

Kearton Pasture

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 Kearton Pasture site was surveyed during 18 – 19 March 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

The Kearton Pasture site is 186 ha, located in the Pennines in North Yorkshire. It is part of Arkengarthdale, Gunnerside and Reeth Moors SSSI, and the North Pennine Moors SAC and SPA. The most frequent vegetation type is heather heath which, along with fragmented heath comprises just under half of the sample points in 2014 (Figure 1). The heather heath is mainly H12 (*Calluna vulgaris* - *Vaccinium myrtillus* heath), which is impoverished and almost entirely dominated by heather. Most of the remainder of the site on extensive lower-lying southern slopes comprises rough acid grassland and bent-fescue grassland. This is likely to reflect heavier grazing by livestock (at least historically) in these areas, given their proximity to farms fringing the southern side of the moor. A small amount of blanket bog (10% of sample points) is also present. Most of the heather was in the building and mature growth stages at the time of the re-survey but there was also a notable amount of pioneer growth (22% of sample points; Figure 3c). A wide range of species comprise the dominant graminoids, including *Agrostis capillaris*, *Juncus squarrosus*, *Molinia caerulea*, *Deschampsia flexuosa* and *Eriophorum vaginatum* (Figure 3h).

The site is grazed by sheep and managed for grouse by controlled burning in small patches, which has created a patchwork of different ages. Evidence of predator control was noted on site during the survey. This, together with management of heather through burning, appears to have benefited ground-nesting birds other than grouse, with Lapwing, Curlew and Golden Plover all seen in significant numbers. Heather also appears to have been affected locally by rabbits (much evidence of which was seen in places).

2.2 Site management

Concerns about overgrazing on the site were first noted in 1994. Before intervention in 1996, the site was grazed in winter at up to 1.5 ewes ha⁻¹ and in summer at 0.2 cattle ha⁻¹. Surveys during 1996 – 2000 concluded that the site continued to be overgrazed and that stocking levels were too high. The site was entered into a Higher Level Stewardship (HLS) agreement in 2011, which specified a detailed stocking calendar. The requirements were to graze up to 0.5 sheep ha⁻¹ from November to March, and 0.7 – 0.9 sheep ha⁻¹ in May, June and October, along with 0.2 cattle ha⁻¹ from July to September¹. In addition, the land was required to be grazed for a minimum of 6 months, including summer grazing, between lambing and tupping. Shepherding was also required, to avoid localised heavy grazing and to concentrate cattle on acid grassland and away from blanket bog and other sensitive habitats. The HLS agreement also had several aims additional to heather restoration, including support of summer cattle grazing to benefit waders, reduced grazing pressure on heath and bog in winter, and continuation of a Wildlife Enhancement Scheme burning plan and peat restoration works.

A number of surveys have taken place over the last 20 or so years, and are summarised in Table 1. Early overgrazing 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. This conversion was dropped in the 2000 survey, reverting to the more objective measure of GI. The development of the Surveillance Survey saw a more holistic approach to the assessment of grazing pressure and added the measurement of sward heights, which could be compared to threshold heights for broad habitats, below which a sample area is deemed to be heavily grazed. Other variables including dwarf shrub heights, the presence of suppressed heather growth features, bare ground, animal droppings etc were measured as part of these surveys. 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 Kearton Pasture are set out in Table 1.

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

| Years | Survey type | Main variables | Sampling Strategy | Sample numbers |
|------------------------|--------------|-------------------|-------------------|----------------|
| 1996, 1997, 1998, 1999 | Overgrazing | GI, BU | grid | c115 |
| 2000 | Overgrazing | GI | grid | 120 |
| 2002, 2003 | Surveillance | GI, Sward heights | grid | 115 |
| 2007 | Surveillance | GI, Sward heights | random | 83 |

¹ Note that LU equivalents have varied among different schemes

2.3 Condition and grazing pressure in 2014

There was evidence of high grazing levels in heather heath, blanket bog and other target vegetation types. The mean GI was 45% overall (Table 2), and particularly high in the scarcer target vegetation types (56% in fragmented heath, wet heath and flushes, fens & swamps combined). These mean values were above the CSM GI target of less than 33%, indicating levels of grazing that were likely to be damaging. In terms of individual samples, two thirds of points had GI values above 33% (Figure 2, Table 2, Map 1), scattered throughout the heather area, and 20% had GIs of greater than 66%, mainly on the slopes of Brunt Hill in the west of the site. Heavily grazed features were recorded in 39% of sample points in heather heath and 35% of samples where heather was recorded (Figure 3d, Map 2), with concentrations on the slopes of Brunt Hill, and on the lower eastern part of the moor. Sheep droppings were recorded at 74% of points (Figure 3f) with a slightly higher incidence in the scarcer target vegetation types. Detached heather stems were also recorded in 24% of sample points across the site (Figure 3g). The mean sward height at 25% of sample points where graminoid height could be measured, and 22% of samples overall, indicated that heavy grazing was likely in these areas (Map 2). These short swards were found mainly on Brunt Hill and around the periphery of the moor.

