Thornton Moor

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 Thornton Moor site was surveyed during 2 – 3 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

Thornton Moor is located in the South Pennines and covers 91 ha. It is part of the South Pennine Moors SSSI, SAC and SPA. The vegetation across the majority of the site (56% of sample points in 2014; Figure 1) is blanket bog (M19 *Calluna vulgaris - Eriophorum vaginatum* blanket mire), which is rather impoverished, with *Sphagnum* largely absent. There are also significant areas of heather heath, wet heath and fragmented heath (collectively, 26% of sample points) on shallower peat. Rough acid grassland also occurs relatively frequently (12% of sample points). Heather was found to be in the building and mature growth stages in approximately equal amounts (49% and 44% of sample points respectively, where found; Figure 3c), but with pioneer and degenerate heather very scarce across the site. The most commonly recorded dominant graminoids were *Eriophorum vaginatum* and *Nardus stricta* (Figure 3h).

2.2 Site management

In 1995, the site was assessed as being significantly overgrazed and the grazier was required to reduced stocking numbers to a maximum of 40 hoggs (only for the summer period) and 90 ewes,

and to rake sheep at least once a day to distribute grazing across the whole area. The site entered a Higher Level Stewardship (HLS) agreement in November 2007, which required all livestock to be excluded from 30 November to 15 May. The agreement was amended to Uplands Entry Level Stewardship / HLS in 2011, with a maximum of 80 ewes and the same stock-free period. On areas of rough grazing, there was also a requirement to follow HL8 prescriptions (restoration of rough grazing for birds), *i.e.* grazing with cattle and/or sheep at an agreed stocking density (between 0.4 and 1.0 Livestock Units ha^{-1} depending on site conditions and objective[1]) between 31 March and 20 June, and at other times, stocking densities managed to achieve the desired sward height.

Overgrazing was originally identified in 1995 and monitored again in 1998 using a modified version of the then English Nature Grazing Index (ENGI) - a more subjective assessment than later surveys which measured a heather grazing index (GI) based on the proportion of shoots grazed on sampled heather stems. Adherence to the grazing requirements and response of the vegetation was assessed 2002 and 2003, using an early version of the Surveillance Survey methods, which also inform the 2014 re-survey. Other surveillance variables including dwarf shrub heights, the presence of suppressed heather growth features, bare ground, animal droppings etc are measured as part of these surveys. The two earlier surveys involved 109 and 104 quadrats respectively, on a grid pattern.

2.3 Condition and grazing pressure in 2014

There was only very sparse evidence of grazing on the blanket bog, with heavily grazed features at only 3% of sample points, and a very low GI (4.9% overall) (Table 1), although sheep droppings were recorded at 23% of points. In the heather heath, no heavily grazed features or detached stems were recorded, and the mean heather grazing index was also low (6.6%), even although sheep droppings were present at 38% of sample points (32% overall; Figure 3f). Overall, only 5% of samples failed to meet the CSM GI target of less than 33%, above which level grazing is likely to be damaging (Figure 2, Table 1, Map 1) and were well scattered, although two points occurred on the north-eastern edge. The mean sward height at 6% of sample points where graminoid height could be measured, and 5% of samples overall, indicated that heavy grazing was likely in these areas (Map 2). These points were again well scattered but towards the edge of the moor.

There is no evidence of any burning across the whole site, either in the last 12 months or the previous 3-4 years (Figure 3e).

The mires habitat failed to achieve the condition assessment threshold (targets to be passed at 90% of sample points) relating to species composition (apart from negative indicators). At the overall site level, it also failed the overall target for maximum extent of eroding peat. This indicates the habitat is highly degraded, which might reflect historically high levels of air pollution in the area. Surprisingly, and despite the low grazing index, it was also judged to be below the condition threshold for browsing on dwarf shrubs, as assessed in the field. In contrast, the dry heath habitat passed the condition threshold for levels of browsing on dwarf shrub but did not meet the threshold for the number of indicator species. If the measure of dwarf shrub cover is taken as indicator species cover, which for Thornton Moor is a reasonable assumption as no *Racomitrium lanuginosum* was recorded, this threshold is similarly not achieved. Failure to meet these thresholds probably reflects recovery from past impacts of grazing.

