Fieldwork to Support Habitat Restoration Work at The Frith, South Lopham

NVC survey and initiation of Vegetation Monitoring Programme June 2017

Undertaken on behalf of the Little Ouse Headwaters project

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SUMMARY

1. The core of the Little Ouse Headwaters Project (LOHP) area lies within the Blo' Norton and Thelnetham Fens SSSI, which forms part of the Waveney and Ouse Valley Fens Special Area of Conservation (SAC). The Frith, South Lopham occupies a low, sandy ridge forming part of the headwaters of the Waveney and Little Ouse rivers, which is situated along the western boundary of the Redgrave and Lopham Fens National Nature Reserve (NNR), also part of the Special Area of Conservation.

2. LOHP has requested that a National Vegetation Classification survey of The Frith is carried out following a period of habitat restoration, and that three permanent monitoring plots are established on the site's grassland and peatland as part of the Vegetation Monitoring Programme. The initial survey of the plots will provide a baseline for assessing the changes that may occur in the structure and composition of these habitats as restoration proceeds.

3. Four grassland NVC communities were identified. An area of acid grassland forms the southwest corner of the site, with an immature stand to its north; this is the Typical sub-community of the *Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland (U1b). The margin of the immature stand includes a re-excavated field pond, mantled by a grassy swamp of the *Glycerietum fluitantis* Wilczek 1935, *Alopecurus geniculatus* sub-community (S22c). Several mildly acidic swards were distinguished over large parts of the main field and fringing the area of peat in the southeast corner. These variants are all assigned to the *Anthoxanthum odoratum* sub-community of the *Lolio-Cynosuretum* community (MG6b). Although Creeping Thistle is actively managed against, one vigorous stand of the *Urtica dioica-Cirsium arvense* community, *Lolium perenne-Papaver rhoeas* sub-community (OV25c) is mapped separately. Two distinct and mildly calcareous grassland stands of the *Trisetum flavescens* sub-community (MG6c) are located in the northwest and northeast corners of the main field. The shallow depressions in this field are distinguished as *Lolium perenne – Poa trivalis* swards assigned to the *Lolio-Plantaginion* Sissingh 1969 p.p (MG7b).

4. A small wooded area on the margin of the main field neighbouring the peatland area is an immature form of the *Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland, *Holcus lanatus* sub-community (W10d).

5. The rush-dominated vegetation forming the southeast corner of the stand grades from rush-pasture towards degraded fen-meadow, and is collectively assigned to the *Holco-Juncetum effusi* Page 1980, *Juncus inflexus* sub-community (MG10b).

6. The three monitoring plots were established in locations intended to represent both the typical characters of each sward and also areas that would be sensitive to some combination of management and hydrological influence, if appropriate.

   F01 Rush-dominated Vegetation. This plot represents the transitional area between the fringes of the peatland – where a band of Soft Rush-dominated rush-pasture is well established – and a zone of degraded fen meadow.

   F02 Ordinary Dry Grassland – Acidic. This plot is located in association with the slightly acidic variant of the Ordinary Dry Grasslands in the main field at The Frith. The monitored area has been deliberately placed around the boundary of this sward with an area where Creeping Thistle is still prevalent.

F03 Ordinary Dry Grassland – Calcareous. This plot is located within the more developed of the two stands of the slightly calcareous variant of the Ordinary Dry Grassland at The Frith. The monitored area has been placed in the centre of the western stand away from perceived stand boundaries.

7. This field report for the Vegetation Monitoring Programme makes three recommendations, that:

   a) The Vegetation Monitoring Programme is adopted at The Frith, South Lopham as an aid to management decision-making;
   b) Target conditions for each sward should be devised, based on the initial descriptions of the vegetation types and character given in the Fieldwork Report;
   c) Monitoring surveys should be repeated regularly, and the results incorporated into the management decision-making process.

CONTENTS

1. INTRODUCTION

1.1 Background

The Little Ouse Headwaters Project (LOHP) was formally constituted as a Charitable Company in 2002 to restore and link fenland remnants along the upper Little Ouse Valley, and to promote access and enjoyment of the wildlife and landscape of the valley. The core of the project area lies within the Blo' Norton and Thelnetham Fens SSSI, which forms part of the Waveney and Ouse Valley Fens Special Area of Conservation (SAC). These valley fens are remnants of what was formerly more extensive habitat, for which East Anglia had one of the most important concentrations in Western Europe.

The Frith, South Lopham is a low, sandy ridge forming part of the headwaters of the Waveney and Little Ouse rivers, leased by LOHP from the Trustees of the South Lopham Estates Charity. The site comprises c.10.7 ha of rough pasture, fen, woodland and hedgerows with veteran trees, each habitat being regarded as of Local Importance by LOHP (2012). As shown in Figure 1, The Frith is situated along the western boundary of the Redgrave and Lopham Fens National Nature Reserve (NNR), part of the Special Area of Conservation.

Figure 1. The location of The Frith, South Lopham and surrounding land

1.2 Survey requirements and objectives

Since The Frith was leased in 2002, a programme of habitat restoration has been carried out, guided by a 'condition assessment' protocol (Stone 2006), which placed the site's vegetation within the context of the National Vegetation Classification (NVC) and provided a mechanism for assessing the effectiveness of grassland and fen management. From 2011, funding for the ongoing restoration work on the Frith has come from Natural England through a Higher Level Stewardship Scheme agreement[1].

[1] HLS Agreement No. AG00357439 Date commenced: 01 October 2011

The LOHP has requested that two vegetation surveys are carried out, a full NVC survey of the main habitats, and the establishment of three permanent monitoring plots.

The NVC survey has the primary objective of establishing the character of grassland, fen and woodland vegetation making up the survey area. This Joint Nature Conservation Committee (JNCC) classification is the common standard for defining types of vegetation and describing them within a British and European context. The classification is widely used by Natural England and has been employed to describe the vegetation of much of the nature conservation interest in the Waveney-Little Ouse valley corridor.

The second requirement is to extend the Vegetation Monitoring Programme established on other LOHP sites with the objective of providing a baseline for the grassland and rush-dominated swards of The Frith, in terms of their character and condition, in order to assess the subsequent changes that may occur in the swards during continued site restoration.

1.3 Survey reporting

Jonny Stone has been commissioned by LOHP to undertake these vegetation surveys on The Frith. The NVC and vegetation monitoring methodologies are summarised in Section 2. The NVC survey results and their evaluation are given in Sections 3 and 4. Section 5 gives management considerations.

The results of the initial survey for the new vegetation monitoring plots are given in the 2017 Fieldwork Report in section 6.

2. SURVEY METHODOLOGIES

2.1 NVC survey methodology

The National Vegetation Classification (NVC) is the common standard for defining types of vegetation and describing them within a British and European context (e.g. Rodwell et al. 2007). The classification (Rodwell 1991-2000) is widely used by Natural England and has been employed to describe the vegetation of many semi-natural sites in Suffolk and over the rest of the United Kingdom. Although not designed as a scientific or strict monitoring tool, it is particularly useful for placing the current character of the habitats within a national spectrum of grassland or woodland types, and for interpreting the natural and management-induced changes over time.

Fieldwork followed the methodology set out in the JNCC NVC Users' Handbook (Rodwell 2006). General habitat characters were assessed by an initial walkover to establish the location and extent of distinctive community types. Sample plot locations were selected to represent typical vegetation characters within each type of community. Five or more sample plots were selected for each vegetation-type where possible and are shown in ***Figure 2. Location of NVC survey plots***. Each plot was geo-referenced and listed in Appendix 1.

The grassland swards were sampled using 2 x 2m plots and fenland using 4 x 4m plots, including photographs taken at oblique and vertical angles. All plots were assessed for their floristic composition and species cover/abundance and for the range of variables characterising their structure including vegetation height and the relative coverage of the constituent plant groups. Definitions for each attribute are given in Table 1.

Owing to the small size of the woodland, the canopy and shrub layers were sampled by two standard plots of 50 x 50m (roughly square in outline), with 5 nested field and ground layer plots, as shown in Appendix 5.

All vascular plants are named following Stace (2010); the bryophyte flora follows Hill et al. (2008), and a stonewort species by John et al. (2002). Species recorded in NVC sample plots are listed in Appendix 2.

Field data was tabulated in Microsoft Excel are stand sample plots grouped by floristic similarity to show the common and typical characters; each ensueing vegetation type was then compared with the published NVC accounts (Rodwell 1991-2000). For the grassland swards, this comparison was refined following the European phytosociological framework recently adopted by the International Association for Vegetation Science (Mucina et al. 2016). Field data is presented in Appendices 3, 4 and 5.

Table 1. Definitions of the attributes used to assess plot character

Sward height (cm)	This variable is defined as the average height of the top of the main leaf canopy of the sward. Sward height is therefore not the height of the tallest stem, nor is it the average height of flowering stems, unless these form that canopy layer.
% Total veg. cover	This is the average of values given in each plot for the proportion of the plot, when viewed from overhead, which is covered by the foliage and flowering stems of vascular plants, rather than by bryophytes or lichens. The combined values for these three groups of plants may exceed 100 per cent as, frequently, lichens and mosses may grow beneath the other plants.
% Bryophyte cover	This is the average of the estimated cover values for all mosses and liverworts recorded in the plot.
% Lichen cover	This is the average of the estimated cover values for all ground-dwelling lichens recorded in the plot.
% Plant litter	Litter is defined as dead plant material, and the cover value is that proportion of the ground surface of the plot that is covered either by dead stems retained in the growing position, or by materials lying prostrate on or near the ground surface. Plant litter cover is difficult to estimate, particularly in swards where tussock-forming species are prevalent, and here only refers to dead material lying prostrate on or above the ground surface. The values given are not, therefore, identical to those required by the current condition assessment protocols used by Natural England, which assess only thick, continuous thatches.
% Bare ground	This variable is defined as an estimate of the proportion of the ground surface that is not directly mantled by plant litter or bryophytes, and not occupied by shoots and other living aerial plant matter as they pass through that surface. The estimate therefore includes bare ground covered by prostrate stems or other living plant material lying on or near the ground surface. It is always a greater figure than that required for Natural England's condition assessment, which only refers to non-vegetated areas.
Species No.	This metric is simply an average of the numbers of listed species occurring in each plot.

2.2 Vegetation monitoring survey methodology

Documentation for a Vegetation Monitoring Programme was initially developed for LOHP to aid the ecological restoration of the Bleyswyck's Bank and Parkers Piece sites in 2010. The development, methodology and functions of the programme were described in detail in the Monitoring Plan (ELP 2010) for those sites and is not repeated here.

The methodology was applied to The Frith in establishing three permanent plots, with the following objectives:

1. To establish permanent monitoring plots in the grassland and fen habitats, using the protocols developed in the Monitoring Plan.

2. To undertake the initial monitoring survey, using the 'full' Fieldwork Protocols.

3. To interpret the fieldwork results, and provide guidance on the establishment of initial target conditions.

This initial fieldwork report followed the prescriptions of the Monitoring Plan (ELP 2010) and records the 'full' survey protocol, using the four Fieldwork Elements summarised in Table 2.

Table 2. Summary of survey techniques

Survey intensity	Fieldwork Element		Function within the Survey
Rapid	1	Locating Monitoring Plots	To establish locations for the Monitoring Plots
	2	Photographic Record	To produce a record of surveillance images showing the condition of the developing vegetation
Full	3	Vegetation structural characters	To record features of the vegetation structure against which management requirements can be established.
	4	Floristic sub-sampling	To record the floristic composition of the plot in order to judge to success of the restoration measures against target floristic conditions.

In addition to the photographic record, the structural characters of the vegetation were assessed from each quarter of the two 10 x 10 m plots. Floristic composition was tabulated by stratified sub-sampling of the monitoring plots using twenty 1 x 1 metre sub-samples. The field records for floristic sampling are given in Appendices 6, 7 and 8.

2.3 Limitations to the surveys

Both surveys were carried out in June 2017 at an optimal time of year for all habitats. A supplementary visit was undertaken in December to confirm particular boundaries of vegetation types. No access issues were encountered. Although it is possible that some plant species were not recorded by the sampled plots, this is not considered to have significantly affected the conclusions of this report.

There were no limitations affecting the location of grassland or peatland NVC sample plots, but the small size of the wooded area constrained the number of woodland plots, though samples taken were sufficient to assess the character of the woodland type. It should also be noted that grassland sample plots were surveyed immediately following the routine 'topping' of areas of The Frith colonised by Common Nettle and Creeping Thistle; the potential cover/abundance values may be underestimated for these species.

The general locations of each permanent monitoring plot were established during on-site discussions with LOHP. The subsequent emplacement of permanent marker posts matched the locations of the temporary posts used to carry out the baseline survey.

