Arnfield Moor

1. Introduction

Natural England (NE) and its predecessors have 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 Arnfield Moor site was re-surveyed during 24 – 26 February 2015. 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

Arnfield Moor is located in the North Peak and is 832 ha in area. It falls within the Dark Peak SSSI, and the South Pennine Moors SAC and SPA. The majority of the site is heather heath (51% of sample points in 2015) and blanket bog (36%), with only small areas of other vegetation types present (Figure 1). The heather heath is located mainly on the lower slopes of Ormes Moor, Arnfield Flats, Boar Flat, Arnfield Moor and Tintwhistle Low Moor. The blanket bog is concentrated on the upper plateaux areas towards the north and east of the moor, encompassing Tintwhistle Knarr, Windgate Edge, Featherbed Moss and Robinson's Moss. Much of the blanket bog is M20 *Eriophorum vaginatum* blanket mire, some of which appeared to have been degraded by burning, at least historically. There was also some regenerating heather (*Calluna vulgaris*) and bilberry (*Vaccinium myrtillus*) on more recent burns, and heather and bilbery were both dominant locally.

Heather occurs frequently on the site, being present at 77% of sample points in 2015, and having mean cover of 59% on heather heath and 34% on blanket bog. Heather was predominantly in the mature growth stage at just over half of the sample points where it was present, with approximately one quarter in the building stage and both degenerate and pioneer also well represented (Figure

3c). Graminoids were absent at a substantial number of sample points (39%). Where graminoids were present, the most frequently dominant species were *Eriophorum vaginatum, E. angustifolium* and *Festuca ovina* (Figure 3h).

2.2 Site management

The site was in an agreement in the North Peak Environmentally Sensitive Area (ESA), and was subjected to surveys of heather condition in 1993, 1994, 1995 and 1996. These surveys focussed on grazing pressure on dwarf shrub, deriving a heather grazing index (GI) from shoots collected in the field, from around 100 quadrats in each survey, stratified by dominant and sub-dominant heather areas. In ESA monitoring surveys the GI was converted to a measure of Biomass Utilisation (BU) using a mathematical function, although later surveillance surveys on other sites and in the current survey have reverted to the more objective measure of GI.

The site entered a Tier 1C management agreement in the North Peak Environmentally Sensitive Area (ESA) in 1994, which required a maximum of 0.15 LU ha^{-1} (1 ewe ha^{-1} plus followers), and a 25% reduction in overwintering ewes and replacement hoggs during 1 November to 28 February. Cattle and horses were also prohibited during the overwinter period. There was also a requirement to avoid localised damage from heavy grazing and to agree a burning management plan. Prior to 1994, the site had been under Tier 2 agreement in the original ESA scheme, which specified the same maximum stocking levels but a shorter off-wintering period (January to March inclusive). In 2013, the site entered a Higher Level Scheme (HLS) agreement for restoration of moorland (option HL10), along with seasonal livestock exclusion (HL15) in defined areas during January and December[1]. Over a 367 ha part of the site, the prescribed stocking rates were 0.3 – 0.5 ewes ha^{-1} plus followers during winter (October – March inclusive) and 0.4 – 0.8 ewes ha^{-1} plus followers during summer (and zero cattle or equines).

2.3 Condition and grazing pressure in 2015

Levels of grazing in 2015 was fairly low, the mean GI being 16% in the heather heath and blanket bog (the overall mean was slightly higher (18%; Table 1) but was skewed by a single high value from fragmented heath). However, 10% of sample points containing heather failed to meet the CSM GI target of less than 33%, indicating a level of grazing likely to be damaging in these areas (Table 1, Figure 2, Map 1). These tended to be in the northern half of the moor, but there was no obvious clustering. Sheep droppings were fairly widespread (present at 17% of sample points; Figure 3f) and detached vegetation or heather stems at *c.* 10% frequency (Figure 3g). However, heavily grazed features on heather were only noted at 5% of points where heather was present (Figure 3d; Map 2). Recent burning was present at 7% of the sample points containing heather (Figure 3e), and heather beetle damage was also noted at 3% (Figure 3d). The mean sward height at 30% of sample points where graminoid height could be measured, or 14% of the overall sample, indicated that heavy grazing (Map 2). These short sward measurements were most common on Tintwhistle Low Moor in the south of the site.