In the heather heath vegetation type, a relatively small percentage of sample points (8%) had been burned in the previous 12 months, although a similar amount had been burned in the past 3-4 years (Figure 3e). Notably, 11% of sample points in blanket bog had been burned in the past 3-4 years, and substantially more (45%) in the remaining target habitats.

The condition assessment results also indicate high levels of grazing, and additional inappropriate burning practices. If the measure of dwarf shrub cover is taken as indicator species cover, which for Kearton Pasture is a reasonable assumption as no *Racomitrium lanuginosum* was recorded, this condition threshold (targets to be passed at 90% of sample points) is not met, nor is the threshold for number of indicator species met, with the target of two species achieved at only 43% of points. Mires were similarly below all thresholds associated with species composition, particularly for the cover of indicator species with the target for the number of indicator species met at only 36% of sample points. Both the dry heath and mires habitats were below the threshold for both dwarf shrub browsing and burning in sensitive areas. Dry heath failed to reach the threshold for heather growth stages.

2.4 Change since previous surveys

The grazing index had declined from 39.2% in 2003 to 24.3% in 2007. However, between 2007 and 2014 there had been a significant increase to 45.1% ($F_{1,99} = 17.2$, $P < 0.001$) (Table 2), which is similar to the previous level in 2003 (the 2003 survey used a different sampling regime so formal analysis of change from 2003 is not possible). Taking covers, heights and detached stems collectively, there had been no significant change across the site since 2007. However, both heather and graminoid heights had increased significantly and the area of bare ground had declined (Table 3). There had also been a significant increase in the frequency of livestock droppings but a decline in frequency of heavily grazed features (Table 4). Together, these results suggest that grazing levels at the time of the 2014 re-survey were higher than the previous survey (*cf.* livestock droppings and grazing index) but some of the changes in vegetation structure are indicative of an overall reduction in grazing pressure during this period. It is possible that grazing levels at the time of the re-survey may not have been typical of the longer term changes and might be partly attributable to rabbits, as heather was heavily grazed around rabbit warrens, which were quite numerous on the site.

Under optimum management, major changes to the vegetation cannot be expected to occur for several years, although some positive change in condition would be likely. However, the persistence of high grazing levels and increase in the grazing index since 2007 is surprising, given that the HLS

agreement has been in existence since 2011. The increase in vegetation heights might indicate some recent changes to the grazing regime, and indeed the cattle numbers specified have not been achieved in recent years since retirement of the main grazier and might have been replaced by sheep (D. Martin, pers. comm.). Despite this, the site does appear still to be subjected to relatively high levels of grazing, and also some inappropriate burning practices, including burning on blanket bog and in other sensitive areas.