3. VEGETATION SURVEY RESULTS

3.1 Character of the survey area

The Frith is a Proposed Geodiversity Site (LOHP 2012) which plays an important role in Richard West's hypothesis about the environmental development of the Little Ouse valley (West 2009). It consists of a low, sandy ridge in the floor of the valley, grading gently to the upland slope on its northern side. Along the northern edge of The Frith, the British Geological Survey (BGS 1996) map the occurrence of a band of hillwash, derived from Chalky Boulder Clay. The sandy ridge extends eastwards onto Redgrave and Lopham Fen NNR - and is partly dissected by the western field ditch and by the modern course of the Little Ouse on its southern side. The ridge falls away gently in the southeast of The Frith, where the dry, sandy topsoil progressively grades to a humic and then peaty surface. The largely level surface of the main field is also somewhat disrupted along the western side where slight topographical depressions and a long, thin, channel are picked out. As indicated on the geological map (BGS 1996), these features may also mark the margin of the sandy terrace (*sensu* Mathers et al. 1993) as it descends into the peatland to the west.

The outline of The Frith at Lopham Ford is clearly marked on Faden's Map of Norfolk 1797 (Barringer 1987) and shown as separate from the surrounding wet valley floor. On the Ordnance Survey Six-inch England and Wales series, 1842-1952[2], the remaining internal field boundaries (or traces thereof) are shown. At this time, the fen area was separated from the drier grasslands, and the remaining 'Breck pine' group had been established. Through the 1940s, The Frith supported acid grassland and heathland; as noted by LOHP (2012), "local people remember its huge anthills, gorse and heather, and breeding stone curlews".

Following LOHP (2012): "In *ca* 1950, most of the field was bulldozed and ploughed. Arable crops fared badly on the sandy soils and, after only five years under cultivation, it was progressively reseeded to provide pasture for sheep. Heavy applications of pig slurry during the 1990's not only prevented recovery of its former flora but also encouraged proliferation of stinging nettles. When LOHP took over the lease in 2002, much of the grassland was dominated by stinging nettles although small pockets of acid grassland remained around the field margins and formed a potential source for recolonisation."

The prevalence of nettle was noted in the Condition Assessment baseline survey (Stone 2006) and has been a focus of management since LOHP took over the lease.

3.2 NVC survey results

The current survey was undertaken following several months of normal rainfall levels[3], when the darker green of Common Nettle was contrasting with the increasingly parched flora of the dry grasslands in the main field. These conditions also made it possible to detect changes in the softness of the ground surface on the margins of the fen area, where a quite abrupt transition is evident from dry sands to moist peaty sands.

[2] The Ordnance Survey historic maps are not reproduced here as no copyright was sought; they can be viewed on the National Library of Scotland website [http://maps.nls.uk (accessed 28th September 2017)]

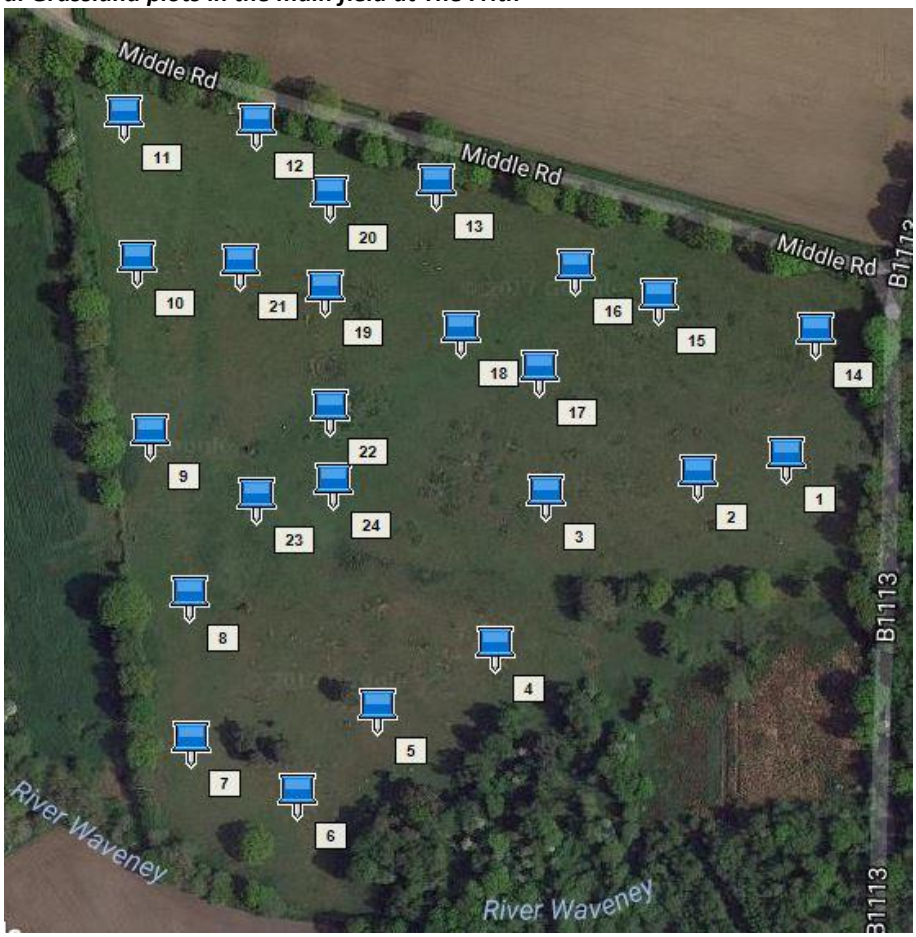
[3] Final NCIC (National Climate Information Centre) data based on the Met Office 5km gridded rainfall dataset derived from rain gauges (Source: Met Office © Crown Copyright, 2017).

As shown in ***Figure 2. Location of NVC survey plots***, the main grass field was sampled by 25 vegetation plots in representative locations. Floristic and physiognomic data were recorded from each plot, and the raw data is provided separately as an electronic spreadsheet. Appendix 1 lists the National Grid references taken by GPS; Appendix 2 gives the species recorded. Common names are given in the description of the NVC communities, but scientific names are retained for the plant community titles.

The block of woodland along the southern boundary and the adjacent field in the southeast are sampled by a further group of plots, also shown in Figure 2.

Figure 2. Location of NVC survey plots

a. Grassland plots in the main field at The Frith



b. Grassland, Rush and Woodland plots to the southeast

In total, eight NVC communities were identified, including four variants of the *Lolio-Cynosuretum* grasslands, which are listed in Table 3 and shown in ***Figure 3. Location of NVC plant communities***. The total measured areas of these communities (10.41 ha) is slightly less than the 10.7 ha reported for the whole of The Frith; the difference is made up by the areas of trees and shrubs on the site perimeter.

Table 3. NVC communities recorded from The Frith, South Lopham

Code	Community title	Area
U1b	*Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland, Typical sub-community	1.93 ha
MG6b	*Lolio-Cynosuretum cristati* grassland, *Anthoxanthum odoratum* sub-community	4.58 ha
MG6c	*Lolio-Cynosuretum cristati* grassland, *Trisetum flavescens* sub-community	1.48 ha
MG7b	*Lolio-Plantaginion* Sissingh 1969 p.p., *Lolium perenne – Poa trivalis* leys	0.66 ha
S22c	*Glycerietum fluitantis* Wilczek 1935, *Alopecurus geniculatus* sub-community	0.01 ha
OV25c	*Urtica dioica-Cirsium arvense* community, *Lolium perenne-Papaver rhoeas* sub-community	0.21 ha
MG10b	*Holco-Juncetum effusi* Page 1980, *Juncus inflexus* sub-community	0.75 ha
W10d	*Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland, *Holcus lanatus* sub-community	0.80 ha

Full floristic and physiognomic data tables are given in Appendices 3, 4 and 5 for each habitat.

Figure 3. Location of NVC plant communities.

3.2.1 Synopsis of the grassland communities

The parched, dry or damp grasslands largely occur in the main field of The Frith, but also include a smaller, transitional area between the grasslands and rush-dominated vegetation in the southeast corner of the site. The grasslands share many species in common, though six distinct types are recognised. When viewed as a whole, The Frith grasslands can be split into three groups.

The first is the parched, acid grassland typical of Breckland grass-heaths and the sandy terraces of the Little Ouse-Waveney river corridor. Here, Common Bent and Red Fescue form an open sward colonised by mosses.

The second group - of four distinct variants - is the most extensive on The Frith and falls into Ratcliffe's (1977) 'Ordinary Dry Meadows' group. These are typically the result of some agricultural improvement and, as here, may revert to a 'semi-natural' analogue when restored. Mildly acidic and calcareous forms are evident, sometimes infested with Common Nettle and Creeping Thistle.

The third group is the 'Ordinary Damp Meadows' type (Ratcliffe 1977) and is restricted to the lower-lying areas of the low sandy ridge.

A summary of the floristic characters of each grassland type is given in Table 4. The relative frequency of occurrence of each species in the sample plots is given using Roman numerals according to the following scale:

V = 81-100 per cent
IV = 61-80 per cent
III = 41-60 per cent
II = 21-40 per cent

Species occurring in 20 per cent or fewer sample plots are excluded from this table. They are listed in the community tables in Appendix 3.

As shown in Table 4, few species occur with any frequency in all grassland swards. The grasses Yorkshire Fog and Common Bent occur throughout, and the former, with Dandelion and Rough Meadow-grass, is indicative of a rather elevated fertility, even within drought-prone situations. Otherwise, the swards have overlapping species compositions, and can be distinguished by the presence – or absence – of particular species groups.

The 'signature' species group of more 'heathy' conditions includes Red Fescue, Lesser Stitchwort and Sheep's Sorrel. These three species are tolerant of both dry and acidic conditions and occur widely. They often occur with a pair of feather mosses, *Brachythecium albicans* and *B. rutabulum*. The former is a denizen of thin swards on dry, acidic sand, and is often a colonist of occasionally disturbed ground. The latter, on the other hand, is a catholic species of humic and rather humid conditions. These two feather mosses do not commonly grow together in semi-natural habitats, and their co-occurrence tends to reflect situations where fertilized arable areas on sandy soils are left uncultivated. This group of species is best developed on the more acidic dry swards.

Where the ground is prone to parching, the aforementioned species form a rather open sward which is frequently colonised by Spreading Meadow-grass and Springy Turf-moss. Although tolerant of mild acidity, these species are most typical of dry situations.

Table 4. Synopsis of the grasslands

Grassland types	**Acid**	**Ordinary dry**				**Ordinary damp**
Stands	**U1b**	**A-MG6b**	**B-MG6b**	**C-MG6b**	**D-MG6c**	**MG7b**
Holcus lanatus	V	V	V	V	V	V
Agrostis capillaris	V	V	V	V	V	IV
Poa trivialis	II	II	IV	V		V
Taraxacum agg.	II	V	V	V		II
Festuca rubra	V	V	V	V	V	
Brachythecium rutabulum	II	IV	V	IV	V	
Rhytidiadelphus squarrosus	IV	III			II	
Poa humilis	IV	IV			II	
Brachythecium albicans	IV	III				
Rumex acetosella	V	V	V	II		
Stellaria graminea	V	V	IV	IV		
Lolium perenne		V	IV	V		V
Cerastium fontanum		IV	III	V	II	V
Veronica chamaedrys		V	V	V	V	III
Dactylis glomerata		IV	IV	III	IV	II
Urtica dioica		V	II		V	IV
Bromus hordeaceus		IV	III	II		
Veronica arvensis		III		IV		
Cirsium vulgare		II		II		
Cerastium glomeratum		II				
Trifolium repens		II			V	
Cirsium arvense			IV	V	IV	V
Phleum bertolonii			II	III		
Potentilla reptans			III	II		
Vulpia bromoides			II	III		
Trifolium dubium			III	II		
Achillea millefolium			IV	III	III	
Glechoma hederacea			II			
Trisetum flavescens				IV		
Geranium dissectum				III		
Geranium molle				II		
Ranunculus repens					IV	II
Agrostis stolonifera					III	V
Anthoxanthum odoratum					III	
Juncus effusus						III

The transition to dry grasslands with little indication of acidity is represented, in Table 4, by the presence of species such as Soft Brome and Spear Thistle. These are associated with a more catholic group, present everywhere except in the more parched area; the most frequently occurring species are Perennial Ryegrass and Common Mouse-ear, often occurring with Germander Speedwell, Cock's-foot and Common Nettle. These widespread species are not favoured by dry conditions, and probably owe their ubiquity to past soil improvements.