2.4 Change since previous surveys

Previous surveys of the site used a different sampling regime from that in 2014 so formal analysis of change is not possible. However, some general comparisons can be made between the various survey periods. Between the first assessment in 1995 and the next in 1998, there had been a significant improvement in condition of heather on the site, and an increase in its extent. The site was assessed as still significantly overgrazed in 2000, but in 2003 this was no longer the case. The

[1] Note that LU equivalents have varied among different schemes

mean grazing index in 2003 was 27% but in 2014 was substantially lower, at only 4.9%. Comparison with the 2003 results suggests that the dominant growth stage of heather on the heather heath has shifted from 'building' to 'mature'. There has been similar shift on the blanket bog, although in 2014 there are equal frequencies of building and mature growth phases. Heather also shows a corresponding increase in height across the site. No burning was recorded in either survey.

The restrictions on grazing imposed since 1995, and subsequently under the HLS agreement, appear to have been very successful in reducing the grazing intensity on heather to very low levels. It is possible that the failure of blanket bog to pass the condition assessment threshold for browsing of dwarf shrubs could be attributable partly to background levels of grazing from wild herbivores, since there was no evidence of heavy grazing by sheep, even although sheep droppings were recorded at a high proportion of sample points. Despite this, and the fact that burning has not been a recent issue on the site, the blanket bog vegetation is still in poor condition and lacks the typical suite of species, including *Sphagnum*. This is probably a legacy of the historically high levels of grazing, combined with atmospheric pollution from local industry and suggests that re-colonisation of typical blanket bog species will only occur over much longer timescales or with more interventionist restoration practices.

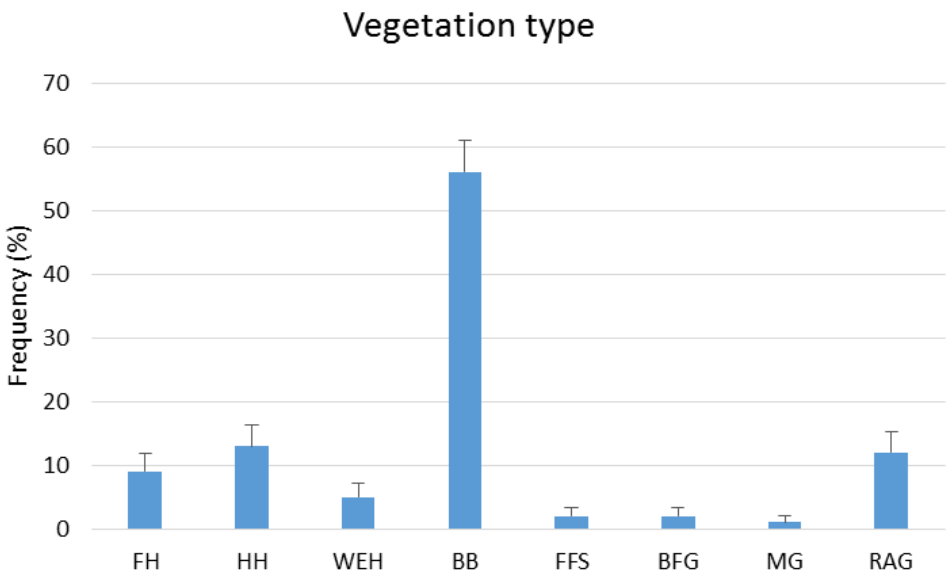

Figure 1. Frequency of vegetation types across the site in 2014. Bars are standard deviations. FH – fragmented heath; HH – heather heath; WEH – wet heath; BB – blanket bog; FFS – flush, fen, & swamp; BFG – bent-fescue grassland; MG – mesotrophic grassland; RAG – rough acid grassland.