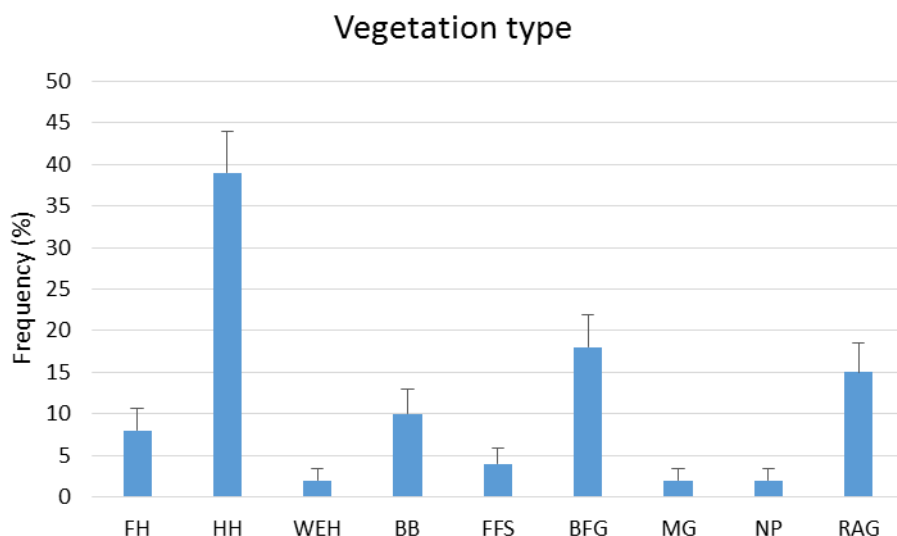


Figure 1. Frequency of vegetation types across the site. Bars are standard deviations. FH – fragmented heath; HH – heather heath; WEH – wet heath; BB – blanket bog; FFS – flush, fen, & swamp; BFG – bent-fescue grassland; MG – mesotrophic grassland; NP – non-productive; RAG – rough acid grassland.

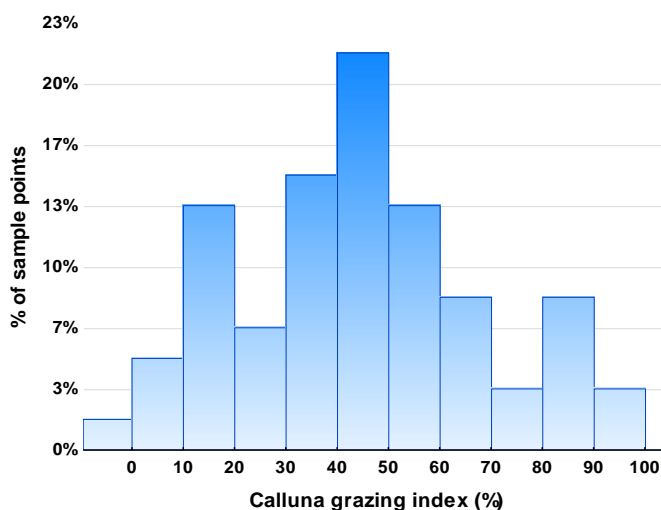


Figure 2. Frequency distribution of heather Grazing Index from sample points containing heather at whole site level.

Table 2. Heather Grazing Index in current (2014) and previous (2007) surveys (mean \pm standard deviation; n is number of sample points with heather stems).

| | 2007 | 2014 | | | |
|----------------------|-------------------------|--------------------------------------|-------------------------------|----------------------------|------------------------------------|
| | Overall ($n = 41$) | Overall ¹ ($n = 60$) | Heather heath ($n = 36$) | Blanket bog ($n = 9$) | Other ² ($n = 11$) |
| Grazing Index | 24.3 \pm 28.20 | 45.1 \pm 23.98 | 40.4 \pm 22.23 | 42.2 \pm 21.45 | 56.3 \pm 28.7 |
| Samples \geq 33.3% | 29.3% | 70.0% | 66.7% | 66.7% | 72.7% |
| Samples \geq 66.6% | 14.6% | 20.0% | 13.9% | 11.1% | 36.4% |

¹ non-target habitats $n = 6$

² wet heath $n = 2$, flushes, fens & swamps $n = 3$, fragmented heath $n = 6$

Table 3. Cover, height and detached stems in current (2014) and previous (2007) surveys (mean \pm standard deviation; n is total number of sample points (covers, detached heather, detached vegetation), number of sample points containing heather or graminoids (heights)).

| | 2007 | | | 2014 | | | $F_{1,86}$ | P |
|---------------------|------|------|-------------|------|------|-------------|------------|-------|
| | n | mean | st.dev. | n | mean | st.dev. | | |
| Bilberry cover | 83 | 0.4 | \pm 1.68 | 95 | 0.2 | \pm 0.57 | 2.1 | n.s. |
| Heather cover | 83 | 27.8 | \pm 36.01 | 95 | 30.6 | \pm 36.84 | 1.5 | n.s. |
| Bare ground | 83 | 2.5 | \pm 9.59 | 95 | 0.8 | \pm 2.87 | 4.9 | <0.05 |
| Heather height | 45 | 19.5 | \pm 12.45 | 60 | 25.6 | \pm 15.84 | 4.8 | <0.05 |
| Graminoid height | 67 | 6.6 | \pm 4.53 | 89 | 11.8 | \pm 11.40 | 4.9 | <0.05 |
| Detached heather | 83 | 0.7 | \pm 2.03 | 95 | 0.8 | \pm 1.82 | 0.4 | n.s. |
| Detached vegetation | 83 | 0.3 | \pm 1.04 | 95 | 0.3 | \pm 1.13 | 0.4 | n.s. |
| Overall | | | | | | | $F_{7,80}$ | P |
| Overall | | | | | | | 1.8 | n.s. |