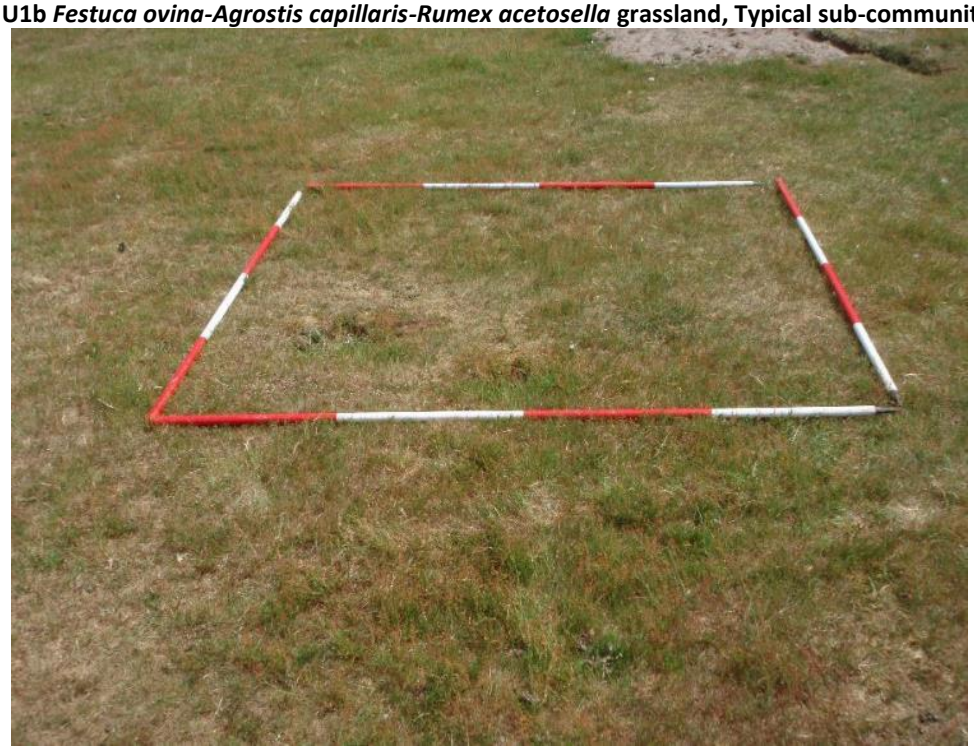
A reasonably well-defined area within The Frith grades towards quite mesic conditions where indicators of dry, calcareous soils occur. Here, species such as Yarrow, Smaller Cat's-tail and Yellow Oat-grass are scattered through a turf where less vigorous growth, often without Common Nettle, is perhaps suggestive of lower fertility.

The final transition is a usually abrupt change in floristic composition in the lower parts of The Frith where scattered clumps of Soft Rush occur in a sward composed of Yorkshire Fog with Rough Meadow-grass, Creeping Bent and occasional Creeping Buttercup.

3.2.1.1 Parched acid grassland

The sole sward that is unequivocably acid grassland surrounds the group of mature in-field trees in the southwest quadrant of the main field. A secondary, less distinct stand is developing to the north, between the two shallow depressions. Both stands are restricted to the 'slightly raised sandy ridges' identified in section 3.1. The larger area around the in-field trees appears to be more mature, and patches of mosses occupy much of the available ground. The soil surface is perhaps more rabbit-disturbed than elsewhere in the field, which may also be evidence for its greater age (rather than for more intense rabbit activity).

Parched acid grassland
U1b *Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland, Typical sub-community



The sward becomes progressively more distinct through the growing season, as it yellows and becomes thinner when a proportion of the new growth is affected by the droughting inherent in the sharply-draining soils. Common Bent is abundant, and usually associated with Red Fescue and Yorkshire Fog. Lesser Stitchwort and Sheep's Sorrel are the only common herbs. Spreading Meadow-grass is thinly scattered through the sward and no other species is more than occasional. Of these, Harebell is the sole acidophyte and the remaining species indicate neutral (Dandelion and Field Woodrush) or fertile (Rough Meadow-grass) conditions. Their low numbers confirm that typical conditions are acidic with relatively low fertility.

The mosses Whitish Feather-moss and Springy Turf-moss, occasionally with Rough-stalked Feather moss, are noticeable gap-fillers in the sward, suggesting that the sward has not recently experienced the type of drought that is a distinctive feature of this type of acid grassland.

Although very similar in composition, the smaller stand also supports scattered Common Nettle and Cock's-foot grass, which may indicate residual fertility.

The composition and physiognomy of the sample plots is given in Appendix 3.

At the time of survey, average sward height in the plots was 4-5 cm, though this would be expected to decrease somewhat if sheep-grazing is sustained to the end of the main growing season.

Both stands are readily accommodated within the Typical sub-community of the ***Festuca ovina-Agrostis capillaris-Rumex acetosella*** **grassland** (U1b). While this type of dry, acid grassland lacks a developed suite of drought-specialists, it is also a key component of Breckland Grass-heath, where drought-sensitive heathers occur.

3.2.1.2 Ordinary Dry Grasslands

A large proportion of the grass field is composed of four variants of Ordinary Dry Grassland. These swards are typically dominated by Common Bent, with Yorkshire Fog and Red Fescue, and lesser amounts of Germander Speedwell, Cock's-foot and Rough-stalked Feather-moss. Levels of acidity, moisture and fertility vary between the variants, and this is reflected in the presence and frequency of occurrence of associate species. Together, these swards are best placed within the ***MG6 Lolio-Cynosuretum cristati community***, though one of the eponymous species, Crested Dog's-tail is absent. The broad concept of the community, as described within the NVC, includes grasslands that have developed across a broad spectrum of Brown Soil types (Rodwell 1992, p.69), and here refers to the drier end of this range. The Variants A-C are most closely allied to the moderately acidic Sweet Vernal Grass sub-community (MG6b), whilst Variant D is somewhat closer to the slightly calcareous Yellow Oat-grass sub-community (MG6c).

Variant A surrounds the eastern and northern margins of the main block of acid grassland and extends across the grass field towards the northeast corner. This variant shares a number of acid-tolerant species, most noticeably Sheep's Sorrel, but also Lesser Stitchwort and Whitish Feather-moss. The drought-tolerant Spreading Meadow-grass is also a frequent associate of both swards. Compared to the other variants, the species-composition is of a slightly more acidophilic flora.

Stand A is structurally distinct from the acid grassland, however, as it is a much more open sward and appears to be relatively immature. It also supports a number of mesophytic species common in *Lolio-Cynosuretum* grasslands, including Perennial Ryegrass, Common Mouse-ear, Dandelion and Soft Brome. Nettle and occasionally patches of Creeping Thistle are present, suggesting both past disturbance and the presence of freely available nutrients.

Variant B lies alongside the western edge of the grass field and and extends north-eastwards to separate two blocks of slightly more calcareous Ordinary Dry Grassland (Variant C). It appears to lie at an intermediate level between the lower damp grassland and the higher acid grassland blocks. It has an indistinct boundary with the calcareous grassland in the northwest corner of the field.

Variant B is a rather more nutrient-rich stand, with several indicators of elevated fertility present. These include Rough Meadow-grass, Creeping Thistle, Creeping Cinquefoil and Yarrow, with occasional Ground-Ivy. The soil appears to be dry but circum-neutral in reaction, with occasional

indicators of acid (Sheeps Sorrel) and calcareous (Lesser Trefoil) occurring amongst generalists of dry conditions, such as Smaller Cat's-tail and Squirrel-tail Fescue.

Ordinary Dry Grassland – Variant A
MG6b *Lolio-Cynosuretum cristati* grassland, *Anthoxanthum odoratum* sub-community

Ordinary Dry Grassland – Variant B
MG6b *Lolio-Cynosuretum cristati* grassland, *Anthoxanthum odoratum* sub-community

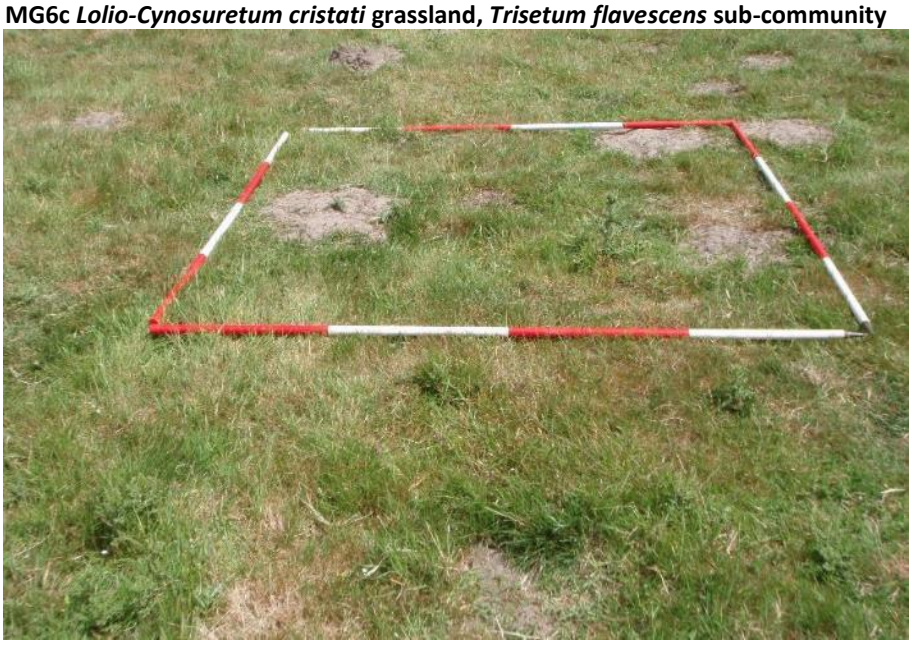
Variant C is a smaller stand outside the main grass field. It forms the dry fringe to the rush-dominated area in the southeast corner of The Frith. The sward appears to be more mature than those of the other variants, with Sweet Vernal Grass and White Clover both forming an integral part of the tight-knit sward. This variant retains some the indicators of fertility found generally in the grasslands, with constant Common Nettle and Creeping Thistle. It is distinct from the other variants, however, in

grading towards damp grassland, through the presence of Creeping Buttercup, Creeping Bent, and the occasional tussock of Soft Rush.

Ordinary Dry Grassland – Variant C
MG6b *Lolio-Cynosuretum cristati* grassland, *Anthoxanthum odoratum* sub-community

Variant D occurs as two blocks along the northern boundary of the main field and has a less 'fertile' appearance and a stronger presence of mildly calcareous species. This may, at least in part, be due to the influence of calcareous hillwash grading out along the site margin (see section 3.1).

Ordinary Dry Grassland – Variant D
MG6c *Lolio-Cynosuretum cristati* grassland, *Trisetum flavescens* sub-community



Although Common Bent remains abundant in these two stands, and occasional Sheep's Sorrel is present, Yellow Oat-grass, Smaller Cat's-tail and often frequent Cock's-foot, give a calcareous feel to the sward not observed in the other variants. Occasional plants of Musk Thistle, Purging Flax and Common Bird's-foot Trefoil were also recorded from the plots. The shift in species composition is

sufficient to refer the swards to the **Yellow Oat-grass sub-community of the *Lolio-Cynosuretum* community (MG6c).**

Ordinary Dry Grassland – Variant D
Musk Thistle *Carduus nutans*

3.2.1.3 Ordinary Damp Grassland

The Ordinary Damp Grassland is restricted to the shallow depressions in the main field. Creeping Bent and Rough Meadow-grass dominate with Yorkshire Fog and Perennial Ryegrass. Creeping Thistle and Common Nettle are frequent, and Soft Rush tussocks are scattered throughout. This sward is best placed within the ***Lolium perenne – Poa trivalis* grasslands** of the ***Lolio-Plantaginion* Sissingh 1969 p.p. (MG7b**). On the slightly drier slopes on the edge of the stands, Common Bent re-appears in thin strips of a transitional sward grading to the surrounding dry grasslands.

Ordinary Damp Grassland
MG7b *Lolio-Plantaginion* Sissingh 1969 p.p., *Lolium perenne – Poa trivalis* sub-community

3.2.1.4 Other vegetation amongst the grasslands

Field pond. The modern field pond was re-excavated in 2006 on the site of an earlier pond that had been infilled in the 1960s. It is situated in sands on the margin of a slightly elevated ridge that supports immature acid grassland. The pond is winter- and spring-wet and was dry at the time of survey and mantled in an open sward of Floating Sweet-grass. No aquatic plant species were found, though it is possible evidence for them may have cryptic. This swamp vegetation can be assigned to the **S22c *Glycerietum fluitantis* Wilczek 1935, *Alopecurus geniculatus* sub-community**. It is fringed by scattered tussocks of Soft Rush.

