Natural England Commissioned Report NECR107

A survey of selected agri-environment grassland and heathland creation and restoration sites

Part 2

First published 11 January 2013

www.naturalengland.org.uk

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Foreword

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Background

Species-rich grassland is one of the glories of the English landscape. Having shrunk in extent by some 98% through the mid 20th century its protection became, from the outset of agri-environment schemes in the 1980s, a prime objective. Heathland, although less common that grassland, is distinctive and highly valued part of the English Landscape and a rare and threatened habitat. It has also been a priority for restoration and re-creation under agri-environmental schemes and the subject of much R&D.

In the 1990s the agri-environment Research & Development programme began to find out how species-rich grassland can be re-created and restored. Research showed that grassland with a very wide range of species can be created on arable land, or restored from agriculturally improved grassland provided sufficient gaps are created for seed establishment. It also showed that almost all species-rich grassland is on soils low in available phosphorus and/or with other stress factors limiting competition from vigorous species.

These findings began to be fed into Classic Scheme delivery from the 1990s, but in a limited way. When Environmental Stewardship was introduced in 2005 a much more targeted and pro-active approach was taken in the Higher Level Scheme with specific options for creation (HK8) and restoration (HK7) of species-rich grassland of BAP Priority quality.

This project was initiated in August 2010 to find the best examples of creation and restoration to demonstrate how close it is possible to get to the target habitat and in what timescale. We also hoped to identify the key ingredients for success.

This is part 2 of the report and contains the results of the 2011 surveys of hay meadows, heathlands and acid grassland. The grassland surveys carried out in August 2010 are recorded in part 1.

It is intended that the best examples of restored and recreated habitats will be written up as case studies to explain and illustrate how arable and improved grassland, plantations or scrub can be transformed into species-rich grassland or heathlands respectively. For example, what sites, methods and management practices have been the most successful.

This report should be cited as:

WILSON, P., WHEELER, B., REED, M. & STRANGE, A. 2013. *A survey of selected agri-environment grassland and heathland creation and restoration sites: Part 2*. Natural England Commissioned Reports, Number 107.

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Keywords - Agri-environment schemes, grassland restoration, heathlands

Further information
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ISSN 2040-5545

Foreword

Species-rich grassland is one of the glories of the English landscape. Having shrunk in extent by some 98% through the mid 20th century its protection became, from the outset of agri-environment schemes in the 1980s, a prime objective. The focus in the Classic Schemes (Environmentally Sensitive Areas; Countryside Stewardship Scheme) was very much on maintaining and improving the condition of the remaining resource. There was also a considerable investment in creation of grassland ('arable reversion') but this was largely with the aim of restoring landscape character rather than biodiversity.

In the 1990s the agri-environment R&D programme began to find out how species-rich grassland could be re-created and restored. It was found that once wildflower species have been lost, often because of herbicides or fertilisers, they do not return quickly even when inputs cease. This is because most of these species do not have a persistent soil seedbank, their seeds do not travel far and do not germinate and establish readily in improved grassland because it is too dense. The absence of a seedbank also means that to revert from arable requires deliberate introduction of seeds unless the site is immediately adjacent to species-rich grassland and seeds can travel via grazing livestock. But the research showed that grassland with a very wide range of species can be created on arable land, or restored from agriculturally improved grassland provided sufficient gaps are created for seed establishment. It also showed that almost all species-rich grassland is on soils low in available phosphorus and/or with other stress factors limiting competition from vigorous species.

These findings began to be fed into Classic Scheme delivery from the 1990s but in a limited way. This was demonstrated by Kirkham et al (2006) who in 2004 surveyed 112 ESA and CSS grassland creation parcels, established between and 6 and 12 years previously, and found that only 10% were sown with diverse mixtures and only c.4% would have met the minimum threshold for Biodiversity Action Plan (BAP) Priority Habitat as subsequently defined in the Farm Environment Plan Manual (Natural England, 2010). When Environmental Stewardship was introduced in 2005 a much more targeted and pro-active approach was taken in the Higher Level Scheme with specific options for creation (HK8) and restoration (HK7) of species-rich grassland of BAP Priority quality.