Table 4. Livestock droppings, burning and heavily grazed features in current (2014) and previous (2007) surveys (presence, standard deviation and chi-square results; n is total number of sample points (droppings), number of sample points containing heather (heavily grazed features, burning)).

| | 2007 | | | 2014 | | | Chi-square | P |
|-------------------------|------|----------|---------|------|----------|---------|------------|-------|
| | n | presence | st.dev. | n | presence | st.dev. | | |
| Livestock droppings | 83 | 47 | 4.52 | 98 | 74 | 4.26 | 7.23 | <0.01 |
| Heavily grazed features | 45 | 25 | 3.33 | 60 | 21 | 3.69 | 4.41 | <0.05 |
| Burning | 45 | 5 | 2.11 | 63 | 14 | 3.30 | 1.53 * | n.s. |

* Yates corrected chi-square

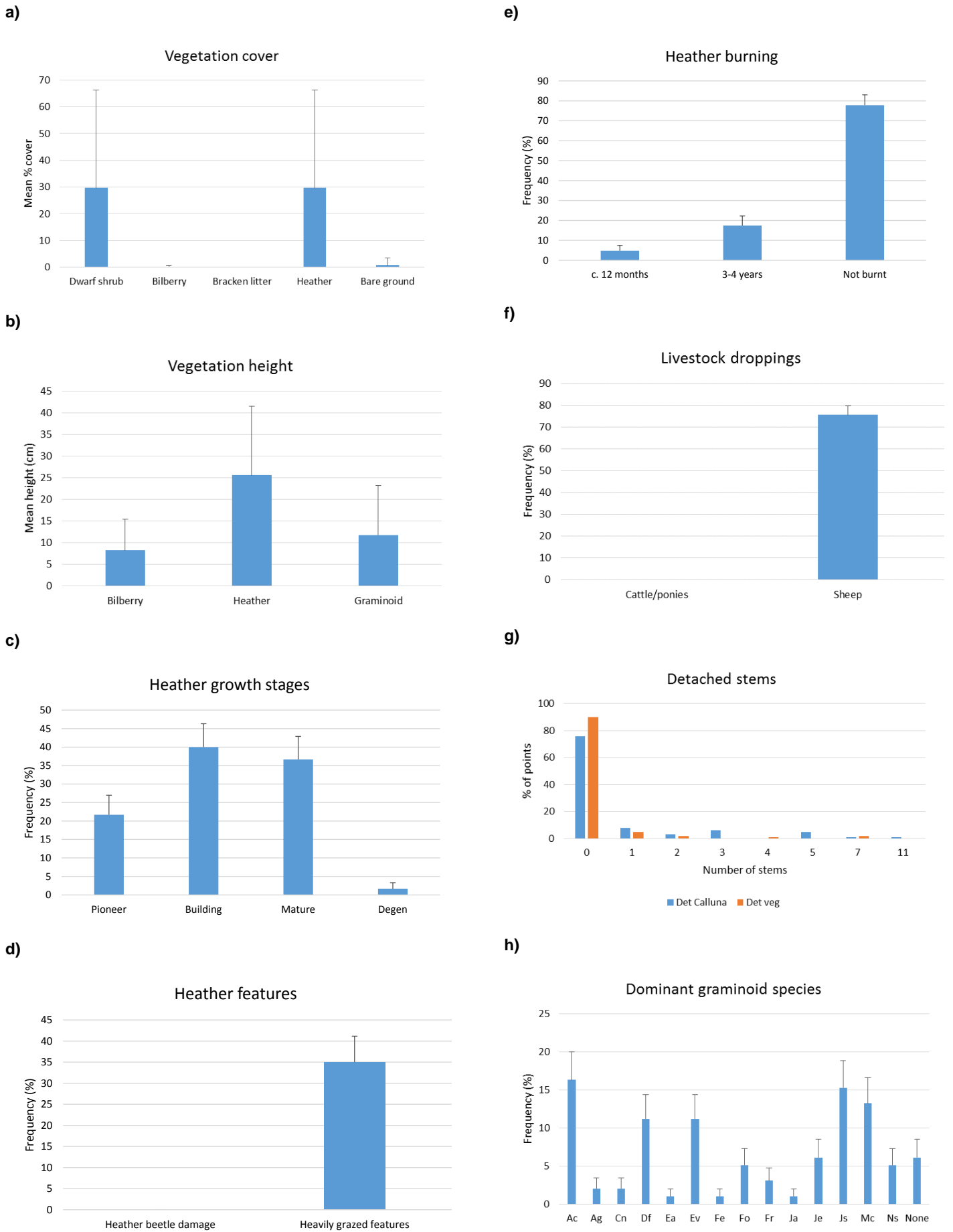


Figure 3. Surveillance variables at whole site level in 2014 (bars are standard deviations).