Field Pond
S22c *Glycerietum fluitantis* Wilczek 1935, *Alopecurus geniculatus* sub-community

Tall ruderals. Some of the potential variability seen in the main grassland field has been masked during the process of sward restoration by the persistence of extensive patches of Creeping Thistle and Nettle. Repeated topping, and the impact of conservation grazing, has made great progress in weakening the vigour of these tall ruderal. Notwithstanding, one particularly tenacious patch of this kind of vegetation is mapped separately as the thistle, in particular, was dominant at the time of survey. This is the **OV25c *Urtica dioica-Cirsium arvense* community, *Lolium perenne-Papaver rhoeas* sub-community**, which is the form that develops on 'derelict pastures' (Rodwell 2000, p.411). It should be noted that one or other of the two eponymous rhizomatous species remain active over all the neutral grasslands, and nettle is also present in small numbers in the acid grassland area.

3.2.2 Rush-dominated vegetation

The smaller field in the southeast corner of The Frith is dominated by a stand of rush tussocks, which mark the location of the gently-shelving margin of the peatland that extends westwards in Redgrave and Lophams Fens NNR. Much of the stand is dominated by Soft Rush, but grades into patches of mixed rushes where Soft Rush is mixed with Hard Rush and occasional tussocks of Blunt-flowered Rush. Jointed Rush is also present in the excavated ditch (see section 3.2.2.1).

The associated vegetation is comprised of three suites of species: the general matrix, especially around the fringes, is of grass-dominated rush-pasture species. Nettle, with some Creeping Thistle and Cleavers, is particularly frequent in a central belt, while a sprinkling of fen species is present through the central and southern parts. The fen component is most evident in the rather wetter southeast corner of the stand, where fringing reed also forms small stands.

Tall ruderals OV25c *Urtica dioica-Cirsium arvense* community, *Lolium perenne-Papaver rhoeas* sub-community

Overall, the stand is regarded as a single entity as, even where fen species are present, Soft Rush and Common Nettle are prevalent. Although the fringes lack Hard Rush, the stand is placed with the ***Juncus inflexus* sub-community of the *Holco-Juncetum effusi* rush-pasture (MG10b)**, which reflects the shift to a slightly more fenny character. It should be noted that the internal variation in floristic composition is likely to reflect a hydrological gradient, from conditions conducive to the development of wet grassland and rush-pasture to those in the deeper peats in the southeast. Here, the rush-dominated vegetation is more likely to represent a degraded form of fen meadow, rather than rush-pasture *per se*.

Rush-dominated vegetation
MG10b *Holco-Juncetum effusi* rush-pasture, *Juncus inflexus* sub-community

At the time of survey, a block of rush-pasture had recently been mown and, as elsewhere away from the northern and western margins, a thick bed of plant litter was exposed. This is likely to reduce germination and survival of many potential denizens of the stand. Notwithstanding, LOHP (2012) notes the potential for high groundwater levels, especially in winter, "since the closure of the Redgrave borehole in 1999, which has provided an uplift in groundwater levels in the upper Little Ouse" (LOHP 2012).

3.2.2.1 Ditch Vegetation

As shown in the accompanying photograph a recently scraped section of ditch within the rush-dominated stand has been blocked off to form a linear pond. The winter water-level is marked by a sprawl of Jointed Rush, below which are small stands of Bulrush, Floating Sweetgrass and the remains of what is believed to be Delicate Stonewort *Chara virgata* (*sensu* John et al. 2002).

Ditch vegetation

3.2.3 Woodland vegetation

An area of woodland is developing on the margin of the sands between the main field and the rush-pasture. A scatter of mature pines and birches prove a light canopy for a scattered understorey of open grown Common Hawthorn and a few planted saplings of Pedunculate Oak and Holly. Close to the river are a few Grey Willows. A large part of the centre of the wooded area is a glade, and much of the stands is mantled in Yorkshire Fog, typically with Ground Ivy and Common Nettle. There are also occasional clumps of bramble and also nettle patches with cleavers.

Although largely immature, the woodland can be assigned to the ***Holcus lanatus*** **sub-community of the** ***Quercus robur-Pteridium aquilinum-Rubus fruticosus*** **woodland (W10d).** This is the typical type of woodland to develop on moderately fertile, free-draining soils.

Woodland vegetation W10d *Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland *Holcus lanatus* sub-community

4. EVALUATION OF HABITATS AND SPECIES

Following discussion of the character of the survey area in terms of its constituent habitat and species in section 3.2, an indication of the ecological value of features present can be given (IEEM 2006; CIEEM 2016).

4.1 Habitat evaluation

The habitats recorded from the survey area are evaluated against the guidelines given in Table 5 (IEEM, 2006).

Table 5. Levels of Value of Ecological Resource

Level of Value	Examples
International	Internationally designated or proposed sites such as Ramsar Sites, Special Protected Areas, Biosphere Reserves and Special Areas of Conservation, or otherwise meeting criteria for international designation. Sites supporting populations of internationally important species in internationally important numbers, numbers i.e. Annex 1 of Birds Directive, migratory species on migration routes, or in breeding, moulting, wintering or staging areas.
National	SSSI or NNR designated or qualifying sites holding species or assemblage of national importance. Sites supporting viable breeding populations of Wildlife and Countryside Act Schedule 1 Species and supplying critical elements of their habitat requirements. Sites supporting nationally important numbers of a single species (>1% UK population). Species contributing to the integrity of an SPA or SSSI but which are not cited as species for which the site is designated.
Regional	Sites not meeting SSSI criteria but comfortably exceeding SINC criteria. Species subject to special conservation measures in UK BAP or sites holding viable breeding populations or supplying critical elements of their habitat requirements. Sites containing regionally important numbers of a single species (>1% regional population).
High Local	Sites meeting the criteria for a county area designation (SINC), Designated Local Nature Reserves holding viable populations of any key species identified in the Local BAP. Sites supporting viable breeding populations of substantial number of species known to be Red or Amber List Species of Conservation Concern and supplying critical elements of their habitat requirements.
Moderate Local	Undesignated sites, or features considered to appreciably enrich the habitat resource within approximately 10 km radius from the site. Sites supporting viable breeding populations of a small number of species listed as Red list or Amber list Species of Conservation Concern or supplying critical elements of their habitat requirements.
Low Local	Undesignated sites, species or areas considered to enrich the species richness within the immediate environs of the site.
Negligible	Areas with a poor species richness and none of the above. Any other species.

Evaluated against the criteria given in Table 5, the ecological value of the habitats in the surveyed area is indicated in Table 6.

The primary habitat of interest is the mature area of acid grassland in the southwest corner of The Frith. Although relatively species-poor, it complements other sites where acid grassland has developed on the low-lying terraces of the Little Ouse-Waveney river corridor, such as that fringing Hinderclay Fen. At the Frith, secondary and immature acid grassland is developing in a smaller stand

to the north, and Variants A and B of the Ordinary Dry Grassland may also show more characters of this type of grassland in time.

Table 6. Level of ecological value (geographic scale of importance

	Ecological feature
Moderate Local	**Acid grassland** U1b *Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland, Typical sub-community
Low Local	**Ordinary Dry Grassland** **Acidic** MG6b *Lolio-Cynosuretum cristati* grassland, *Anthoxanthum odoratum* sub-community **Calcareous** MG6c *Lolio-Cynosuretum cristati* grassland, *Trisetum flavescens* sub-community
	Rush-dominated Vegetation MG10b *Holco-Juncetum effusi* Page 1980, *Juncus inflexus* sub-community
	Woodland W10d *Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland, *Holcus lanatus* sub-community
Negligible	**Ordinary Damp Grassland** MG7b *Lolio-Plantaginion* Sissingh 1969 p.p., *Lolium perenne – Poa trivalis* leys
	Swamp S22c *Glycerietum fluitantis* Wilczek 1935, *Alopecurus geniculatus* sub-community
	Tall Ruderals OV25c *Urtica dioica-Cirsium arvense* community, *Lolium perenne-Papaver rhoeas* sub-community

It should be noted that Lowland Dry Acid Grassland is listed under the Section 41 'habitats of principal importance (priority habitats)' requirement published by Natural England in August 2010. Section 41 (S41) of The Natural Environment and Rural Communities (NERC) Act 2006 requires the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England. The S41 list is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under section 40 of the Natural Environment and Rural Communities Act 2006, to have regard to the conservation of biodiversity in England, when carrying out their normal functions.

Following prolonged habitat restoration, it might be expected that the Ordinary Dry Grassland and and also the Rush-dominated Vegetation would increase in significance and attain the 'Moderate Local Level of Value of Ecological Resource'.

4.2 Notable plant species

No notable plant species was recorded during the survey.

The presence of a stonewort species – probably Delicate Stonewort - is of local interest – it is a feature of calcareous pools amongst the headwater fens. The species was recorded from several LOHP sites by Stewart (2010), but there is no record of it from The Frith[4].

[4] http://www.lohp.org.uk/our-area/list-species-records

5. MANAGEMENT CONSIDERATIONS

5.1 As part of the landscape unit

The Frith is a Proposed Geodiversity Site (LOHP 2012) which plays an important role in Richard West's hypothesis about the environmental development of the Little Ouse valley (West 2009). It is the largest fragment of floodplain terrace (*sensu* Mathers et al. 1993) managed by LOHP. The existing area of Lowland Dry Acid Grassland habitat - coupled with the immature stand and the sub-optimal areas (Variants A and B of Ordinary Dry Grassland) – is potentially the largest block of dry acid grassland in the surrounding countryside.

The Rush-Dominated Vegetation in the southeast corner is part of the much larger landscape unit encompassed by the NNR. Of lesser significance, part of the western side of the Frith is also the boundary between the floodplain terrace and the peatlands to the west.

The Frith is an important buffer area contiguous with Redgrave and Lopham Fen NNR and, since it's reversion from arable, an important 'stepping-stone' site between Redgrave and Lopham Fens SSSI and Blo'Norton and Thelnetham Fens SSSI.

5.2 At the site-scale

The framework for site scale management is set out by LOHP (2012). Since beginning the restoration of The Frith in 2002, LOHP has secured funding for a programme of management, currently under a Higher Level Stewardship Agreement with Natural England. This encompasses the grasslands and rush-pasture.

The main grassland field received "Heavy applications of pig slurry during the 1990s" with a subsequent proliferation of Common Nettle. Subsequent management has seen the decline in nettle infestation and the spread of Creeping Thistle, which has been progressively controlled by repeat topping and grazing. The re-assertion of distinct variants of Ordinary Dry Grassland, including immature forms of both acid and calcareous grassland, has inevitably been a prolonged process requiring constant effort. However, LOHP is achieving a suitable sward matrix that, in time, is likely to support colonizing plant species that will continue to strengthen the differences between types of grassland, and restore some of the character of the semi-natural grasslands ploughed up in c.1950.

The area of rush pasture in the southwest corner of the Frith, and potentially the southern part of the western edge, are both transitional habitats grading into the eastern and western peatlands. It is not known when these fringing habitats were drained, but they have the potential to become wetter habitats; "this has been particularly so since the closure of the Redgrave borehole in 1999, which has provided an uplift in groundwater levels in the upper Little Ouse" (LOHP 2012).

With appropriate management and suitable hydrological conditions, the stand mapped as a rather weedy rush-pasture in the southeast of The Frith has the potential to differentiate into fringing rush-pasture around a form of M22 *Juncus subnodulosus-Cirsium palustre* fen-meadow.

6. VEGETATION MONITORING PROGRAMME – FIELDWORK REPORT

Fieldwork to establish the permanent plots and undertake the initial vegetation survey was undertaken on 22nd June 2017.

6.1 Locating the Monitoring Plots

Monitoring plots were established using the rationales given in section 6.5 for each plot, using the following plot names:

F01 Rush-dominated Vegetation. This plot represents the transitional area between the fringes of the peatland – where a band of Soft Rush-dominated rush-pasture is well established – and a zone of degraded fen meadow.

F02 Ordinary Dry Grassland – Acidic. This plot is located in association with the slightly acidic variant of the Ordinary Dry Grasslands in the main field at The Frith. The monitored area has been deliberately placed around the boundary of this sward with an area where Creeping Thistle is still prevalent.

F03 Ordinary Dry Grassland – Calcareous. This plot is located within the more developed of the two stands of the slightly calcareous variant of the Ordinary Dry Grassland at The Frith. The monitored area has been placed in the centre of the western stand away from perceived stand boundaries.

The plots were readily established using the method given in the Monitoring Plan; each plot is 10 m x 10 m in size and lies between two permanent marker posts. The post locations were established using temporary marker posts placed near the edge of each grassland unit. These posts were subsequently replaced by permanent posts by LOHP. The location of the permanent marker posts is given in Figure 4. The precise location of the monitoring plot is re-established by stretching a 50 metre tape between the posts. From known lengths along this baseline, the plot is reconstructed at right angles to it, as indicated in Table 7.