The dry heath habitat was below the condition assessment minimum threshold (targets to be passed at 90% of sample points) for the number of indicator species present, and on the range of heather growth phases, with no pioneer heather recorded as the main growth stage at any sample point in this habitat. If the measure of dwarf shrub cover is taken as indicator species cover, which for Arnfield is a reasonable assumption as no *Racomitrium lanuginosum* was recorded, this threshold is similarly not achieved. Condition assessment thresholds for dwarf shrub composition are however achieved. The mires habitat was impoverished and also below the minimum thresholds for number and cover of indicator species and relative covers of key species. Sphagnum was only present at three sample points, which may well also reflect historically high levels of atmospheric pollution, as with much upland vegetation in Peak District. It was also just below the condition

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

assessment threshold for browsing on dwarf shrubs and failed the criteria relating to burning. The burning was attributable to an accidental wildfire in April 2014 on part of the site, rather than to managed burns.

Exposed peat was a significant feature along the sides of numerous gullies in blanket bog areas on plateaux. However, the site passed the criterion relating to eroding peat because it generally appeared to be consolidating rather than eroding, with a number of exposed surfaces recently colonised by *Campylopus* sp. and *Eriophorum angustifolium* where many of the gullies had been blocked with large boulders.

2.4 Change since previous surveys

Previous surveys of the site as part of the ESA monitoring programme used a different sampling regime from that in 2015 so formal analysis of change was not possible. However, some general comparisons could be made. 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 46% of the sample, but the level of biomass utilisation (and presumably suppression) of heather declined during that period, albeit with annual variation. Although the methods used were different from the 2015 survey, this does suggest that these historic grazing levels were higher than at present.

The reduction in stocking rates under subsequent agri-environment schemes appears to have been successful in reducing grazing intensity on heather. However, restoration of the full indicator species complement in both heather heath and blanket bog is likely only to occur over a longer period of time, and might require some further reductions in grazing levels. The gully-blocking to slow the flow of water and consolidate previously eroding peat appears to be having some beneficial effect.

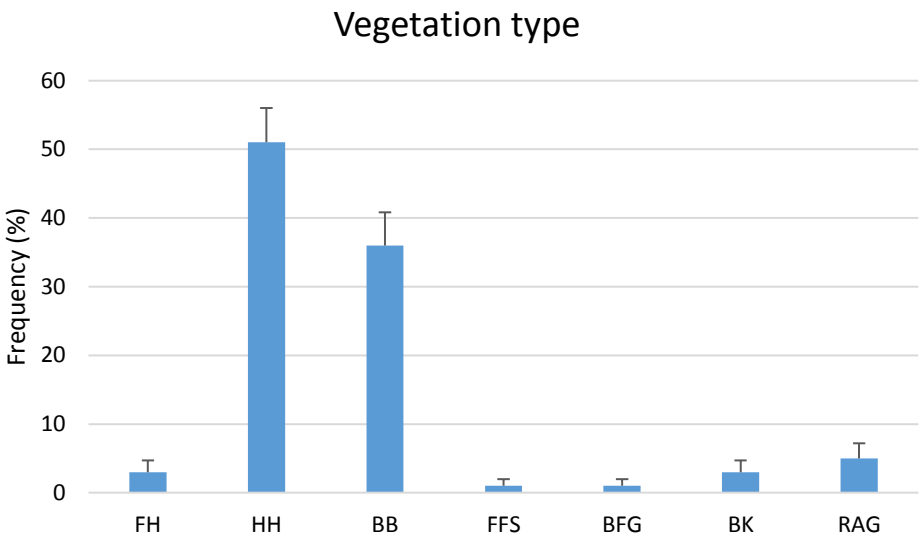


Figure 1. Frequency of vegetation types across the site in 2015. Bars are standard deviations. FH – fragmented heath; HH – heather heath; BB – blanket bog; FFS – flush, fen, & swamp; BFG – bent-fescue grassland; BK – bracken; RAG – rough acid grassland.

