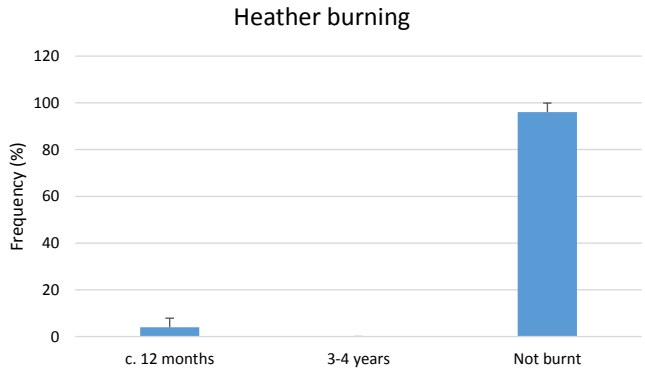

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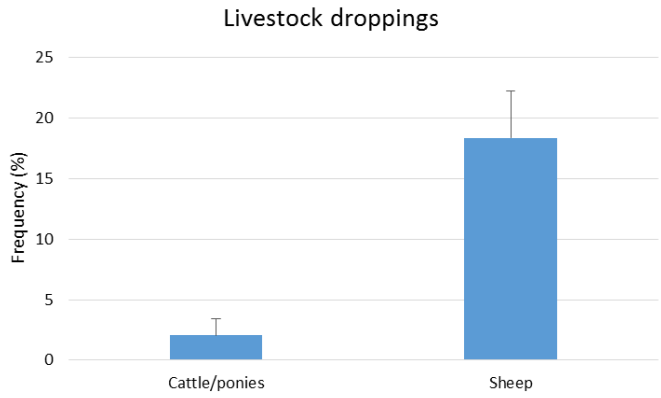

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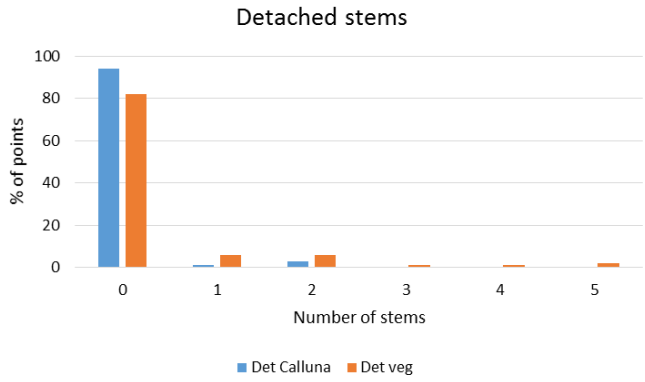

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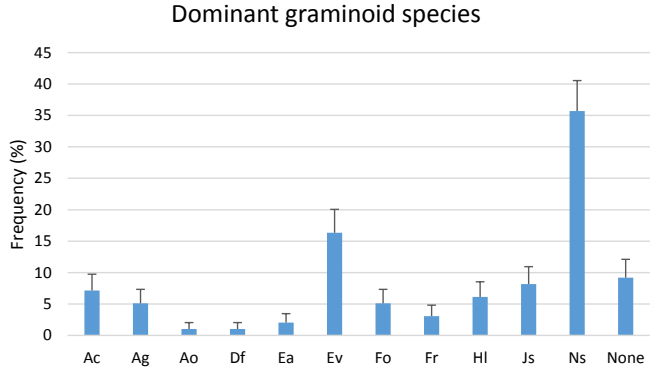


Figure 3. Surveillance variables at whole site level in 2014 (bars are standard deviations).