Table 7. Details of permanent monitoring plot locations

VEGETATION TYPE	PLOT CODE	MARKER POSTS	Marker Post Location	EASTING	NORTHING	Plot location
Rush-dominated Vegetation	**F01**	F01-01	This free-standing post is located on the boundary; also the F02-02 marker.	603883	279116	The northern corner of the plot is 35 m along the line from post 01 to 02. The plot is west of that line.
		F01-02	This free-standing post is located along an internal management boundary.	603905	279064	
Ordinary Dry Grassland - Acidic	**F02**	F02-01	This free-standing post is located in open grassland.	603865	279168	The northwest corner of the plot is situated 25 m along the line from post 01 to 02.
		F02-02	This free-standing post is located on the boundary; also the F01-01 marker	603883	279116	
Ordinary Dry Grassland - Calcareous	**F03**	F03-01	This marker post lies on the fence-line.	603630	279319	The northeast corner of the plot is situated 15 m along the line from post 01 to 02.
		F03-02	This free-standing post is located due south of F03-01, in line with a linear depression in the field.	603630	279279	

Figure 4. Location of permanent marker posts
Source: Map data c 2017 Google Imagery, GigitalGlobe, Getmapping plc, Infoterra Ltd & Bluesky

F01 Rush-dominated Vegetation

F02 Ordinary Dry Grassland – Acidic

F03 Ordinary Dry Grassland – Calcareous

6.2 Monitoring Plot Report – F01 Rush-dominated Vegetation 2017

Plot code	F01 Rush-dominated Vegetation
Treatment type	**Summary of preceding Monitoring Plot Report**
Rush-dominated	This is the initial Monitoring Plot Report

Vegetation structure

• In 2017, the ground surface was slightly damp, with several moist patches between tussocks. There was no surface saturation or standing water.
• Thick plant litter was strongly associated with rush tussocks and no bryophyte cover or seedlings were present.
• The sward structure was dominated by rush tussocks, with arching stems forming sufficient canopy to partially shade understorey plants. These consisted largely of stoloniferous species; taller ruderals were scattered throughout, frequently growing on tussocks. Scrambling species were frequently encountered but active growth had rarely entered the canopy.
• As shown in the accompanying photographs, the sward has not been managed recently.
• Woody seedlings and saplings were absent.

Floristics

• This is a rush-dominated sward with Soft Rush dominant, Hard Rush frequent and with occasional Blunt-flowered Rush.
• Small contributions to the canopy were provided by Creeping Thistle and Common Nettle, which were the main negative indicators.
• The understorey was concentrated in the gaps between tussocks, and consists largely of Creeping Bent, Silverweed and Creeping Buttercup.
• The flora is dominated by rush-pasture species, with several ruderals typical of drained peats; fen species, with the exception of Common Marsh-bedstraw are very uncommon. The bedstraw is widespread but appears to be shade-affected as scrambling stems are infrequent.

Summary of records and events

• Not available at the time of reporting.
• Field evidence suggests that the sward had not been recently disturbed; no evidence of wheel-ruts, hoof-prints or dunging, though cattle were present in the following autumn.

Relation to past and target conditions

• This survey initiates the Vegetation Monitoring Programme and provides a baseline for assessing subsequent meadow vegetation development.
• Vegetation characters suggest that the plot can be regarded as a rush-dominated area, on the transition between grassy rush-pasture and fen-meadow. The thick litter layer and overstood rush canopy are likely to be preventing further colonization. However, restoration management to reduce the rush cover and plant litter, if combined with an appropriate hydrological regime, is likely to allow colonization of species characteristic of this transitional area.

Plot code F01	Photographic Record 2017

Monitoring Plot Field Form – Vegetation structural characters

Monitoring Plot	**F01 Rush-dominated Vegetation**
Recorder	**Jonny Stone**
Survey Date	**22nd June 2017**

Character of the ground surface

● The ground surface was fairly soft and composed of typically moist to slightly damp black, earthy structureless peat.
● The ground surface was planar with an uneven surface. The plot appears to be level but is likely to slope very slightly to the southeast.

Soil wetness

Dry, dusty	Dry, firm	Slightly damp	Moist	Wet	Saturated
		II	II		

	ATTRIBUTE	SAMPLE from each plot quarter 1	2	3	4	AVERAGE
Layer height	Standing water (cm)	0	0	0	0	0 cm
	Plant litter (cm)	4	8	2	10	6 cm
	Woody seedlings (cm)	0	0	0	0	0 cm
	Large sedges / rushes (cm)	70	90	70	80	77.5 cm
	Reed-like grasses (cm)	0	0	0	0	0 cm
	Woody saplings (cm)	0	0	0	0	0 cm
Cover value	Standing water (%)	0	0	0	0	0 %
	Trampling (%)	0	0	0	0	0 %
	Dunging (%)	0	0	0	0	0 %
	Bare ground (%)	0	2	0	1	0.8 %
	Plant litter (%)	50	80	40	70	60 %
	Bryophytes (%)	0	0	0	0	0 %
	Woody seedlings (%)	0	0	0	0	0 %
	Large sedges / rushes (%)	100	60	100	70	82.5 %
	Reed-like grasses (%)	2	0	0	0	0.5 %
	Woody saplings (%)	0	0	0	0	0 %

Monitoring Plot Field Form – Floristic sub-sampling – all survey years

Monitoring Plot	**F01 Rush-dominated Vegetation**
Recorder	**Jonny Stone**
Survey Date	**22nd June 2017**

This data is collated from the 20 1x1 m sub-samples given in Appendix 6.

Species		**2017**
		[ex 20]
Fen indicator species		
Galium palustre	Common Marsh-bedstraw	16
Juncus subnodulosus	Blunt-flowered Rush	2
Carex acutiformis	Lesser Pond-sedge	1
Eleocharis palustris	Common Spike-rush	1
Epilobium parviflorum	Hoary Willowherb	1
Rush Pasture species		
Juncus effusus	Soft Rush	20
Agrostis stolonifera	Creeping Bent	19
Potentilla anserina	Silverweed	16
Juncus inflexus	Hard Rush	16
Ranunculus repens	Creeping Buttercup	10
Cardamine pratensis	Cuckooflower	8
Holcus lanatus	Yorkshire Fog	6
Festuca rubra	Red Fescue	4
Deschampsia cespitosa	Tufted Hair-grass	3
Carex hirta	Hairy Sedge	3
Rumex acetosa	Common Sorrel	1
Negative indicators		
Cirsium arvense	Creeping Thistle	13
Urtica dioica	Common Nettle	8
Glechoma hederacea	Ground-ivy	6
Epilobium obscurum	Short-fruited Willowherb	4
Elytrigia repens	Common Couch	3
Rumex conglomeratus	Clustered Dock	1

Floristic character	2017
Fen indicator species	5
Rush-pasture species	11
Negative indicators	6

6.3 Monitoring Plot Report – F02 Ordinary Dry Grassland - Acidic 2017

Plot code	F02 – Ordinary Dry Grassland - Acidic
Treatment type	**Summary of preceding Monitoring Plot Report**
Ordinary Dry Grassland - Acidic	This is the initial Monitoring Plot Report

Vegetation structure

• The ground surface was dry, quite firm with several softer patches on flattened molehills; c.30 % was either bare ground or thinly covered with colonizing species. Plant litter was thin or absent.
• A thin grassy sward was dominant, frequently intertwined with White Clover stolons. Shoots from Creeping Thistle and occasional Common Nettle were present throughout, but more frequent on the southern half of the plot.
• Wefts of pleurocarpous mosses were thinly scattered through the plot.
• Sheep grazing pressure was maintaining a short sward, though frequent leafy thistle shoots and bare ground patches gave the sward a rather 'scruffy' appearance.

Floristics

• The most frequent grasses are Common Bent and Yorkshire Fog, but sward disturbance by mole activity prevents the development of a thick sward. Perennial Ryegrass and Red Fescue are also frequent. Although Creeping Thistle is ubiquitous, it occurs as scattered shoots and, providing topping is sufficiently frequent, no substantive canopy is present.
• White Clover is the most extensively occurring herb, but Germander Speedwell, Sheep's Sorrel and Common Mouse-ear are also frequent.
• Rough-stalked and Whitish Feather-mosses are scattered throughout, the latter tending to colonize bare ground, while the former is typically associated with longer-established patches of the sward.
• Associated species are circum-neutral in affinity, though Lesser Stitchwort and Field Speedwell are typically of a mildly acidic substrate.

Summary of records and events

• Not available at the time of reporting, though stocking with sheep is understood to be replaced by cattle-grazing in the autumn. Topping targetted at Creeping Thistle had just been undertaken at the time of survey.

• Field evidence suggests that the sward has evolved considerably since a previous survey (Stone 2006) had described the grassland. In particular, the programme of grazing and topping has muted the vigour of rhizomatous nettle growth and, to a lesser extent, that of the thistle.

Relation to past and target conditions

• This survey initiates the Vegetation Monitoring Programme and provides a baseline for assessing subsequent meadow vegetation development.
• Vegetation characters suggest that the plot can be regarded as a immature form of slightly acidic neutral grassland with a weedy component, related to both disturbance and rather elevated fertility. In time, and with continued management and, potentially, occasional drought periods, the target condition is likely to be a slightly acidic dry grassland, recognised as intermediate between the *Lolio-Cynosuretum* (MG6) and U1 *Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland. The potential target condition of the sward may be dependent upon the character of the sandy substrate in terms of basal acidity and fertility levels.

Plot code F02	Photographic Record 2017

Monitoring Plot Field Form – Vegetation structural characters

Monitoring Plot	**F02 Ordinary Dry Grassland - Acidic**
Recorder	**Jonny Stone**
Survey Date	**22nd June 2017**

Character of the ground surface

• The plot is located on a level area, near the edge of a very shallow incline into the neighbouring peatland to the southeast.
• The ground surface was dry and generally quite firm with several softer patches on flattened molehills; c.30 % was either bare ground or thinly covered with colonizing species.
• The amount of plant litter was frequent but spread thinly beneath the patches of maturing turf. It was absent over the bare ground and colonizing areas.

Soil wetness

Dry, dusty	Dry, firm	Slightly damp	Moist	Wet	Saturated
II	II				

	ATTRIBUTE	SAMPLE from each plot quarter 1	2	3	4	AVERAGE
Layer height	Standing water (cm)	0	0	0	0	0 cm
	Plant litter (cm)	0.4	0.4	0	0	0.2 cm
	Woody seedlings (cm)	0	0	0	0	0 cm
	Large sedges / rushes (cm)	0	0	0	0	0 cm
	Reed-like grasses (cm)	0	0	0	0	0 cm
	Woody saplings (cm)	0	0	0	0	0 cm
Cover value	Standing water (%)	0	0	0	0	0 %
	Trampling (%)	0	0	0	0	0 %
	Dunging (%)	1	2	1	1	1.3 %
	Bare ground (%)	5	5	10	20	10 %
	Plant litter (%)	10	10	0	0	5 %
	Bryophytes (%)	1	1	1	1	1 %
	Woody seedlings (%)	0	0	0	0	0 %
	Large sedges / rushes (%)	0	0	0	0	0 %
	Reed-like grasses (%)	0	0	0	0	0 %
	Woody saplings (%)	0	0	0	0	0 %

Monitoring Plot Field Form – Floristic sub-sampling – all survey years

Monitoring Plot	**F02 Ordinary Dry Grassland - Acidic**
Recorder	**Jonny Stone**
Survey Date	**22nd June 2017**

This data is collated from the 20 1x1 m sub-samples given in Appendix 7.

Species		**2017**
		[ex 20]
Acid-tolerant species		
Agrostis capillaris	Common Bent	20
Holcus lanatus	Yorkshire Fog	19
Rumex acetosella	Sheep's Sorrel	13
Brachythecium albicans	Whitish Feather-moss	9
Stellaria graminea	Lesser Stichwort	5
Veronica arvensis	Field Speedwell	5
Rhytidiadelphus squarrosus	Springy Turf-moss	2
Neutral grassland species		
Trifolium repens	White Clover	18
Lolium perenne	Perennial Ryegrass	17
Veronica chamaedrys	Germander Speedwell	17
Festuca rubra	Red Fescue	16
Taraxacum agg.	Dandelion	16
Brachythecium rutabulum	Rough-stalked Feather-moss	13
Cerastium fontanum	Common Mouse-ear	12
Achillea millefolium	Yarrow	6
Dactylis glomerata	Cock's-foot	5
Cirsium vulgare	Spear Thistle	4
Ranunculus repens	Creeping Buttercup	3
Bromus hordeaceus	Soft Brome	3
Phleum bertolonii	Smaller Cat's-tail	2
Geranium molle	Soft Cranesbill	2
Rumex acetosa	Common Sorrel	1
Negative indicators		
Cirsium arvense	Creeping Thistle	20
Urtica dioica	Common Nettle	12
Poa trivialis	Rough Meadow-grass	8
Cerastium glomeratum	Sticky Mouse-ear	1
Capsella bursa-pastoris	Shepherd's Purse	1

Floristic character	2017
Acid tolerant species	7
Neutral Grassland species	15
Negative indicators	5

6.4 Monitoring Plot Report – F03 Ordinary Dry Grassland - Calcareous 2017

Plot code	F03 – Ordinary Dry Grassland - Calcareous
Treatment type	**Summary of preceding Monitoring Plot Report**
Ordinary Dry Grassland - Calcareous	This is the initial Monitoring Plot Report

Vegetation structure

• The ground surface was dry, quite firm with several softer patches on flattened molehills; c.10 % was either bare ground or thinly covered with colonizing species. Plant litter was thin or absent, though parching (which had killed c.5 % of grass tufts) is evident.
• A thin grassy sward was dominant. Shoots from Creeping Thistle were present throughout.
• Wefts of pleurocarpous mosses were thinly scattered through the plot.
• Sheep grazing pressure was maintaining a short sward, though frequent leafy thistle shoots and occasional bare ground patches gave the sward a rather 'scruffy' appearance.