3. Overgrazing surveillance variables 2014

| Category | Variable | Heather Heath (n = 39) | | | Blanket Bog (n = 10) | | | Other Target Types* (n = 14) | | |
|-----------------------|---------------------------------------|------------------------|------|----|----------------------|------|----|------------------------------|------|----|
| | | Mean | SD | n | Mean | SD | n | Mean | SD | n |
| Peat | Peat depth (cm) | 19 | 8.1 | 30 | 53 | 20.8 | 10 | 35 | 16.2 | 9 |
| Vegetation cover | Dwarf shrub cover (%) | 58 | 34.0 | 39 | 49 | 39.3 | 10 | 9 | 15.2 | 14 |
| | Bilberry cover (%) | 0 | 0.8 | 39 | 0 | 0.0 | 10 | 0 | 0.0 | 14 |
| | Bracken litter cover (%) | 0 | 0.0 | 39 | 0 | 0.0 | 10 | 0 | 0.0 | 14 |
| | Calluna cover (%) | 58 | 34.0 | 39 | 49 | 39.3 | 10 | 9 | 15.2 | 14 |
| | Bare ground (%) | 0 | 1.1 | 39 | 0 | 0.0 | 10 | 0 | 0.0 | 14 |
| Vegetation height | Bilberry height (cm) | 12 | 6.9 | 12 | 3 | 0.0 | 1 | 3 | 1.0 | 3 |
| | Calluna height (cm) | 29 | 15.1 | 36 | 31 | 15.6 | 9 | 17 | 13.6 | 11 |
| | Graminoid height (cm) | 9 | 6.4 | 31 | 17 | 8.3 | 10 | 11 | 8.1 | 13 |
| Heather growth stages | Pioneer (% of points) | 8 | 4.6 | 36 | 11 | 10.5 | 9 | 64 | 14.5 | 11 |
| | Building (% of points) | 47 | 8.3 | 36 | 44 | 16.6 | 9 | 9 | 8.7 | 11 |
| | Mature (% of points) | 42 | 8.2 | 36 | 44 | 16.6 | 9 | 27 | 13.4 | 11 |
| | Degenerate (% of points) | 3 | 2.7 | 36 | 0 | 0.0 | 9 | 0 | 0.0 | 11 |
| Heather features | Heather beetle damage (% of points) | 0 | 0.0 | 36 | 0 | 0.0 | 9 | 0 | 0.0 | 11 |
| | Heavily grazed features (% of points) | 39 | 8.1 | 36 | 22 | 13.9 | 9 | 18 | 11.6 | 11 |
| Heather burning | Burnt (c. 12 months) (% of points) | 8 | 4.3 | 39 | 0 | 0.0 | 9 | 0 | 0.0 | 11 |
| | Burnt (3-4 years) (% of points) | 8 | 4.3 | 39 | 11 | 10.5 | 9 | 45 | 15.0 | 11 |
| Droppings | Cattle / ponies (% of points) | 0 | 0.0 | 39 | 0 | 0.0 | 10 | 0 | 0.0 | 14 |
| | Sheep (% of points) | 74 | 7.0 | 39 | 50 | 15.8 | 10 | 79 | 11.0 | 14 |
| Detached stems | Detached Calluna (no.) | 1.6 | 2.5 | 39 | 0.3 | 0.9 | 10 | 0.4 | 0.9 | 14 |
| | Detached vegetation (no.) | 0.2 | 0.5 | 39 | 0.0 | 0.0 | 10 | 0.5 | 1.9 | 14 |

* Other target types = Fragmented Heath (n=8); Wet Heath (n=2); and Flushes, fens & swamps (n=4).