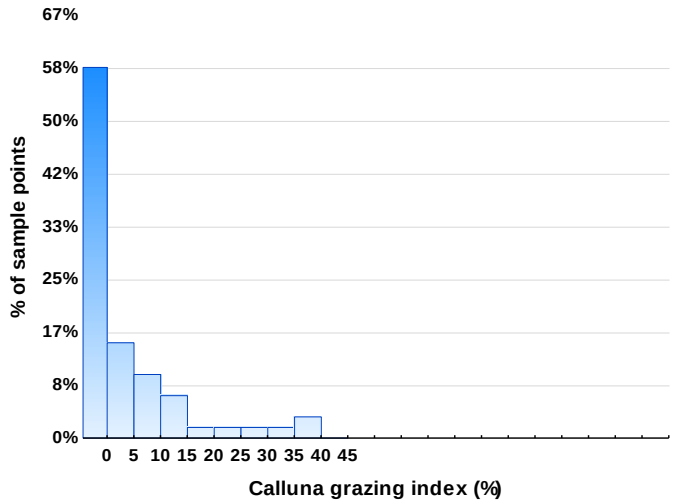

Figure 2. Frequency distribution of heather Grazing Index from sample points containing heather at whole site level in 2014.

Table 1. 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[1] (*n* = 60)	Heather Heath (*n* = 8)	Blanket Bog (*n* = 41)	Other[2] (*n* = 10)
Grazing Index	4.9 ±9.49	6.6 ±13.36	4.2 ±8.65	7.0 ±10.33
Samples ≥ 33.3%	5.0%	12.5%	2.4%	10.0%
Samples ≥ 66.6%	0.0%	0.0%	0.0%	0.0%

[1] non-target habitats *n*=1
[2] wet heath *n*=5, fragmented heath *n*=5

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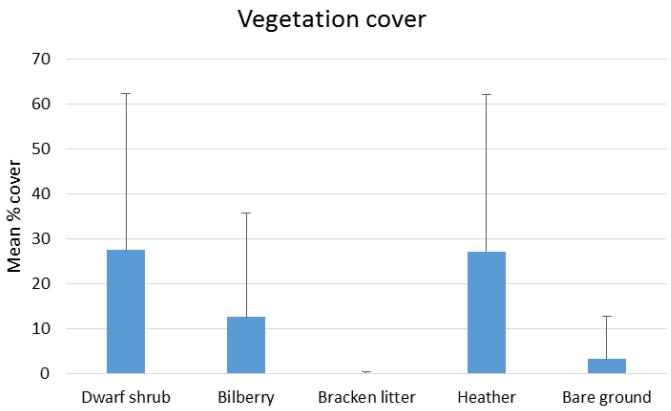

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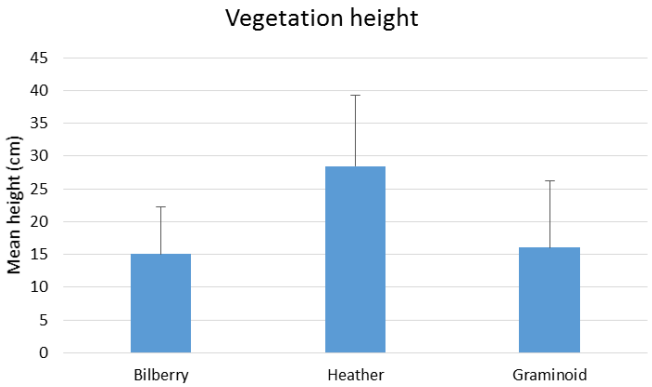