Floristics

• The matrix of the sward is comprised of Common Bent, Yorkshire Fog and Red Fescue, with sufficiently frequent Yellow Oat-grass, Cock's-foot and Smaller Cat's-tail to characterize the grassland. Although Creeping Thistle is ubiquitous, it occurs as scattered shoots and, providing topping is sufficiently frequent, no substantive canopy is present.
• Germander Speedwell is the most extensively occurring herb, and Dandelion and Yarrow are scattered throughout. There are also patches of the sward where the acidophilic Lesser Stitchwort, Field Speedwell and Sheep's Sorrel are present, indicating potential variability in the substrate.
• Rough-stalked Feather-moss is scattered throughout, and Springy Turf-moss occurs in close association with the more acid-tolerant species.
• Several weak calcicoles are also present in low numbers: Musk Thistle, Fairy Flax and Rough Hawkbit.

Summary of records and events

• Not available at the time of reporting, though stocking with sheep is understood to be replaced by cattle-grazing in the autumn. Topping targetted at Creeping Thistle had just been undertaken at the time of survey.

• Field evidence suggests that the sward has evolved considerably since a previous survey (Stone 2006) had described the grassland. In particular, the programme of grazing and topping has muted the vigour of rhizomatous nettle growth and, to a lesser extent, that of the thistle.

Relation to past and target conditions

• This survey initiates the Vegetation Monitoring Programme and provides a baseline for assessing subsequent meadow vegetation development.
• Vegetation characters suggest that the plot can be regarded as an immature form of slightly calcarous neutral grassland with a weedy component, related to both disturbance and rather elevated fertility. In time, and with continued management and occasional drought periods, the target condition is likely to be a slightly calcareous dry grassland tolerant of occasional parching, recognised as most closely resembling the *Lolio-Cynosuretum, Trisetum flavescens* sub-community (MG6c), with associate calcicolous species from the locale. The sward represented by the F03 plot may, in time, approximate to a form of calcicolous Breck heath.

Plot code F03	Photographic Record 2017

Monitoring Plot Field Form – Vegetation structural characters

Monitoring Plot	**F03 Ordinary Dry Grassland - Calcareous**
Recorder	**Jonny Stone**
Survey Date	**22nd June 2017**

Character of the ground surface

• The plot is situated on level ground between the shallow, linear depression to the south, and the gently rising toeslope of the valley side to the north.
• The ground surface was dry, quite firm with several softer patches on flattened molehills; c.5 % was bare ground.
• Plant litter was thin or absent, though parching (which had killed c.5 % of grass tufts) is evident.

Soil wetness

Dry, dusty	Dry, firm	Slightly damp	Moist	Wet	Saturated
I	III				

	ATTRIBUTE	SAMPLE from each plot quarter 1	2	3	4	AVERAGE
Layer height	Standing water (cm)	0	0	0	0	0 cm
	Plant litter (cm)	0.2	0.4	0.4	0	0.3 cm
	Woody seedlings (cm)	0	0	0	0	0 cm
	Large sedges / rushes (cm)	0	0	0	0	0 cm
	Reed-like grasses (cm)	0	0	0	0	0 cm
	Woody saplings (cm)	0	0	0	0	0 cm
Cover value	Standing water (%)	0	0	0	0	0 %
	Trampling (%)	0	0	0	0	0 %
	Dunging (%)	1	1	1	1	1 %
	Bare ground (%)	2	2	2	10	4 %
	Plant litter (%)	15	10	15	10	12.5 %
	Bryophytes (%)	1	1	2	2	1.5 %
	Woody seedlings (%)	0	0	0	0	0 %
	Large sedges / rushes (%)	0	0	0	0	0 %
	Reed-like grasses (%)	0	0	0	0	0 %
	Woody saplings (%)	0	0	0	0	0 %

Monitoring Plot Field Form – Floristic sub-sampling – all survey years

Monitoring Plot	**F03 Ordinary Dry Grassland - Calcareous**
Recorder	**Jonny Stone**
Survey Date	**22nd June 2017**

This data is collated from the 20 1x1 m sub-samples given in Appendix 8.

Species		**2017**
		[ex 20]
Calcium-tolerant species		
Trisetum flavescens	Yellow Oat-grass	11
Dactylis glomerata	Cock's-foot	9
Phleum bertolonii	Smaller Cat's-tail	8
Carduus nutans	Musk Thistle	2
Linum catharticum	Fairy Flax	1
Leontodon hispidus	Rough Hawkbit	1
Neutral grassland species		
Agrostis capillaris	Common Bent	20
Holcus lanatus	Yorkshire Fog	18
Veronica chamaedrys	Germander Speedwell	17
Festuca rubra	Red Fescue	14
Brachythecium rutabulum	Rough-stalked Feather-moss	13
Taraxacum agg.	Dandelion	9
Lolium perenne	Perennial Ryegrass	8
Achillea millefolium	Yarrow	8
Stellaria graminea	Lesser Stitchwort	7
Rhytidiadelphus squarrosus	Springy Turf-moss	5
Geranium molle	Soft Cranesbill	5
Veronica arvensis	Field Speedwell	4
Cerastium fontanum	Common Mouse-ear	3
Potentilla reptans	Creeping Cinquefoil	2
Agrostis stolonifera	Creeping Bent	2
Veronica serpyllifolia	Thyme-leaved Speedwell	2
Arrhenatherum elatius	False Oat-grass	1
Bromus hordeaceus	Soft Brome	1
Geranium dissectum	Cut-leaved Cranesbill	1
Obligate acid species		
Rumex acetosella	Sheep's Sorrel	3
Negative indicators		
Cirsium arvense	Creeping Thistle	19
Poa trivialis	Rough Meadow-grass	7
Cirsium vulgare	Spear Thistle	2
Urtica dioica	Common Nettle	2

Floristic character	2017
Calcium tolerant species	6
Neutral Grassland species	19
Obligate acid species	1
Negative indicators	4

6.5 Interpretation of the Monitoring Plot surveys

The three monitoring plots were established in locations intended to represent both the typical characters of each sward and also an area that would be sensitive to some combination of management and hydrological influence, if appropriate.

F01 Rush-dominated Vegetation
This plot is intended to represent the transitional area between the fringes of the peatland – where a band of Soft Rush-dominated rush-pasture is well established – and a zone of degraded fen meadow.

Vegetation characters suggest that the plot can currently be regarded as a rush-dominated area; however, the thick litter layer and overstood rush canopy are likely to be preventing further colonization. Restoration management should aim to reduce the rush cover and plant litter. If combined with an appropriate hydrological regime, this is likely to allow colonization of species characteristic of this transitional area. A target condition would therefore see an increase in the proportion of fen species, leading either to reed-fen or fen-meadow.

Monitoring issues: The plot currently contains a small suite of fen species, mainly in very low numbers, and it is assumed that a positive change in condition would see an increase in the frequency of occurrence of these, and other, fen species. Similarly, the continued dominance of the primary group of species currently present – those typical of rush-pasture – should be assessed as a standstill in the current hydrological regime, with no evidence for an increase in the contribution of groundwater-derived input to the root zone. This may also be indicated by a decline in the presence of fen species. Concomitant with a decline in fen species is likely to be an increase in the group of negative indicator species, whose presence represents a degradation in the condition of the peat topsoil, manifested by drying and ineffective rewetting, coupled with flushes of nutrients, especially phosphate (e.g. Meissner et al. 2008).

F02 Ordinary Dry Grassland – Acidic
This plot has been located in association with the slightly acidic variant of the Ordinary Dry Grasslands in the main field at The Frith. The monitored area has been deliberately placed around the boundary of this sward with an area where Creeping Thistle is still very prevalent.

Vegetation characters suggest that the plot can be regarded as an immature form of slightly acidic neutral grassland with a weedy component, related to both disturbance and rather elevated fertility. In time, and with continued management and, potentially, occasional drought periods, the target condition is likely to be a slightly acidic dry grassland, recognised as intermediate between the *Lolio-Cynosuretum* (MG6) and U1 *Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland. The potential target condition of the sward may be dependent upon the character of the sandy substrate in terms of basal acidity and fertility levels.

Monitoring issues: The inherited nettle infestation has largely been brought under control, but one key variable remains the vigour with which the ramifying rhizomatous network of Creeping Thistle produces shoots in this sward. A second relates to the management ability to prevent the shoots leafing up and shading the young grassland.

Field evidence suggests that the sward has evolved considerably since a previous survey (Stone 2006) had described the grassland. The sward is demonstrably a dry form of the *Anthoxanthum odoratum* sub-community of the *Lolio-Cynosuretum* grassland, and a favourable indication of sward condition would be a continued shift in species composition towards acid-tolerant and drought-tolerant species

and a decline in negative indicators and those neutral grassland species associated with elevated fertility.

F03 Ordinary Dry Grassland - Calcareous
This plot has been located in the more developed of the two stands of the slightly calcareous variant of the Ordinary Dry Grasslands in the main field at The Frith. The monitored area has been placed in the centre of the western stand away from perceived stand boundaries.

Vegetation characters suggest that the plot can be regarded as an immature form of slightly calcarous neutral grassland with a weedy component, related to both disturbance and rather elevated fertility. It should be noted that patches of the sward support several species (most notably Sheep's Sorrel) which indicate slightly acidic soil conditions: this may, in turn, suggest variability in the substrate. Also, the plot shows evidence for seasonal parching.

In time, and with continued management and occasional drought periods, the target condition is likely to be a slightly calcareous dry grassland tolerant of occasional parching, recognised as most closely resembling the *Lolio-Cynosuretum, Trisetum flavescens* sub-community (MG6c), with associate calcicolous species from the locale. The sward represented by the F03 plot may, in time, approximate to a form of calcicolous Breck heath.

Monitoring issues: The inherited nettle infestation has largely been brought under control, but one key variable remains the vigour with which the ramifying rhizomatous network of Creeping Thistle produces shoots in this sward. A second relates to the management ability to prevent the shoots leafing up and shading the young grassland.

Field evidence suggests that the sward has evolved considerably since a previous survey (Stone 2006) had described the grassland. The matrix of the sward is demonstrably a dry form of the *Trisetum flavescens* sub-community of the *Lolio-Cynosuretum* grassland, and a favourable indication of sward condition would be a continued shift in species composition towards drought-tolerant and predominantly calcium-tolerant species and a decline in negative indicators and those neutral grassland species associated with elevated fertility.

6.6 Recommendations of the Vegetation Monitoring Programme

It is recommended that:

1. ***The Vegetation Monitoring Programme is adopted*** at The Frith, South Lopham by those responsible for ensuring appropriate management of the site. This first Fieldwork Report provides details of the successful installation of the permanent plot markers, and the completion of a baseline survey of each plot using the 'full' survey method (photographs, physiognomy and floristics). The Monitoring Plan (ELP 2010) proposes several means to integrate vegetation monitoring as a management decision-making tool.

2. ***Target conditions for each type of monitored vegetation should be devised***, based on the initial descriptions of vegetation types and character given in the Fieldwork Report - supplemented by the NVC survey. Target conditions should reflect the restoration approaches to be employed, and management capacity. As indicated in the report, the character of the main field of The Frith was markedly altered in c.1950 by bulldozing, ploughing and the addition of pig slurry. Similarly, regional drainage has affected the presence and condition of peat in the southeast corner of the site. For these reasons, targets should reflect what is feasible to create, rather than what is believed to have been present in the past.

3. ***Monitoring surveys should be repeated regularly***, and the results incorporated into management decision-making. As recommended in the Monitoring Plan, the 'rapid survey' technique (plot photographs) is a useful annual device to assess gross changes in the sward. This should ideally be supplemented by a rapid walkover survey to identify the presence of colonising plant species, particularly when these can be interpreted as indicators of positive (or negative) change. The 'full survey' should provide a summative statement of the floristic and physiognomic changes that have occurred over a period of several years and should be integrated into a periodic review of restoration progress.