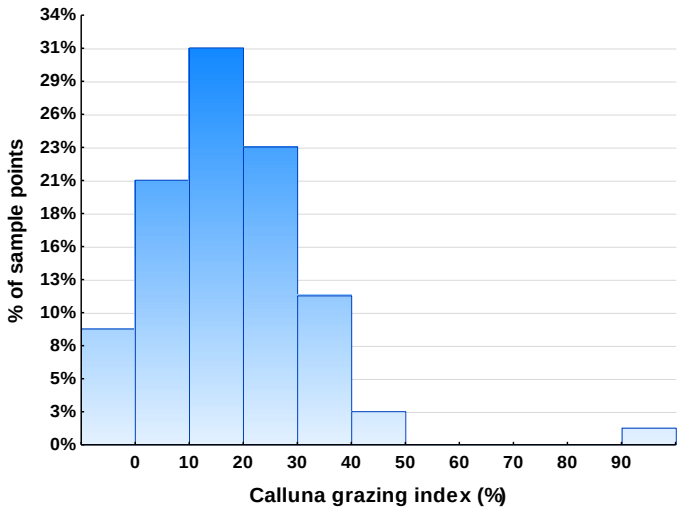


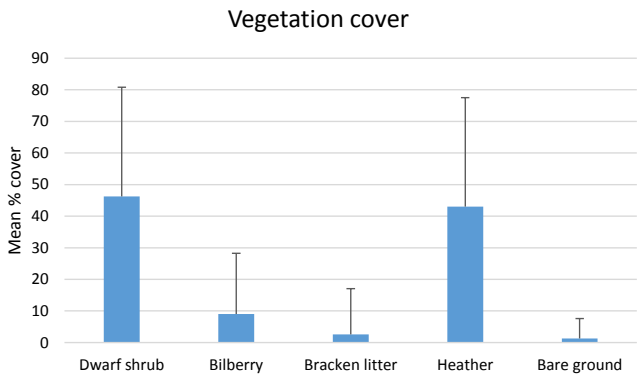
Figure 2. Frequency distribution of heather Grazing Index from sample points containing heather at whole site level in 2015.

Table 1. Heather Grazing Index at site level and by target vegetation type in 2015 (mean ± standard deviation; *n* is number of sample points with heather stems).

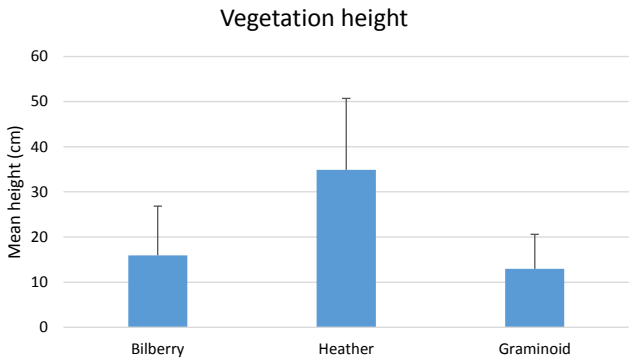
	Overall* (*n* = 77)	Heather Heath (*n* = 48)	Blanket Bog (*n* = 25)
Grazing Index	17.9 ±14.97	16.2 ±10.35	16.4 ±13.17
Samples ≥ 33.3%	10.4%	6.3%	12.0%
Samples ≥ 66.6%	1.3%	0.0%	0.0%

* fragmented heath *n*=3, non-target habitats *n*=1

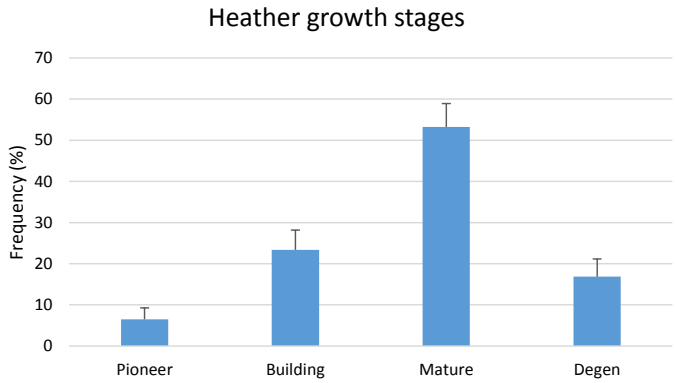
a)