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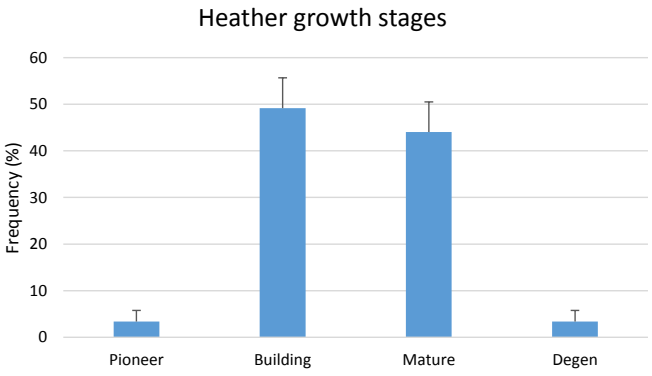

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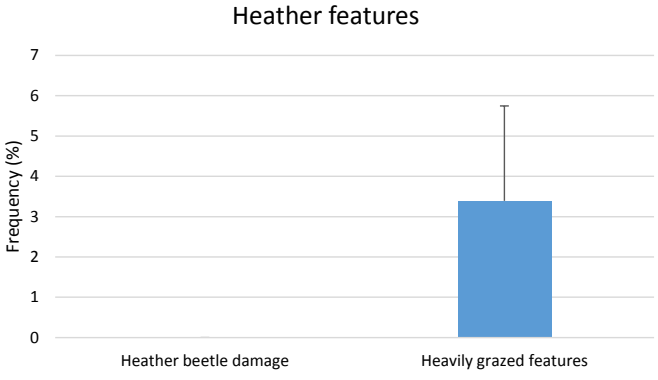

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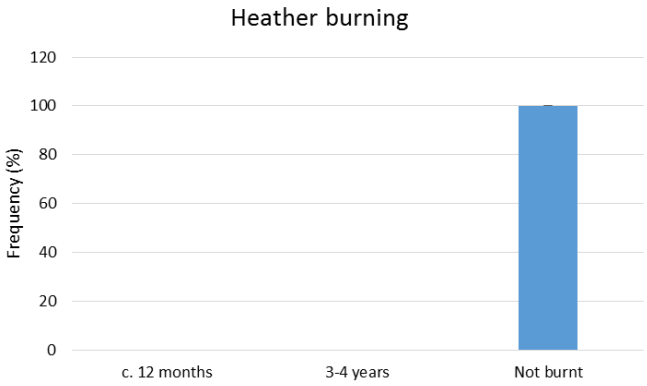

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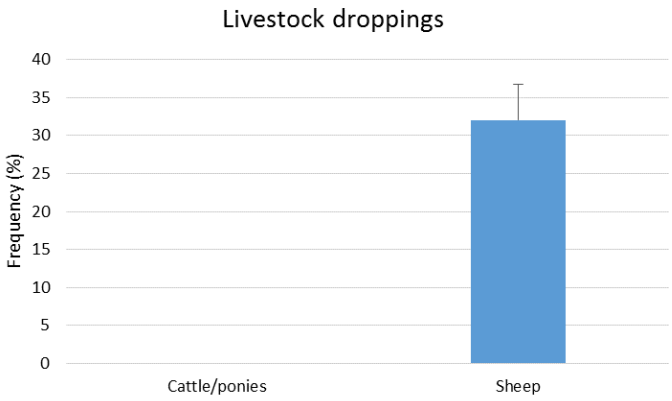

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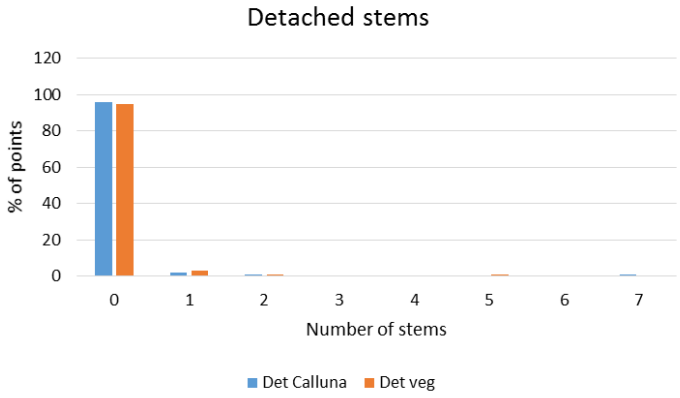