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Appendix 1. NVC SAMPLE PLOT NATIONAL GRID REFERENCES

Plot	Easting	Northing	NVC code
1	603893	279164	D-MG6c
2	603854	279154	A-MG6b
3	603786	279143	A-MG6b
4	603766	279074	A-MG6b
5	603715	279044	U1b
6	603681	279005	U1b
7	603632	279026	U1b
8	603629	279091	U1b
9	603608	279162	B-MG6b
10	603599	279239	B-MG6b
11	603591	279304	D-MG6c
12	603650	279303	D-MG6c
13	603732	279279	B-MG6b
14	603904	279220	D-MG6c
15	603833	279232	A-MG6b
16	603795	279244	MG7b
17	603781	279198	A-MG6b
18	603745	279214	MG7b
19	603684	279230	B-MG6b
20	603684	279272	D-MG6c
21	603645	279240	U1b
22	603688	279176	MG7b
23	603657	279136	MG7b
24	603684	279152	MG7b
25	603816	279075	C-MG6b
26	603856	279102	C-MG6b
27	603911	279103	C-MG6b
28	603827	279082	C-MG6b
29	603879	279107	C-MG6b
30	603714	279243	B-MG6b
31	603858	279069	MG10b
32	603851	279035	MG10b
33	603889	279045	MG10b
34	603913	279043	MG10b
35	603893	279076	MG10b
36	603740	278986	W10d
37	603770	279022	W10d
38	603809	278995	W10d
39	603776	278996	W10d
40	603811	279043	W10d

Appendix 2. SPECIES RECORDED IN NVC SAMPLES AND MONITORING PLOTS

Scientific Name	Common Name
Achillea millefolium	Yarrow
Agrostis capillaris	Common Bent
Agrostis stolonifera	Creeping Bent
Alopecurus pratensis	Meadow Foxtail
Anthoxanthum odoratum	Sweet Vernal Grass
Aphanes australis	Parsley-piert
Arrhenatherum elatius	False Oat-grass
Betula pendula	Silver Birch
Bromus hordeaceus	Soft-brome
Campanula rotundifolia	Harebell
Capsella bursa-pastoris	Shepherd's-purse
Cardamine pratensis	Cuckooflower
Carduus nutans	Musk Thistle
Carex acutiformis	Lesser Pond-sedge
Carex hirta	Hairy Sedge
Cerastium fontanum	Common Mouse-ear
Cerastium glomeratum	Sticky Mouse-ear
Cirsium arvense	Creeping Thistle
Cirsium vulgare	Spear Thistle
Crataegus monogyna	Hawthorn
Crepis capillaris	Smooth Hawksbeard
Dactylis glomerata	Cock's-foot
Deschampsia cespitosa	Tufted Hair-grass
Eleocharis palustris	Common Spike-rush
Elytrigia repens	Common Couch
Epilobium obscurum	Short-fruited Willowherb
Epilobium parviflorum	Hoary Willowherb
Festuca rubra	Red Fescue
Galium aparine	Cleavers
Galium palustre	Common Marsh-bedstraw
Galium verum	Lady's Bedstraw
Geranium dissectum	Cut-leaved Cranesbill
Geranium molle	Soft Cranesbill
Glechoma hederacea	Groung-ivy
Holcus lanatus	Yorkshire Fog
Holcus mollis	Creeping Soft-grass
Hypochaeris radicata	Cat's-ear
Ilex aquifolium	Holly
Juncus effusus	Soft Rush
Juncus inflexus	Hard Rush
Juncus subnodulosus	Blunt-flowered Rush
Leontodon hispidus	Rough Hawkbit
Linum catharticum	Fairy Flax
Lolium perenne	Perennial Ryegrass
Lonicera periclymenum	Honeysuckle
Lotus corniculatus	Common Bird's-foot Trefoil
Luzula campestris	Field Woodrush
Lycopus europaeus	Gypsywort
Mentha aquatica	Water Mint

Scientific Name	Common Name
Phleum bertolonii	Smaller Cat's-tail
Phragmites australis	Common Reed
Pinus sylvestris	Scot's Pine
Plantago lanceolata	Ribwort Plantain
Poa humilis	Spreading Meadow-grass
Poa trivialis	Rough Meadow-grass
Potentilla anserina	Silverweed
Potentilla reptans	Creeping Cinquefoil
Quercus robur	Pedunculate Oak
Ranunculus repens	Creeping Buttercup
Rubus fruticosus agg.	Bramble
Rumex acetosa	Common Sorrel
Rumex acetosella	Sheep's Sorrel
Rumex conglomeratus	Clustered Dock
Salix cinerea	Grey Willow
Stellaria graminea	Lesser Stitchwort
Stellaria media	Common Chickweed
Taraxacum agg.	Dandelion
Trifolium dubium	Lesser Trefoil
Trifolium repens	White Clover
Trisetum flavescens	Yellow Oat-grass
Urtica dioica	Common Nettle
Veronica arvensis	Field Speedwell
Veronica chamaedrys	Germander Speedwell
Veronica serpyllifolia	Thyme-leaved Speedwell
Vicia cracca	Tufted Vetch
Vulpia bromoides	Squirrel-tail Fescue
Bryophytes	
Amblystegium serpens	Creeping Feather-moss
Brachythecium albicans	Whitish Feather-moss
Brachythecium rutabulum	Rough-stalked Feather-moss
Dicranum scoparium	Broom Fork-moss
Kindbergia praelonga	Common Feather-moss
Rhytidiadelphus squarrosus	Springy Turf-moss

Also recorded: Bulrush *Typha latifolia*, Jointed Rush *Juncus articulatus*, Delicate Stonewort *Chara virgata*.

U1b *Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland, Typical sub-community

Plot	5	6	7	8	21		
Agrostis capillaris	6	7	10	10	8	V	(6-10)
Festuca rubra	7	6	5	5	8	V	(5-8)
Rumex acetosella	5	5	6	6	6	V	(5-6)
Holcus lanatus	4	5	4	2	4	V	(2-5)
Stellaria graminea	2	4	5	5	4	V	(2-5)
Brachythecium albicans	6	6		4	4	IV	(4-6)
Rhytidiadelphus squarrosus	5	4	4	5		IV	(4-5)
Poa humilis	3	3	1		3	IV	(1-3)
Brachythecium rutabulum			5	2		II	(2-5)
Poa trivialis			2	1		II	(1-2)
Taraxacum agg.				1	1	II	(1)
Urtica dioica					2	I	(2)
Campanula rotundifolia		2				I	(2)
Veronica chamaedrys				1		I	(1)
Cerastium fontanum	1					I	(1)
Dactylis glomerata					1	I	(1)
Sward height (cm)	4	2	4	8	5		
% Total veg cover	80	70	85	95	90		
% Plant litter	30	40	15	15	30		
% Bryophyte cover	40	30	25	20	5		
% Lichen cover	0	0	0	0	0		
% Bare ground	2	1	5	0	5		
No. of species	9	8	9	11	10	Av.	9.4

MG6 *Lolio-Cynosuretum cristati* grassland
Variant A MG6b *Anthoxanthum odoratum* sub-community

	Plot	2	3	4	15	17		
Agrostis capillaris		10	10	10	8	8	V	(8-10)
Festuca rubra		2	4	5	7	7	V	(2-7)
Rumex acetosella		4	6	5	2	3	V	(2-6)
Holcus lanatus		4	2	4	4	2	V	(2-4)
Lolium perenne		4	2	2	4	4	V	(2-4)
Urtica dioica		3	2	2	2	3	V	(2-3)
Stellaria graminea		1	3	4	1	1	V	(1-4)
Veronica chamaedrys		2	2	2	1	1	V	(1-2)
Taraxacum agg.		2	1	1	1	1	V	(1-2)
Brachythecium rutabulum		2	2		3	2	IV	(2-3)
Cerastium fontanum		3	2		1	2	IV	(1-3)
Bromus hordeaceus		1		1	1	2	IV	(1-2)
Dactylis glomerata		1	1	1		1	IV	(1)
Poa humilis			1	1	1	1	IV	(1)
Rhytidiadelphus squarrosus		2		6	2		III	(2-6)
Brachythecium albicans		3	4			2	III	(2-4)
Veronica arvensis		2	1		1		III	(1-2)
Trifolium repens		3			2		II	(2-3)
Poa trivialis		3		2			II	(2-3)
Cirsium vulgare		2			1		II	(1-2)
Cerastium glomeratum		1				1	II	(1)
Cirsium arvense					5		I	(5)
Galium verum					2		I	(2)
Glechoma hederacea						1	I	(1)
Geranium molle		1					I	(1)
Hypochaeris radicata					1		I	(1)
Holcus mollis				1			I	(1)
Crepis capillaris					1		I	(1)
Plantago lanceolata					1		I	(1)
Aphanes australis				1			I	(1)
Sward height (cm)		7	6	5	14	7		
% Total veg cover		95	95	98	95	80		
% Plant litter		3	5	2	20	30		
% Bryophyte cover		4	5	30	5	2		
% Lichen cover		0	0	0	0	0		
% Bare ground		5	5	2	5	10		
No. of species		21	15	16	22	17	Av.	18.2

MG6 *Lolio-Cynosuretum cristati* grassland
Variant B MG6b *Anthoxanthum odoratum* sub-community

Plot	9	10	13	19	30		
Agrostis capillaris	9	9	9	8	8	V	(8-9)
Holcus lanatus	7	6	5	5	5	V	(5-7)
Festuca rubra	4	5	4	7	6	V	(4-7)
Brachythecium rutabulum	4	2	2	2	2	V	(2-4)
Veronica chamaedrys	3	3	3	2	3	V	(2-3)
Rumex acetosella	2	2	2	2	1	V	(1-2)
Taraxacum agg.	2	2	1	2	2	V	(1-2)
Poa trivialis	5	5	3		3	IV	(3-5)
Achillea millefolium		2	3	3	3	IV	(2-3)
Stellaria graminea	3		3	2	2	IV	(2-3)
Lolium perenne		1	2	2	3	IV	(1-3)
Cirsium arvense		2	3	1	2	IV	(1-3)
Dactylis glomerata	2	2	1		1	IV	(1-2)
Potentilla reptans		5		4	2	III	(2-5)
Cerastium fontanum	3	1	1			III	(1-3)
Bromus hordeaceus	1	1			1	III	(1)
Trifolium dubium	1		1		1	III	(1)
Vulpia bromoides	2		3			II	(2-3)
Urtica dioica				2	2	II	(2)
Glechoma hederacea				2	2	II	(2)
Phleum bertolonii		1	1			II	(1)
Veronica arvensis	1					I	(1)
Cerastium glomeratum	1					I	(1)
Kindbergia praelonga	1					I	(1)
Sward height (cm)	8	8	9	10	9		
% Total veg cover	98	90	90	95	95		
% Plant litter	20	5	2	5	5		
% Bryophyte cover	5	2	2	2	2		
% Lichen cover	0	0	0	0	0		
% Bare ground	2	10	10	5	5		
No. of species	17	16	17	14	18	Av.	16.4

MG6 *Lolio-Cynosuretum cristati* grassland
Variant C MG6b *Anthoxanthum odoratum* sub-community

Plot	25	26	27	28	29		
Agrostis capillaris	9	8	7	7	9	V	(7-9)
Holcus lanatus	3	3	4	5	2	V	(2-5)
Festuca rubra	2	4	5	2	3	V	(2-5)
Brachythecium rutabulum	3	2	4	2	4	V	(2-4)
Urtica dioica	2	1	4	6	2	V	(1-6)
Trifolium repens	3	4	5	1	5	V	(1-5)
Veronica chamaedrys	2	3	3	2	1	V	(1-3)
Cirsium arvense	2	3	2	2		IV	(2-3)
Ranunculus repens	2	2	3		1	IV	(1-3)
Dactylis glomerata	1	2		1	1	IV	(1-2)
Anthoxanthum odoratum		1	2	1		III	(1-2)
Agrostis stolonifera			1	2	1	III	(1-2)
Rhytidiadelphus squarrosus		2		3		II	(2-3)
Poa humilis	1				1	II	(1)
Achillea millefolium	1				1	II	(1)
Cerastium fontanum	1		1			II	(1)
Poa trivialis				3		I	(3)
Juncus effusus				1		I	(1)
Sward height (cm)	3	4	4	15	3		
% Total veg cover	100	90	85	85	100		
% Plant litter	2	5	2	10	2		
% Bryophyte cover	3	3	5	3	5		
% Lichen cover	0	0	0	0	0		
% Bare ground	2	2	5	10	2		
No. of species	13	12	12	14	12	Av.	12.6

MG6 *Lolio-Cynosuretum cristati* grassland
Variant D MG6c *Trisetum flavescens* sub-community