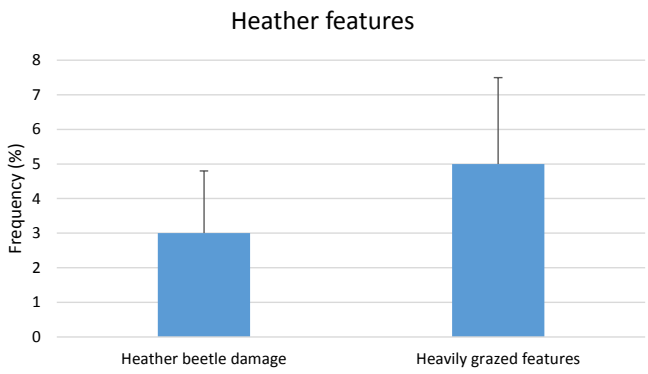
b)



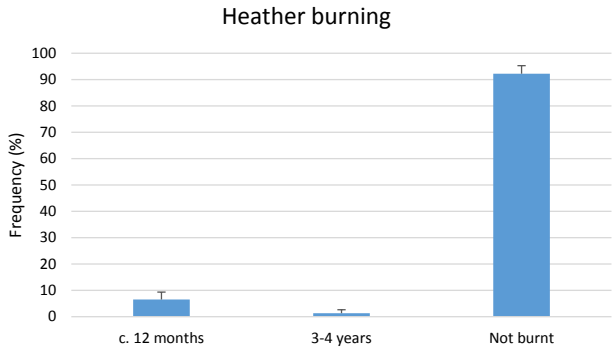
c)



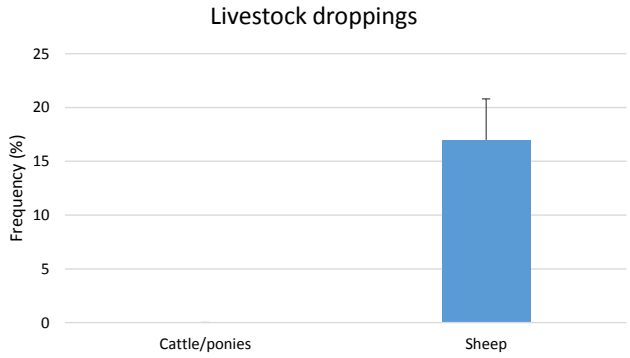
d)



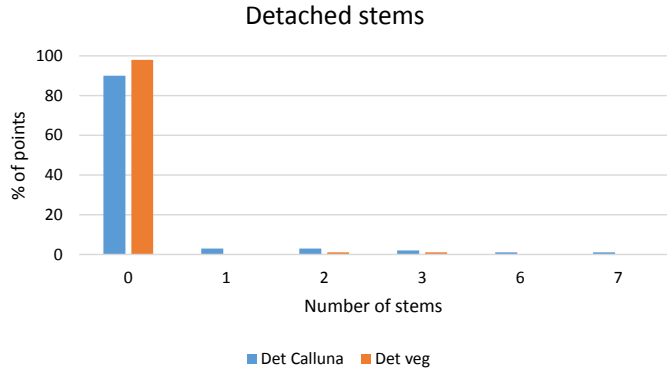
e)



f)



g)



h)

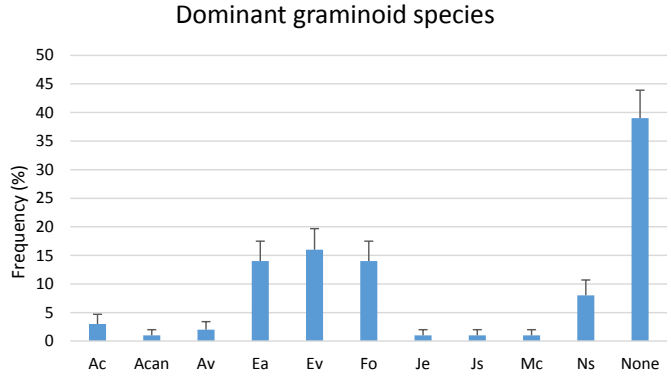


Figure 3. Surveillance variables at whole site level in 2015 (bars are standard deviations).