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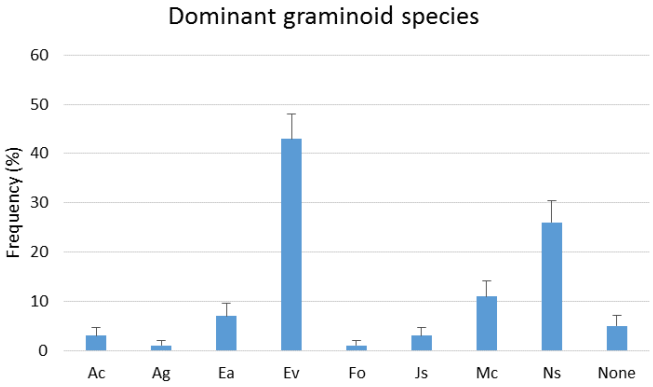


Figure 3. Surveillance variables at whole site level in 2014 (bars are standard deviations).

3. Overgrazing surveillance variables 2014

		Heather Heath (*n* = 13)			Blanket Bog (*n* = 56)			Other Target types* (*n* = 16)		
Category	**Variable**	**Mean**	**SD**	***n***	**Mean**	**SD**	***n***	**Mean**	**SD**	***n***
Peat	Peat depth (cm)	21	9.4	12	66	28.3	56	21	9.0	13
Vegetation cover	Dwarf shrub cover (%)	42	42.7	13	34	36.2	56	20	25.6	16
	Bilberry cover (%)	32	33.1	13	13	23.9	56	4	7.7	16
	Bracken litter cover (%)	0	0.0	13	0	0.7	56	0	0.0	16
	Calluna cover (%)	42	42.7	13	33	36.3	56	20	25.6	16
	Bare ground (%)	2	6.9	13	4	9.0	56	5	15.4	16
Vegetation height	Bilberry height (cm)	15	3.7	10	17	7.8	34	11	6.0	6
	Calluna height (cm)	37	12.0	8	29	9.8	40	21	9.5	10
	Graminoid height (cm)	14	5.1	9	17	9.7	47	12	5.8	16
Heather growth stages	Pioneer (% of points)	0	0.0	8	3	2.5	40	10	9.5	10
	Building (% of points)	13	11.7	8	48	7.9	40	80	12.6	10
	Mature (% of points)	75	15.3	8	48	7.9	40	10	9.5	10
	Degenerate (% of points)	13	11.7	8	3	2.5	40	0	0.0	10
Heather features	Heather beetle damage (% of points)	0	0.0	8	0	0.0	40	0	0.0	10
	Heavily grazed features (% of points)	0	0.0	8	3	2.5	40	10	9.5	10
Heather burning	Burnt (*c.* 12 months) (% of points)	0	0.0	8	0	0.0	40	0	0.0	10
	Burnt (3-4 years) (% of points)	0	0.0	8	0	0.0	40	0	0.0	10
Droppings	Cattle / ponies (% of points)	0	0.0	13	0	0.0	56	0	0.0	16
	Sheep (% of points)	38	13.5	13	23	5.6	56	38	12.1	16
Detached stems	Detached Calluna (no.)	0	0.0	13	0.2	1.0	56	0	0.0	16
	Detached vegetation (no.)	0	0.0	13	0.1	0.7	56	0	0.0	16

* Other target types = Fragmented Heath (*n*=9); Wet heath (*n*=5); and Flushes, fens & swamps (*n*=2).