Plot	1	11	12	14	20		
Agrostis capillaris	9	10	8	9	8	V	(8-10)
Holcus lanatus	8	5	7	4	6	V	(4-8)
Festuca rubra	4	3	5	4	4	V	(3-5)
Poa trivialis	2	4	5	3	2	V	(2-5)
Veronica chamaedrys	2	2	3	3	2	V	(2-3)
Lolium perenne	4	3	1	4	2	V	(1-4)
Cirsium arvense	3	4	2	1	3	V	(1-4)
Taraxacum agg.	1	1	1	1	3	V	(1-3)
Cerastium fontanum	2	1	1	1	1	V	(1-2)
Brachythecium rutabulum	4		2	2	2	IV	(2-4)
Trisetum flavescens	2		3	1	2	IV	(1-3)
Stellaria graminea	2		1	3	2	IV	(1-3)
Veronica arvensis	2	1		2	1	IV	(1-2)
Dactylis glomerata		3	3		3	III	(3)
Vulpia bromoides	3		2	4		III	(2-4)
Phleum bertolonii		2		1	2	III	(1-2)
Achillea millefolium		1	2		2	III	(1-2)
Geranium dissectum	1	1	1			III	(1)
Potentilla reptans	2		4			II	(2-4)
Rumex acetosella	2			3		II	(2-3)
Geranium molle		1			2	II	(1-2)
Bromus hordeaceus			1	1		II	(1)
Trifolium dubium	1			1		II	(1)
Cirsium vulgare			1	1		II	(1)
Urtica dioica	3					I	(3)
Trifolium repens	2					I	(2)
Rhytidiadelphus squarrosus	2					I	(2)
Ranunculus repens					1	I	(1)
Brachythecium albicans				1		I	(1)
Poa humilis	1					I	(1)
Anthoxanthum odoratum		1				I	(1)
Linum catharticum			1			I	(1)
Lotus corniculatus			1			I	(1)
Carduus nutans					1	I	(1)
Veronica serpyllifolia				1		I	(1)
Sward height (cm)	6	14	7	6	8		
% Total veg cover	95	90	95	85	95		
% Plant litter	5	30	5	2	5		
% Bryophyte cover	6	0	2	3	2		
% Lichen cover	0	0	0	0	0		
% Bare ground	5	0	5	15	5		
No. of species	22	16	21	21	19	Av.	19.8

MG7b *Lolio-Plantaginion* Sissingh 1969 p.p., *Lolium perenne – Poa trivalis* leys

Plot	16	18	22	23	24		
Holcus lanatus	6	9	8	8	7	V	(6-9)
Poa trivialis	7	4	5	5	6	V	(4-7)
Lolium perenne	7	4	5	4	6	V	(4-7)
Agrostis stolonifera	4	2	6	5	4	V	(2-6)
Cirsium arvense	5	2	3	3	5	V	(2-5)
Cerastium fontanum	1	3	2	2	2	V	(1-3)
Urtica dioica	3		3	2	2	IV	(2-3)
Agrostis capillaris	2	4		2		III	(2-4)
Juncus effusus	5		5		1	III	(1-5)
Veronica chamaedrys		1		3	2	III	(1-3)
Ranunculus repens			6		1	II	(1-6)
Taraxacum agg.		1		2		II	(1-2)
Dactylis glomerata			1		2	II	(1-2)
Festuca rubra					4	I	(4)
Phleum bertolonii		2				I	(2)
Carex hirta					2	I	(2)
Trifolium repens	1					I	(1)
Alopecurus pratensis	1					I	(1)
Sward height (cm)	9	10	9	9	16		
% Total veg cover	100	95	95	100	95		
% Plant litter	5	2	2	2	2		
% Bryophyte cover	0	0	0	0	0		
% Lichen cover	0	0	0	0	0		
% Bare ground	0	5	5	0	5		
No. of species	11	10	10	10	13	Av.	10.8

Appendix 4. NVC PEATLAND COMMUNITY

MG10b *Holco-Juncetum effusi* Page 1980, *Juncus inflexus* sub-community

Plot	31	32	33	34	35		
Juncus effusus	10	10	8	9	8	V	(8-10)
Agrostis stolonifera	2	5	4	4	8	V	(2-8)
Urtica dioica	3	2	4	6	5	V	(2-6)
Galium aparine	2	1	2	1	1	V	(1-2)
Cirsium arvense	3		2	5	4	IV	(2-5)
Ranunculus repens	2	2	2		2	IV	(2)
Glechoma hederacea	1	1		1	2	IV	(1-2)
Juncus inflexus		1	2		7	III	(1-7)
Vicia cracca			1	2	2	III	(1-2)
Holcus lanatus	2			1	2	III	(1-2)
Mentha aquatica			1	2	1	III	(1-2)
Galium palustre				1	3	II	(1-3)
Arrhenatherum elatius	1	2				II	(1-2)
Rumex conglomeratus	1				2	II	(1-2)
Cardamine pratensis			1		2	II	(1-2)
Epilobium obscurum			1		2	II	(1-2)
Lycopus europaeus			1	1		II	(1)
Potentilla anserina					5	I	(5)
Deschampsia cespitosa				4		I	(4)
Stellaria graminea	2					I	(2)
Festuca rubra					2	I	(2)
Phragmites australis			2			I	(2)
Potentilla reptans	1					I	(1)
Carex hirta					1	I	(1)
Rumex acetosa					1	I	(1)
Sward height (cm)	60	80	70	70	70		
% Total veg cover	100	100	95	95	100		
% Plant litter	20	30	50	50	60		
% Bryophyte cover	0	0	0	0	0		
% Lichen cover	0	0	0	0	0		
% Bare ground	0	0	0	0	0		
No. of species	12	7	13	12	19	Av.	12.6

Appendix 5. NVC WOODLAND COMMUNITY

W10d *Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland, *Holcus lanatus* sub-community

Plot	36	37	38	39	40		
Canopy and shrub layer							
Betula pendula		7		4			
Crataegus monogyna		2		6			
Pinus sylvestris		5		1			
Betula pendula sapling		1		1			
Quercus robur sapling		1		1			
Salix cinerea				2			
Ilex aquifolium shrub		1					
Field and ground layer							
Holcus lanatus	8	9	8	10	4	V	(4-10)
Urtica dioica	3	3	3	4	8	V	(3-8)
Glechoma hederacea	4	4	4	3	2	V	(2-4)
Brachythecium rutabulum	1		1		2	III	(1-2)
Poa trivialis				3	4	II	(3-4)
Dactylis glomerata				1	2	II	(1-2)
Rubus fruticosus agg.	1			1		II	(1)
Veronica chamaedrys		1		1		II	(1)
Galium aparine					5	I	(5)
Lonicera periclymenum		1				I	(1)
Ranunculus repens				1		I	(1)
Eurhynchium praelongum		1				I	(1)
Arrhenatherum elatius					1	I	(1)
Dicranum scoparium	1					I	(1)
Holcus mollis			1				
Betula pendula seedling		1				I	(1)
Amblystegium serpens					1	I	(1)
Stellaria media					1	I	(1)
No. of species	12	13	11	14	17	Av.	13.4

Appendix 6. FIELD RECORD FOR F01 RUSH-DOMINATED VEGETATION MONITORING PLOT P = present in sub-plot

Sub-plots	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	2017
Juncus effusus	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	20
Agrostis stolonifera	P	P	P	P	P	P	P	P	P	P		P	P	P	P	P	P	P	P	P	19
Juncus inflexus	P	P	P			P	P	P	P	P	P	P	P	P			P	P	P	P	16
Galium palustre	P		P	P	P	P	P	P		P	P	P	P		P	P	P	P		P	16
Potentilla anserina	P	P		P	P	P	P	P	P	P	P	P	P			P	P		P	P	16
Cirsium arvense	P		P	P		P		P	P	P			P	P	P	P		P	P		13
Ranunculus repens		P	P	P	P	P	P	P			P	P	P								10
Urtica dioica	P	P							P					P	P	P	P	P			8
Cardamine pratensis					P		P	P				P	P				P	P		P	8
Holcus lanatus			P	P	P		P	P			P										6
Glechoma hederacea	P					P				P			P	P					P		6
Epilobium obscurum			P					P							P	P					4
Festuca rubra				P			P	P			P										4
Deschampsia cespitosa					P													P	P		3
Carex hirta				P	P							P									3
Elytrigia repens															P		P	P			3
Juncus subnodulosus												P	P								2
Rumex conglomeratus		P																			1
Rumex acetosa											P										1
Carex acutiformis														P							1
Eleocharis palustris													P								1
Epilobium parviflorum																P					1
No. of species	8	7	8	9	9	8	9	11	6	7	8	9	11	7	7	8	8	9	7	6	Av. 8.1

Appendix 7. FIELD RECORD FOR F02 ORDINARY DRY GRASSLAND (ACIDIC) MONITORING PLOT P = present in sub-plot

Sub-plots	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	2017
Agrostis capillaris	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	20
Cirsium arvense	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	20
Holcus lanatus	P	P	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	19
Trifolium repens	P	P	P	P	P	P	P	P	P	P	P		P	P	P	P	P		P	P	18
Lolium perenne	P		P	P	P		P	P	P	P	P	P	P		P	P	P	P	P	P	17
Veronica chamaedrys	P	P	P	P	P	P	P		P	P	P	P	P	P			P	P	P	P	17
Festuca rubra		P	P	P	P	P	P	P	P		P		P	P	P	P	P	P		P	16
Taraxacum agg.	P	P	P	P			P	P	P	P	P	P	P	P	P	P		P	P		16
Brachythecium rutabulum	P	P		P	P	P	P			P		P		P	P	P		P		P	13
Rumex acetosella	P	P	P	P	P	P		P	P		P		P			P		P		P	13
Cerastium fontanum	P	P			P	P	P		P	P		P	P			P		P	P		12
Urtica dioica			P	P		P				P	P	P		P	P	P	P	P		P	12
Brachythecium albicans	P	P	P		P			P	P	P			P					P			9
Poa trivialis							P			P		P		P	P		P		P	P	8
Achillea millefolium				P								P		P	P		P		P		6
Dactylis glomerata				P			P			P		P			P						5
Stellaria graminea	P				P			P					P					P			5
Veronica arvensis		P	P			P		P	P												5
Cirsium vulgare							P					P		P					P		4
Ranunculus repens												P			P		P				3
Bromus hordeaceus				P			P			P											3
Phleum bertolonii				P			P														2
Rhytidiadelphus squarrosus	P								P												2
Geranium molle																	P			P	2
Cerastium glomeratum											P						P				1
Rumex acetosa																					1
Capsella bursa-pastoris								P													1
Number of species	13	12	12	14	12	11	15	12	13	14	11	14	12	12	13	11	13	13	11	12	Av. 12.5

Appendix 8. FIELD RECORD FOR F03 ORDINARY DRY GRASSLAND (CALCAREOUS) MONITORING PLOT P = present in sub-plot

Sub-plots	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	2017
Agrostis capillaris	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	20
Cirsium arvense	P	P	P	P	P	P	P	P	P	P		P	P	P	P	P	P	P	P	P	19
Holcus lanatus	P	P		P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	18
Veronica chamaedrys	P	P	P	P	P	P	P	P	P	P	P		P		P	P	P	P		P	17
Festuca rubra	P		P		P	P		P	P	P	P		P		P	P		P	P	P	14
Brachythecium rutabulum		P		P			P		P	P		P	P	P		P	P	P	P	P	13
Trisetum flavescens	P	P	P	P	P		P		P			P			P		P		P		11
Dactylis glomerata	P	P	P		P	P		P	P	P		P			P				P		9
Taraxacum agg.	P			P		P			P		P	P		P		P			P		9
Phleum bertolonii		P	P	P		P	P			P	P				P						8
Lolium perenne		P	P				P		P		P			P		P				P	8
Achillea millefolium			P	P		P		P				P	P				P	P			8
Stellaria graminea											P		P		P	P	P	P		P	7
Poa trivialis	P		P		P		P		P			P							P		7
Rhytidiadelphus squarrosus											P	P		P					P	P	5
Geranium molle			P						P		P				P					P	5
Veronica arvensis													P	P		P	P				4
Rumex acetosella											P							P		P	3
Cerastium fontanum	P									P							P				3
Cirsium vulgare					P			P													2
Carduus nutans			P						P												2
Potentilla reptans						P				P											2
Urtica dioica				P														P			2
Agrostis stolonifera			P			P															2
Veronica serpyllifolia								P				P									2
Linum catharticum					P																1
Leontodon hispidus								P													1
Arrhenatherum elatius	P																				1
Bromus hordeaceus													P								1
Geranium dissectum				P																	1
Number of species	11	9	13	11	9	11	9	10	13	10	11	11	10	8	10	10	10	10	10	11	Av. 10.4