3. **Overgrazing surveillance variables 2014**

		Heather Heath (*n* = 14)			Blanket Bog (*n* = 22)			Other Target Types* (*n* = 13)		
Category	**Variable**	**Mean**	**SD**	***n***	**Mean**	**SD**	***n***	**Mean**	**SD**	***n***
Peat	Peat depth (cm)	17	5.4	13	64	24.1	22	30	21.5	12
Vegetation cover	Dwarf shrub cover (%)	71	34.0	14	34	35.0	22	0	1.4	13
	Bilberry cover (%)	12	18.4	14	2	8.5	22	5	12.7	13
	Bracken litter cover (%)	1	4.1	14	0	0.0	22	6	11.5	13
	Calluna cover (%)	70	33.8	14	33	35.3	22	0	0.3	13
	Bare ground (%)	0	0.5	14	1	6.4	22	0	0.0	13
Vegetation height	Bilberry height (cm)	17	8.6	11	10	5.0	11	11	7.2	3
	Calluna height (cm)	35	9.2	12	22	12.9	12	13	0.0	1
	Graminoid height (cm)	9	4.2	6	13	4.4	22	13	7.4	13
Heather growth stages	Pioneer (% of points)	0	0.0	12	0	0.0	12	0	0.0	1
	Building (% of points)	33	13.6	12	58	14.2	12	100	0.0	1
	Mature (% of points)	67	13.6	12	33	13.6	12	0	0.0	1
	Degenerate (% of points)	0	0.0	12	8	8.0	12	0	0.0	1
Heather features	Heather beetle damage (% of points)	17	10.8	12	17	10.8	12	0	0.0	1
	Heavily grazed features (% of points)	8	8.0	12	8	8.0	12	0	0.0	1
Heather burning	Burnt (*c.* 12 months) (% of points)	0	0.0	12	8	8.0	12	0	0.0	1
	Burnt (3-4 years) (% of points)	0	0.0	12	0	0.0	12	0	0.0	1
Droppings	Cattle / ponies (% of points)	0	0.0	14	0	0.0	22	8	7.4	13
	Sheep (% of points)	21	11.0	14	14	7.3	22	31	12.8	13
Detached stems	Detached Calluna (no.)	0.4	0.7	14	0.1	0.4	22	0.0	0.0	13
	Detached vegetation (no.)	0.1	0.4	14	0.1	0.5	22	0.4	1.4	13

* Other target types = Fragmented Heath (n=5); Wet heath (n=1); and Flushes, fens & swamps (n=7)

4. **Habitat condition assessment results 2014**

4.1 Dry heath

Targets assessed at habitat level in 2 x 2 m quadrat:

Dry heath (*n*=14 heather heath + 5 fragmented heath)		
Target	% of points passed	Habitat pass or fail
Presence of moss, liverworts and non-crustose lichens[1]	100	Pass
At least 50% of vegetation cover made up of Table 1 indicator species[2]	68	Fail
At least 25% of dwarf shrub cover should be made up of Group (i) indicator species	100	pass
Less than 50% of dwarf shrub cover made up of Group (ii) indicator species	100	Pass
At least two indicator species from group (i)	79	Fail
Cover of weeds < 1%	100	Pass
Cover of soft rush < 10%	100	Pass
Dwarf shrub browsing < 33%	68	Fail
Disturbed bare ground < 10%	100	Pass

[1] assessed in 1 x 1 m quadrat

[2]assessed as total dwarf shrub cover, excluding dead and pioneer heather and recent burns

Targets assessed at feature extent:

Target	**Pass or fail**
Cover of non-native species < 1%	Pass
Cover of bracken < 10%	Pass
Cover of native trees/ shrubs < 20%	Pass
Cover of weeds < 1%	Pass
Cover of soft rush < 10%	Pass
Burning of sensitive areas absent	Pass
Disturbed bare ground < 10%	Pass
Mature heather ≥10% & all growth phases present	Fail

Indicator species frequencies (*n* = 19):

Species	**Frequency (%)**	**SD**
Calluna vulgaris	79	9.4
Erica tetralix	0	0.0
Erica cinerea	11	7.0
Vaccinium myrtillus	79	9.4
Vaccinium oxycoccus	0	0.0
Vaccinium vitis-idaea	5	5.1
Empetrum nigrum	11	7.0
Racomitrium lanuginosum	5	5.1
Ulex gallii	0	0.0
Myrica gale	0	0.0

4.2 Wet heath

This habitat type was recorded at fewer than 10 sample points so condition cannot be accurately assessed at 2 x 2m quadrat level or feature extent.

4.3 Mires

Targets assessed at habitat level in 2 x 2 m quadrat:

Mires (*n*=22 blanket bog + 7 flushes, fens & swamps)		
Target	% of points passed	Habitat pass or fail
At least 6 indicator species present	41	Fail
At least 50% of vegetation cover made up of at least 3 indicator species	59	Fail
Sphagnum cover should not consist of only *Sphagnum fallax*	100 [1]	Pass
Any one of *Eriophorum vaginatum*, Ericaceous spp. collectively, or *Trichophorum* should not individually exceed 75% of veg cover	62	Fail
Less than 1% of vegetation cover to comprise of negative indicators	86	Fail
Dwarf shrub browsing < 33%	100 [2]	Pass
Disturbed bare ground/ drainage < 10%	97	Pass
Broken/ crushed Sphagnum < 10%	100	Pass