4. Habitat condition assessment results 2014

4.1 Dry heath

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

Dry heath (*n*=13 heather heath + 7 fragmented heath)		
Target	% of points passed	Habitat pass or fail
Presence of moss, liverworts and non-crustose lichens[1]	95	Pass
At least 50% of vegetation cover made up of Table 1 indicator species[2]	55	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)	55	Fail
Cover of weeds < 1%	100	Pass
Cover of soft rush < 10%	100	Pass
Dwarf shrub browsing < 33%	100[3]	Pass
Disturbed bare ground < 10%	95	Pass

[1] assessed in 1 x 1 m quadrat
[2]assessed as total dwarf shrub cover, excluding dead and pioneer heather and recent burns
[3] *n*=9 (11 points with no 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	Pass
Disturbed bare ground < 10%	Pass
Mature heather ≥10% & all growth phases present	Pass

Indicator species frequencies (*n* = 20):

Species	**Frequency (%)**	**SD**
Calluna vulgaris	70	10.2
Erica tetralix	0	0.0
Erica cinerea	0	0.0
Vaccinium myrtillus	80	8.9
Vaccinium oxycoccus	0	0.0
Vaccinium vitis-idaea	0	0.0
Empetrum nigrum	30	10.2
Racomitrium lanuginosum	0	0.0
Ulex gallii	0	0.0
Myrica gale	0	0.0

4.2 Wet heath

This habitat type was recorded at 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

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

Mires (*n*=56 blanket bog + 2 flushes, fens & swamps)		
Target	% of points passed	Habitat pass or fail
At least 6 indicator species present	33	Fail
At least 50% of vegetation cover made up of at least 3 indicator species	79	Fail
Sphagnum cover should not consist of only *Sphagnum fallax*	36 [1]	Fail
Any one of *Eriophorum vaginatum*, Ericaceous spp. collectively or *Trichophorum* should not individually exceed 75% of veg cover	40	Fail
Less than 1% of vegetation cover to comprise of negative indicators	97	Pass
Dwarf shrub browsing < 33%	75 [2]	Fail
Disturbed bare ground/ drainage < 10%	98	Pass
Broken / crushed *Sphagnum* < 10%	100	Pass