4. Habitat condition assessment results 2014

4.1 Dry heath

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

| Dry heath (n=39 heather heath + 7 fragmented heath) | | |
|--|--------------------|----------------------|
| Target | % of points passed | Habitat pass or fail |
| Presence of moss, liverworts and non-crustose lichens ¹ | 93 ² | Pass |
| At least 50% of vegetation cover made up of Table 1 indicator species ³ | 52 | 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) | 43 | Fail |
| Cover of weeds < 1% | 100 | Pass |
| Cover of soft rush < 10% | 100 | Pass |
| Dwarf shrub browsing < 33% | 55 ⁴ | Fail |
| Disturbed bare ground < 10% | 93 | Pass |

¹ assessed in 1 x 1 m quadrat

² n=45 (1 missing value)

³ assessed as total dwarf shrub cover, excluding dead and pioneer heather and recent burns

⁴ n=42 (4 points with no browsing information)

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 | Fail |
| Disturbed bare ground < 10% | Pass |
| Mature heather ≥10% & all growth phases present | Fail |

Indicator species frequencies (n = 46):

| Species | Frequency (%) | SD |
|--------------------------------|---------------|-----|
| <i>Calluna vulgaris</i> | 93 | 3.6 |
| <i>Erica tetralix</i> | 0 | 0.0 |
| <i>Erica cinerea</i> | 0 | 0.0 |
| <i>Vaccinium myrtillus</i> | 43 | 7.3 |
| <i>Vaccinium oxycoccus</i> | 0 | 0.0 |
| <i>Vaccinium vitis-idaea</i> | 0 | 0.0 |
| <i>Empetrum nigrum</i> | 0 | 0.0 |
| <i>Racomitrium lanuginosum</i> | 0 | 0.0 |
| <i>Ulex gallii</i> | 0 | 0.0 |
| <i>Myrica gale</i> | 0 | 0.0 |

4.2 Wet heath

This habitat types was recorded in less than 10 sample points so condition cannot be accurately assessed at 2 x 2m quadrat level.

Targets assessed at feature extent:

| Target | Pass or fail |
|-------------------------------------|--------------|
| Cover of native trees/ shrubs < 20% | Pass |
| Cover of bracken < 10% | Pass |
| Cover of non-native species < 1% | Pass |
| Cover of negative indicators < 1% | Pass |
| Cover of soft rush < 10% | Pass |
| Burning of bryophyte layer absent | Pass |
| Burning of sensitive areas absent | Pass |
| Active drainage < 10% | Pass |
| Disturbed bare ground < 10% | Pass |

4.3 Mires

| Mires (n=10 blanket bog + 4 flushes, fens & swamps) | | |
|---|--------------------|----------------------|
| Target | % of points passed | Habitat pass or fail |
| At least 6 indicator species present | 0 | Fail |
| At least 50% of vegetation cover made up of at least 3 indicator species | 36 | Fail |
| <i>Sphagnum</i> cover should not consist of only <i>Sphagnum fallax</i> | 64 | Fail |
| Any one of <i>Eriophorum vaginatum</i> , Ericaceous spp. collectively, or <i>Trichophorum</i> should not individually exceed 75% of veg cover | 79 | Fail |
| Less than 1% of vegetation cover to comprise of negative indicators | 86 | Fail |
| Dwarf shrub browsing < 33% | 69 ¹ | Fail |
| Disturbed bare ground/ drainage < 10% | 100 ² | Pass |
| Broken / crushed <i>Sphagnum</i> < 10% | 100 | Pass |

¹ n=13 (1 point with no browsing information)