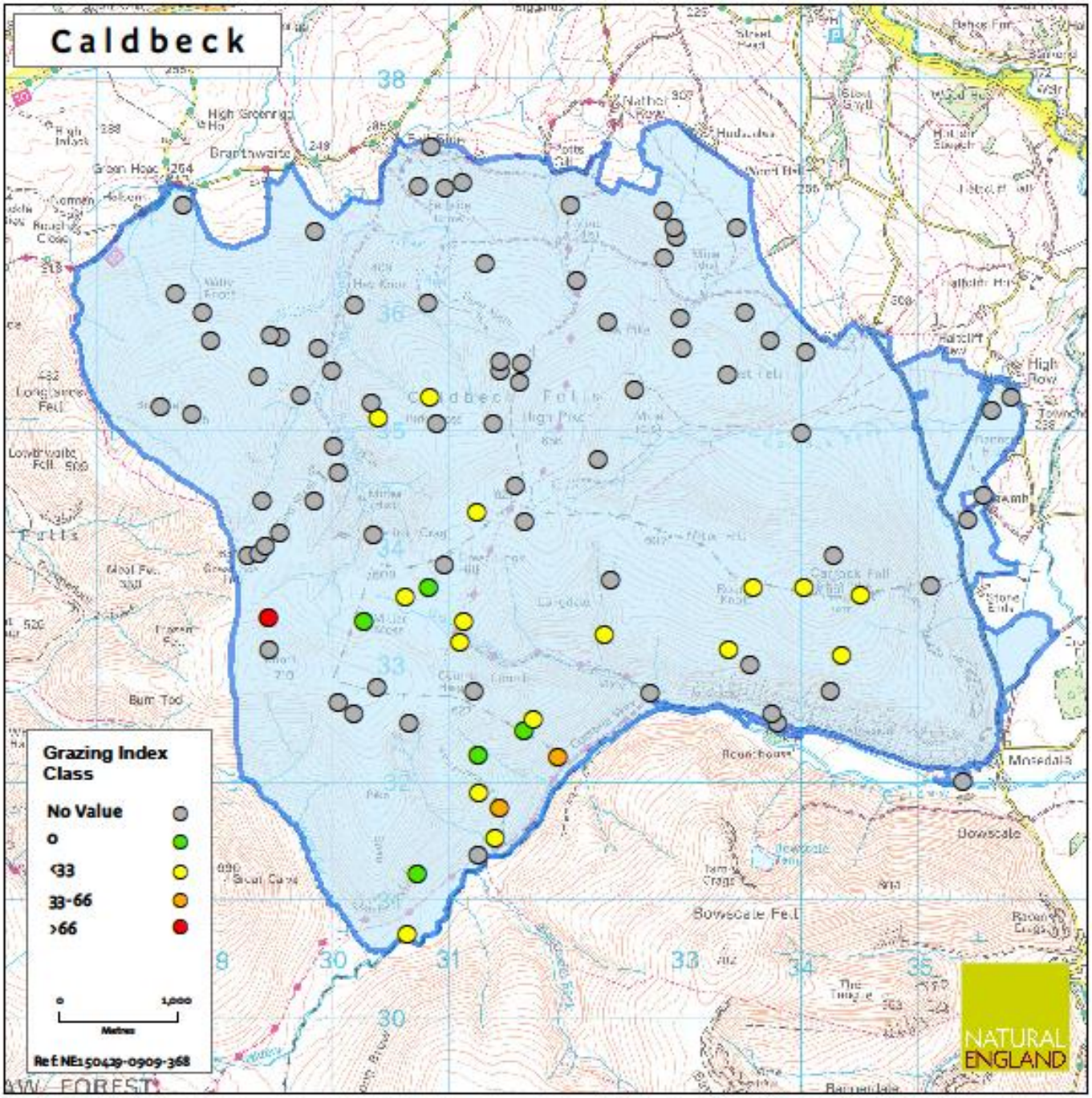
[1] *n*=23 (23 points with Sphagnum present)
[2] *n*=18 (11 points with no information)

Targets assessed at feature extent:

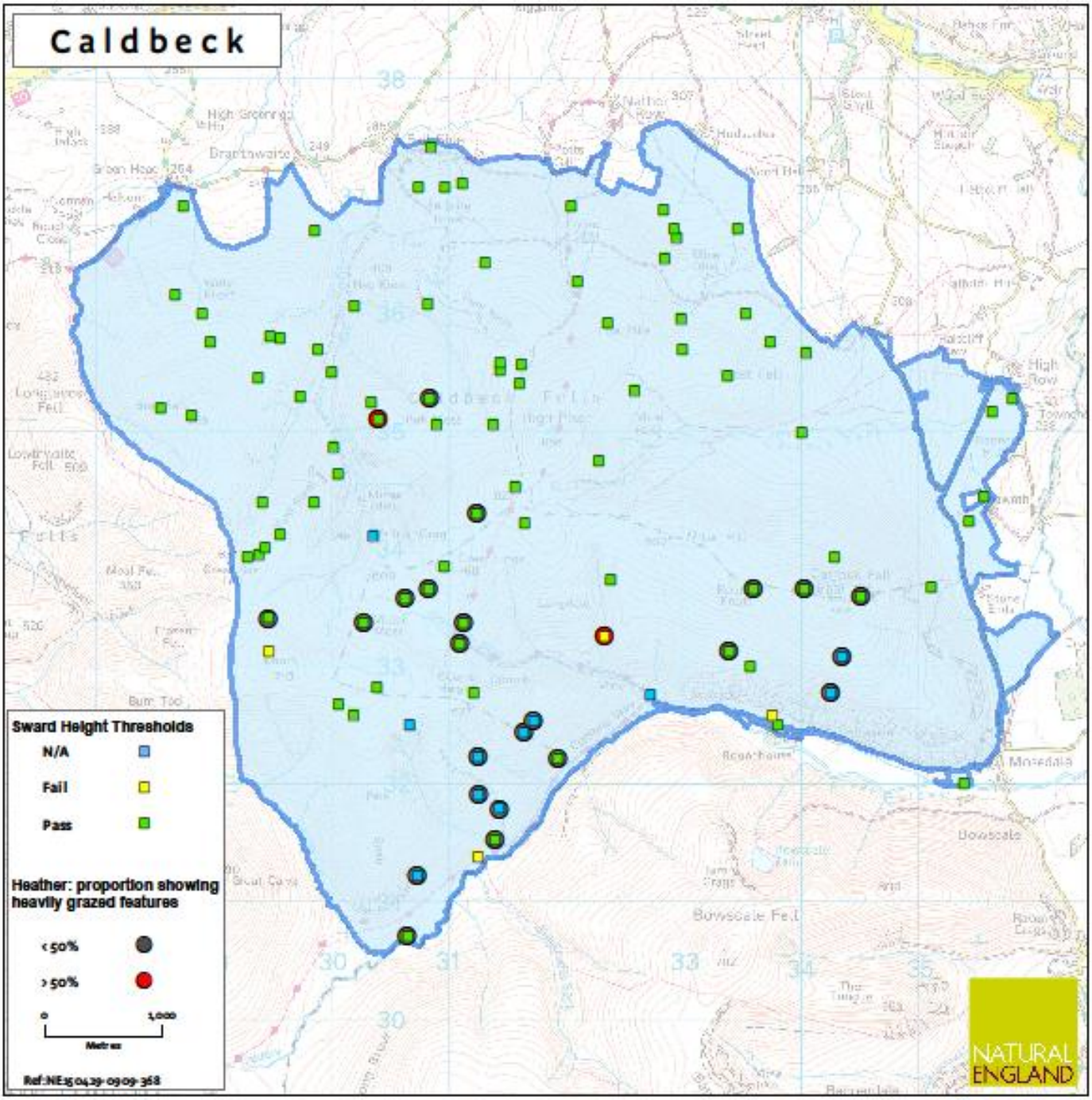
Target	**Pass or fail**
Cover of non-native species < 1%	Pass
Cover of native trees/ shrubs < 10%	Pass
Cover of negative indicators < 1%	Pass
Burning of bryophyte layer absent	Pass
Burning of sensitive areas absent	Pass
Extent of eroding peat	Pass
Disturbed bare ground < 10%	Pass

Indicator species frequencies (*n* = 29):

Species	**Frequency (%)**	**SD**		**Species**	**Frequency (%)**	**SD**
Calluna vulgaris	45	9.2		*E. vaginatum*	72	8.3
Erica tetralix	17	7.0		*Trichophorum cespitosum*	7	4.7
Erica cinerea	0	0.0		*Rhynchospora alba*	0	0.0
Vaccinium myrtillus	45	9.2		*Narthecium ossifragum*	0	0.0
Vaccinium oxycoccus	10	5.7		*Drosera* spp.	3	3.4
Vaccinium vitis-idaea	3	3.4		*Menyanthes trifoliata*	0	0.0
Rubus chamaemorus	0	0.0		*Sphagnum* spp.	79	7.5
Empetrum nigrum	34	8.8		*Racomitrium lanuginosum*	0	0.0
Myrica gale	0	0.0		Pleurocarpous mosses	93	4.7
Andromeda polifolia	0	0.0		Non-crustose lichens	21	7.5
Eriophorum angustifolium	38	9.0				



Map 1: Distribution of random sampling points on Caldbeck in 2014, showing those where heather was present, along with heather grazing index (GI) class, derived from collected heather shoots.



Map 2: Distribution of sample points on Caldbeck in 2014 showing those which fall above (pass) or below (fail) habitat-related height thresholds indicative of heavy grazing, and with more or less than 50% of heather cover showing suppressed growth features.

Further information

Natural England evidence can be downloaded from our **Access to Evidence Catalogue**. For more information about Natural England and our work see **Gov.UK**. For any queries contact the Natural England Enquiry Service on 0300 060 3900 or e-mail **enquiries@naturalengland.org.uk** .

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