3. Overgrazing surveillance variables 2015

		Heather Heath (*n* = 51)			Blanket Bog (*n* = 36)		
Category	**Variable**	**Mean**	**SD**	***n***	**Mean**	**SD**	***n***
Peat	Peat depth (cm)	15	10.8	45	95	13.0	36
Vegetation cover	Dwarf shrub cover (%)	62	28.0	51	39	34.1	36
	Bilberry cover (%)	10	21.3	51	10	19.1	36
	Bracken litter cover (%)	0	0.9	51	0	0.0	36
	Calluna cover (%)	59	29.3	51	34	32.9	36
	Bare ground (%)	1	5.2	51	2	8.5	36
Vegetation height	Bilberry height (cm)	18	12.1	25	13	9.1	19
	Calluna height (cm)	39	14.2	49	29	16.0	25
	Graminoid height (cm)	8	5.6	21	17	6.5	30
Heather growth stages	Pioneer (% of points)	0	0.0	49	20	8.0	25
	Building (% of points)	22	6.0	49	20	8.0	25
	Mature (% of points)	61	7.0	49	40	9.8	25
	Degenerate (% of points)	16	5.3	49	20	8.0	25
Heather features	Heather beetle damage (% of points)	2	2.0	49	4	3.9	25
	Heavily grazed features (% of points)	6	3.4	49	0	0.0	25
Heather burning	Burnt (*c.* 12 months) (% of points)	0	0.0	49	20	8.0	25
	Burnt (3-4 years) (% of points)	0	0.0	49	4	3.9	25
Droppings	Cattle / ponies (% of points)	0	0.0	51	0	0.0	36
	Sheep (% of points)	25	6.1	51	0	0.0	36
Detached stems	Detached Calluna (no.)	0.5	1.4	51	0	0.0	36
	Detached vegetation (no.)	0.0	0.3	51	0	0.0	36

4. Habitat condition assessment results 2015

4.1 Dry heath

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

Dry heath (*n*=51 heather heath + 3 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]	80	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)	57	Fail
Cover of weeds < 1%	100	Pass
Cover of soft rush < 10%	93	Pass
Dwarf shrub browsing < 33%	91	Pass
Disturbed bare ground < 10%	98	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* = 54):

Species	**Frequency (%)**	**SD**
Calluna vulgaris	96	2.6
Erica tetralix	0	0.0
Erica cinerea	2	1.8
Vaccinium myrtillus	52	6.8
Vaccinium oxycoccus	0	0.0
Vaccinium vitis-idaea	0	0.0
Empetrum nigrum	19	5.3
Racomitrium lanuginosum	2	1.8
Ulex gallii	0	0.0
Myrica gale	0	0.0

4.2 Mires

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

Mires (*n*=36 blanket bog + 1 flushes, fens & swamps)		
Target	% of points passed	Habitat pass or fail
At least 6 indicator species present	14	Fail
At least 50% of vegetation cover made up of at least 3 indicator species	86	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	57	Fail
Less than 1% of vegetation cover to comprise of negative indicators	95	Pass
Dwarf shrub browsing < 33%	83[2]	Fail
Disturbed bare ground/ drainage < 10%	97	Pass
Broken/ crushed Sphagnum < 10%	100	Pass