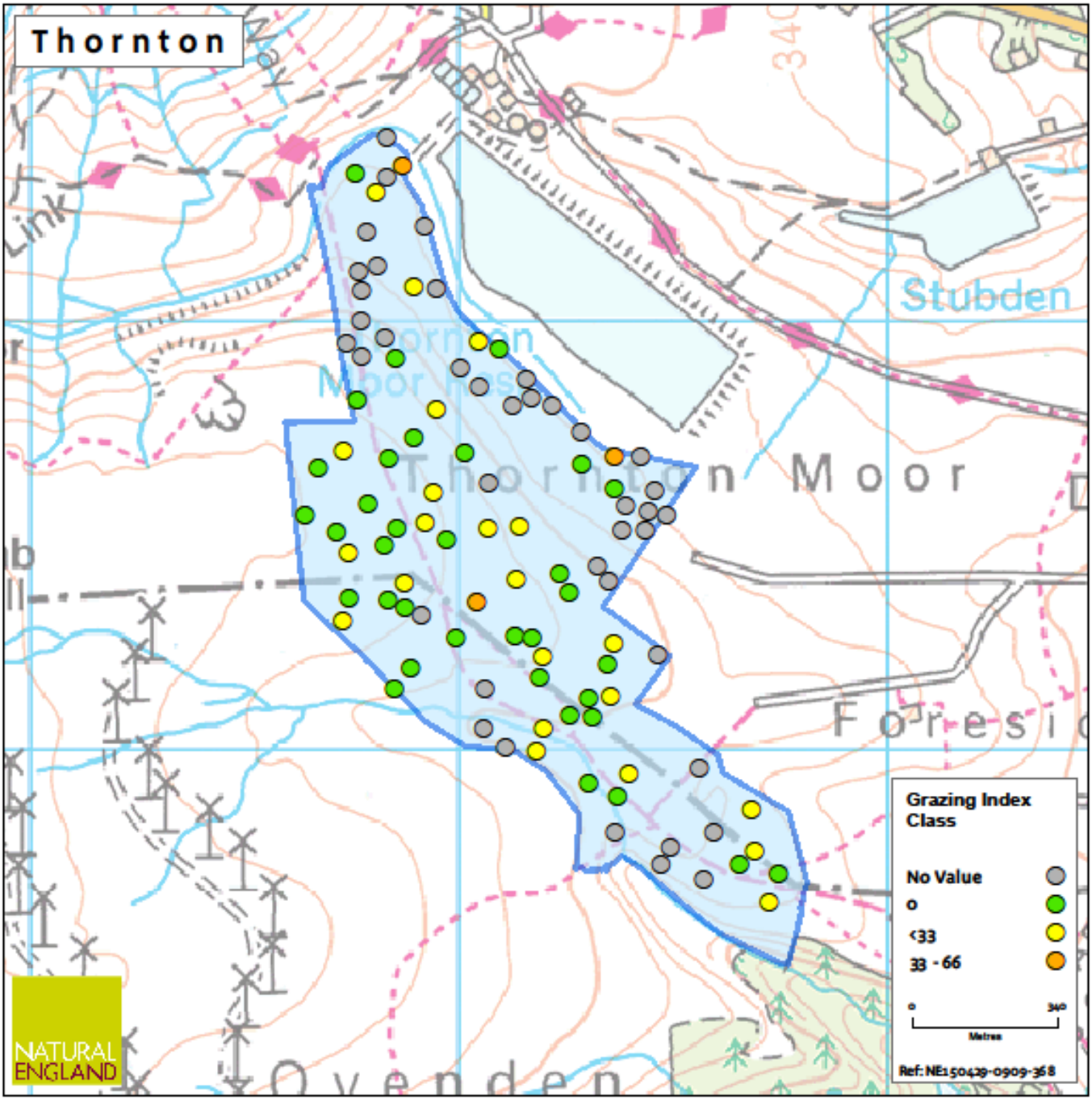
[1] *n*=11 (11 point with *Sphagnum* present)
[2] *n*=57 (1 point with no information)

Targets assessed at feature extent:

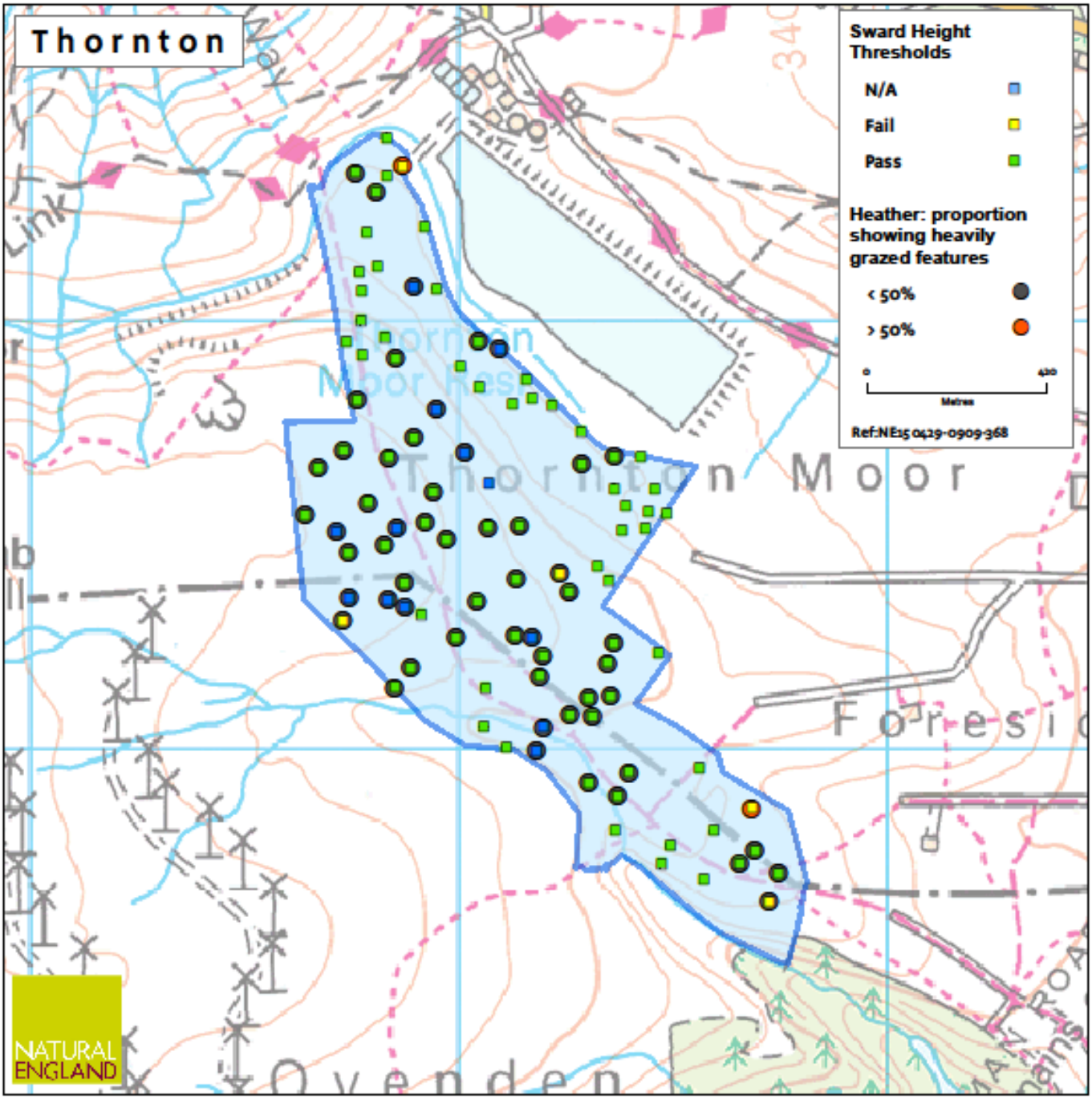
Target	**Pass or fail**
Cover of non-native species < 1%	Pass
Cover of native trees/ shrubs < 10%	Pass
Cover of negative indicators < 1%	Pass
Burning of bryophyte layer absent	Pass
Burning of sensitive areas absent	Pass
Extent of eroding peat	Fail
Disturbed bare ground < 10%	Pass

Indicator species frequencies (*n* = 58):

Species	**Frequency (%)**	**SD**		**Species**	**Frequency (%)**	**SD**
Calluna vulgaris	76	5.6		*E. vaginatum*	93	3.3
Erica tetralix	5	2.9		*Trichophorum cespitosum*	0	0.0
Erica cinerea	0	0.0		*Rhynchospora alba*	0	0.0
Vaccinium myrtillus	69	6.1		*Narthecium ossifragum*	0	0.0
Vaccinium oxycoccus	2	1.7		*Drosera* spp.	0	0.0
Vaccinium vitis-idaea	0	0.0		*Menyanthes trifoliata*	0	0.0
Rubus chamaemorus	0	0.0		*Sphagnum* spp.	19	5.1
Empetrum nigrum	45	6.5		*Racomitrium lanuginosum*	0	0.0
Myrica gale	0	0.0		Pleurocarpous mosses	71	6.0
Andromeda polifolia	0	0.0		Non-crustose lichens	38	6.4
Eriophorum angustifolium	50	6.6				



Map 1: Distribution of random sampling points on Thornton Moor 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 Thornton Moor 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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