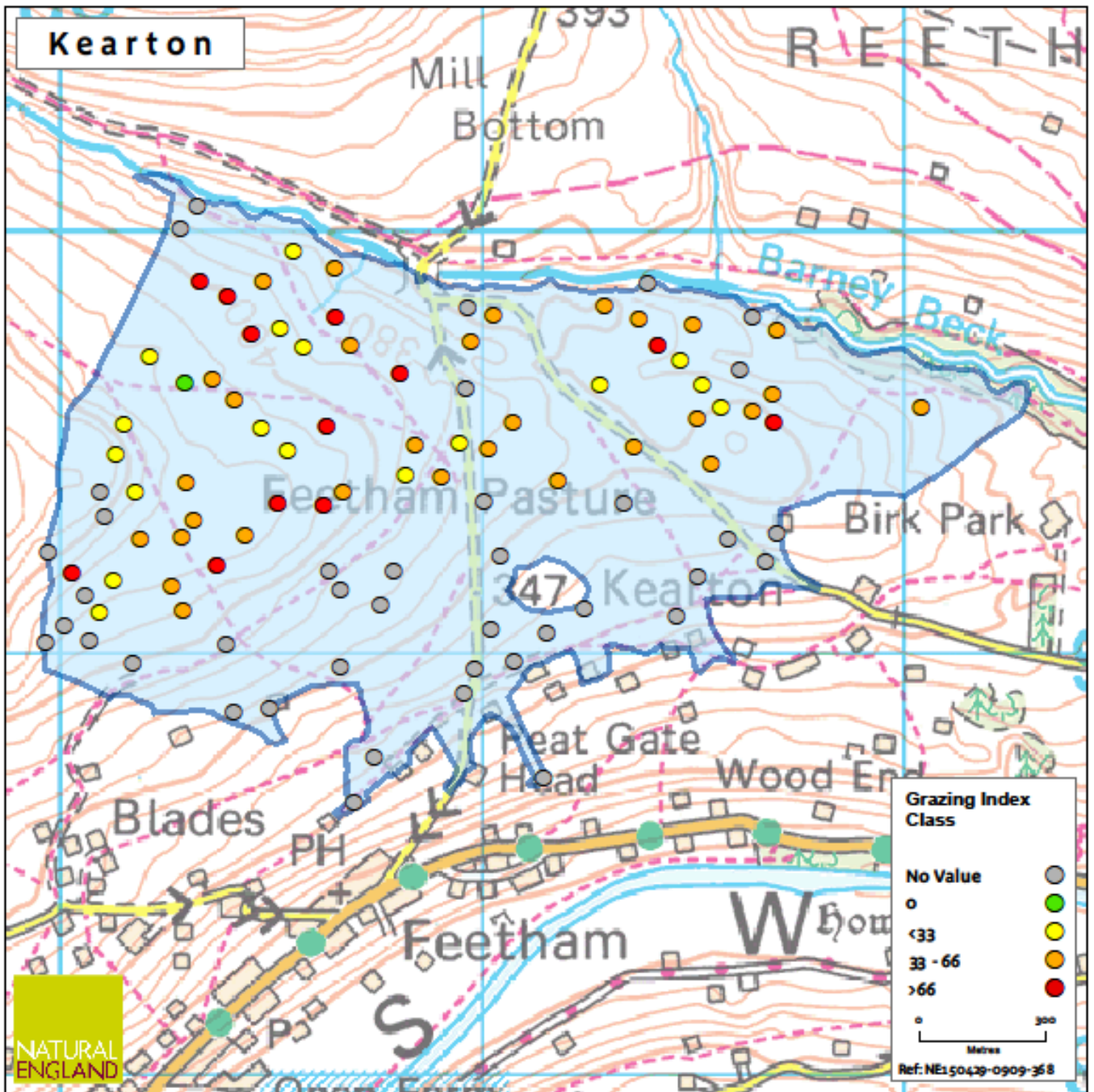
² n=9 (5 points with no BG/drainage information)

Targets assessed at feature extent:

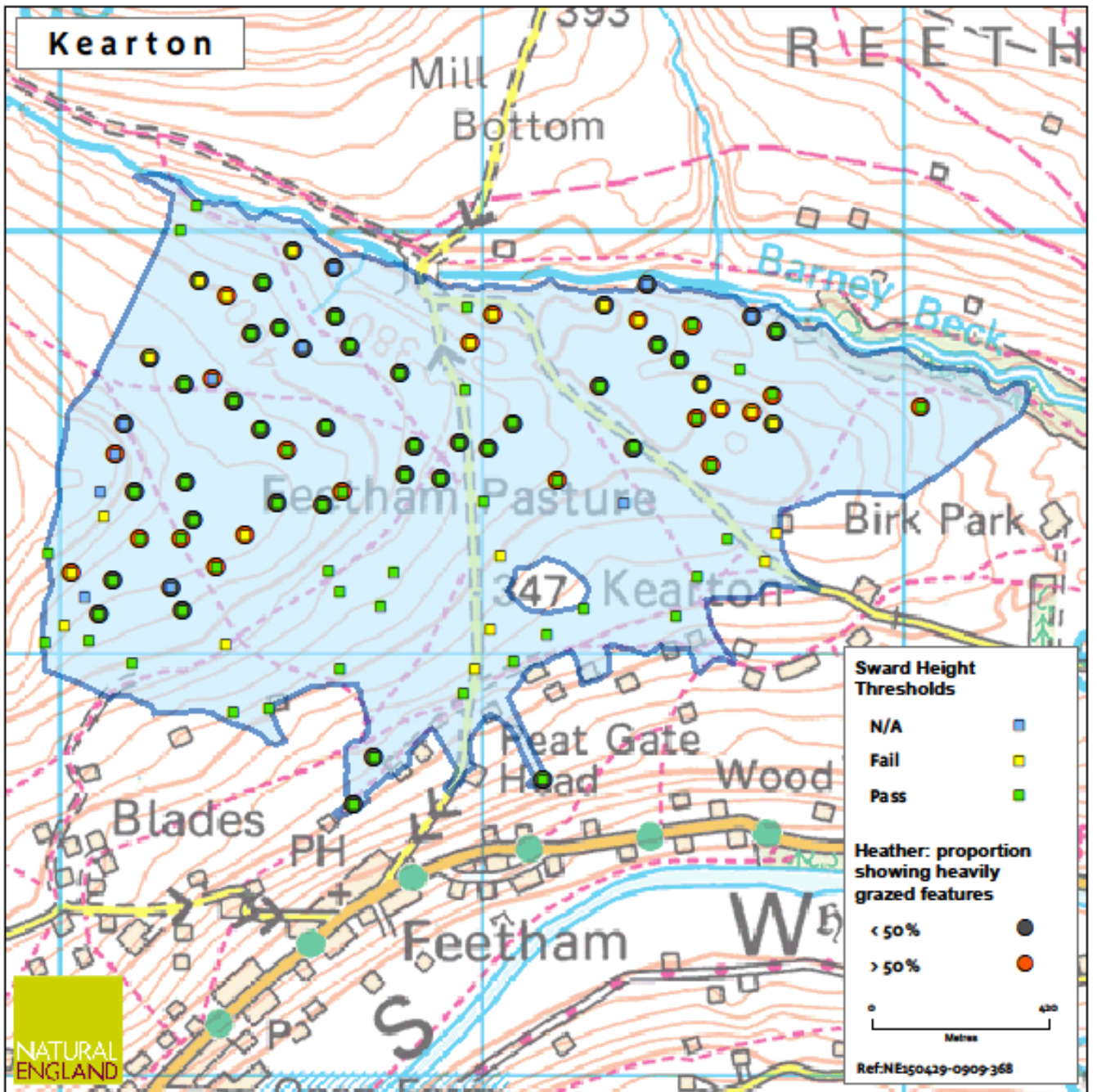
| Target | Pass or fail |
|-------------------------------------|--------------|
| Cover of non-native species < 1% | Pass |
| Cover of native trees/ shrubs < 10% | Pass |
| Cover of negative indicators < 1% | Pass |
| Burning of bryophyte layer absent | Pass |
| Burning of sensitive areas absent | Fail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

Indicator species frequencies ($n = 14$):

| Species | Frequency (%) | SD | Species | Frequency (%) | SD |
|---------------------------------|---------------|-----|--------------------------------|---------------|------|
| <i>Calluna vulgaris</i> | 93 | 6.9 | <i>E. vaginatum</i> | 64 | 12.8 |
| <i>Erica tetralix</i> | 0 | 0.0 | <i>Trichophorum cespitosum</i> | 0 | 0.0 |
| <i>Erica cinerea</i> | 0 | 0.0 | <i>Rhynchospora alba</i> | 0 | 0.0 |
| <i>Vaccinium myrtillus</i> | 7 | 6.9 | <i>Narthecium ossifragum</i> | 0 | 0.0 |
| <i>Vaccinium oxycoccus</i> | 0 | 0.0 | <i>Drosera</i> spp. | 0 | 0.0 |
| <i>Vaccinium vitis-idaea</i> | 0 | 0.0 | <i>Menyanthes trifoliata</i> | 0 | 0.0 |
| <i>Rubus chamaemorus</i> | 0 | 0.0 | <i>Sphagnum</i> spp. | 100 | 0.0 |
| <i>Empetrum nigrum</i> | 0 | 0.0 | <i>Racomitrium lanuginosum</i> | 0 | 0.0 |
| <i>Myrica gale</i> | 0 | 0.0 | Pleurocarpous mosses | 86 | 9.4 |
| <i>Andromeda polifolia</i> | 0 | 0.0 | Non-crustose lichens | 0 | 0.0 |
| <i>Eriophorum angustifolium</i> | 14 | 9.4 | | | |



Map 1: Distribution of random sampling points on Kearton Pasture 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 Kearton Pasture 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

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