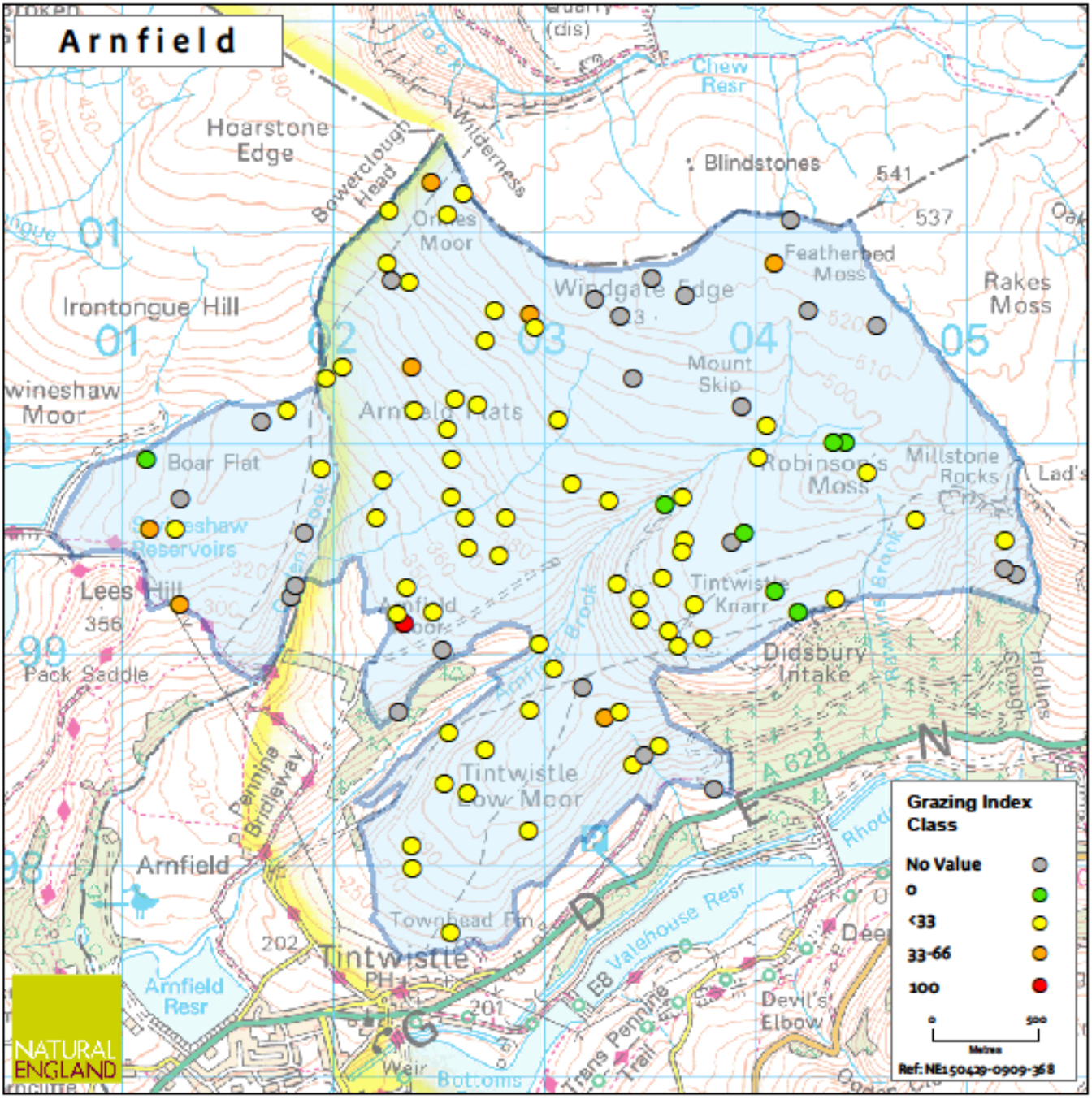
[1] *n*=3 (3 points with Sphagnum present)
[2] *n*=35 (2 points with no information)

Targets assessed at feature extent:

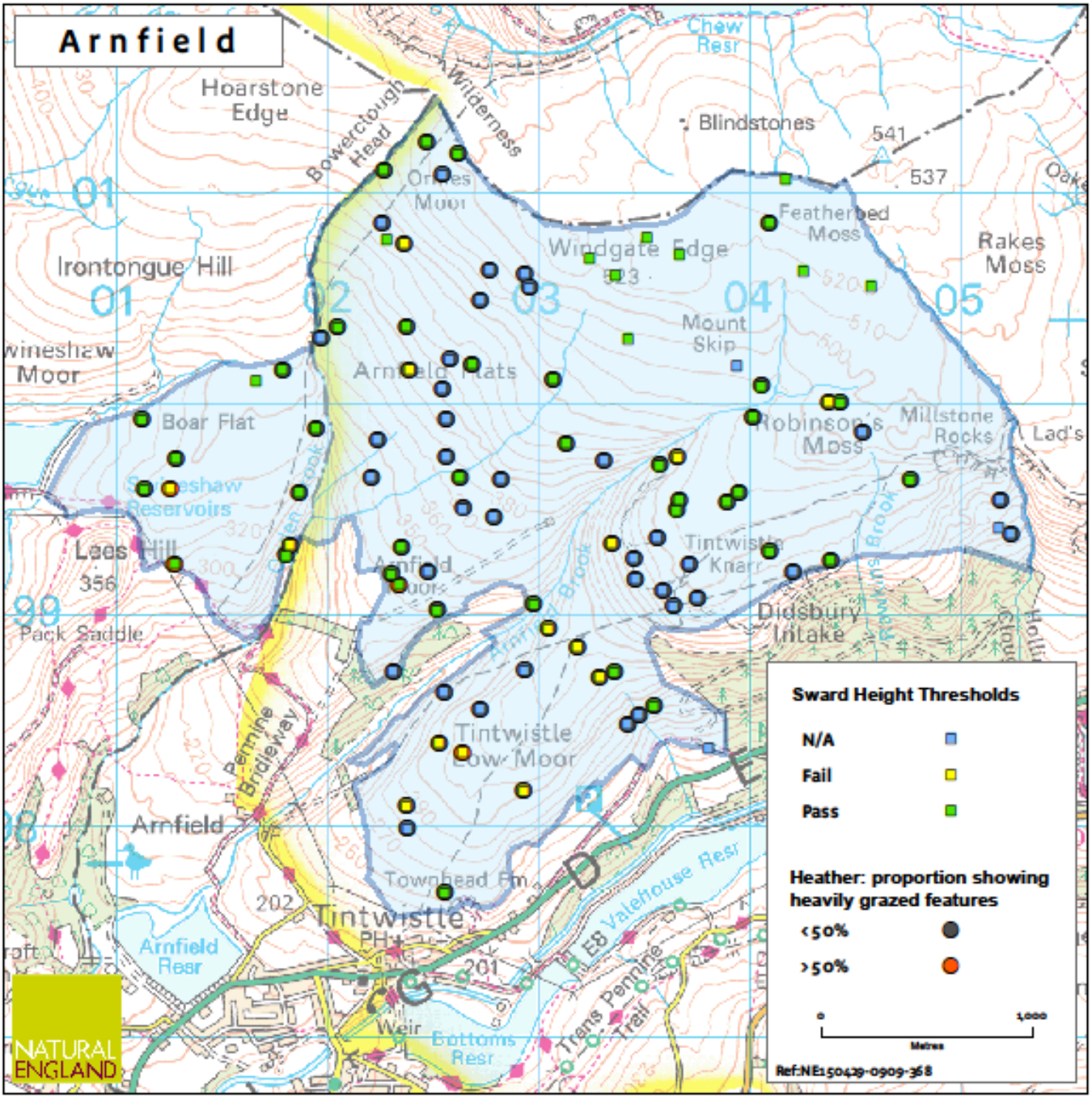
Target	**Pass or fail**
Cover of non-native species < 1%	Pass
Cover of native trees/ shrubs < 10%	Pass
Cover of negative indicators < 1%	Pass
Burning of bryophyte layer absent	Fail
Burning of sensitive areas absent	Fail
Extent of eroding peat	Pass
Disturbed bare ground < 10%	Pass

Indicator species frequencies (*n* = 37):

Species	**Frequency (%)**	**SD**		**Species**	**Frequency (%)**	**SD**
Calluna vulgaris	86	5.6		*E. vaginatum*	73	7.3
Erica tetralix	3	2.7		*Trichophorum cespitosum*	0	0.0
Erica cinerea	0	0.0		*Rhynchospora alba*	0	0.0
Vaccinium myrtillus	65	7.8		*Narthecium ossifragum*	0	0.0
Vaccinium oxycoccus	0	0.0		*Drosera* spp.	0	0.0
Vaccinium vitis-idaea	0	0.0		*Menyanthes trifoliata*	0	0.0
Rubus chamaemorus	3	2.7		*Sphagnum* spp.	8	4.5
Empetrum nigrum	32	7.7		*Racomitrium lanuginosum*	5	3.7
Myrica gale	0	0.0		Pleurocarpous mosses	81	6.4
Andromeda polifolia	0	0.0		Non-crustose lichens	5	3.7
Eriophorum angustifolium	70	7.5				



Map 1: Distribution of random sampling points on Arnfield Moor in 2015, 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 Arnfield Moor in 2015, 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** .

Report number RP01639 Number 1

ISBN 978-1-78354-385-4