This project was initiated in August 2010. The main driver was to find the best examples of creation and restoration so that we could demonstrate how close it is possible to get to the target habitat, in what timescale. We also hoped to identify the key ingredients for success. So we had no intention of selecting a random sample. Instead Natural England advisers were asked to identify sites which they thought had been most successful. Forty-two parcels were surveyed in September 2010 and results are published in Part 1. In 2011 a further 73 grassland parcels, and 9 heathland parcels, were surveyed and results are reported here in Part 2.

Judged by the minimum thresholds defined in Keys 2a and 2b in the FEP Manual, of the 73 grassland parcels reported here 62 qualified as BAP Priority Habitat in a timescale typically of 8-15 years but sometimes as few as 3 years, mostly from an arable or set-aside starting point. These sites are available to be entered onto the Grassland Inventory and hence inform the BAP reporting process. Some have also been the subject of further case studies. And 7 of the 9 heathland sites qualify as BAP Priority Habitat. Habitat creation and restoration are among our most demanding agri-environment objectives – success requires understanding, timeliness and attention to detail. So it is particularly encouraging to find that many of our agreement-holders have the required commitment.

Summary results of grassland creation sites from parts 1 and 2 of this project were reported by Stevens and Wilson, 2012. In the same volume are results from a random sample of grassland creation sites in HLS option HK8 surveyed in 2011 (Hewins, Pinches and Cooke, 2012).

Natural England Project Officer: Steve Peel

Summary

The aim of this survey was to provide data on the success of grassland and heathland creation and restoration carried out under agri-environment schemes.

Seventy-three grassland parcels at 62 separate sites and nine heathland parcels at seven sites were surveyed. These were selected by Natural England local staff, and were distributed throughout England from East Devon to Cumbria. Forty-three grasslands had been created on former arable land by drilling a seed mixture, spreading green hay or by natural regeneration. Thirty grasslands had been restored using a variety of methods including restoration of traditional management, raising water levels, seed supplementation and scrub clearance. All the heathlands had been restored by removal of scrub or woodland.

Standard Farm Environment Plan (FEP) survey methods were followed in order to determine whether vegetation stands could be considered as UKBAP Priority Habitat grassland or heathland. A complete species list was recorded from ten quadrats placed in each vegetation stand and a range of other parameters of vegetation structure was also recorded. Soil samples were collected from each field and analysed for major plant nutrients. Data from each stand was analysed using the keys in the FEP manual to determine whether the vegetation was a UKBAP Priority Habitat and to assess its condition. Reasons for failure to qualify as UKBAP Priority Habitat included high cover of *Trifolium repens* white clover, low number of species per m^2 and low cover of wild flower species and sedges.

Data was entered onto an Excel spreadsheet, and the outlines of land parcels were digitised.

Of the 43 created grassland stands, 22 were UKBAP Priority Habitat Lowland Meadows, ten were Lowland Calcareous Grassland, one was Lowland Dry Acid Grassland , two were Purple Moor Grass and Rush Pastures, one was Upland Hay Meadows and seven were non-priority habitat semi-improved grasslands. Twenty three of the created grasslands were in Condition A, one in Condition B and 13 in Condition C. The main reason for failing the condition assessment was the low frequency of indicator species. Use of species-rich seed mixtures and green hay both gave good results, natural regeneration was also effective where a species-rich seed-source was present in close proximity.

Of the 30 restored grasslands, 14 were UKBAP Priority Habitat Lowland Meadows, five were Lowland Calcareous Grassland, four were Lowland Dry Acid Grassland , two were Purple Moor Grass and Rush Pastures, one was Upland Hay Meadows and four were non-priority habitat semi-improved grasslands. Eleven of the restored grasslands were in Condition A, one in Condition B and 14 in Condition C. Grasslands were usually assigned to Condition C because of the low frequency of indicator species. Under these circumstances, it is likely that condition can be improved through suitable management. In the absence of detailed botanical assessments of the starting condition of these swards it is possible they were already of UKBAP quality although probably in poor condition.

Of the nine heathland stands, seven were UKBAP Priority Habitat Lowland Heathland, one was Upland Heathland and one was non-priority habitat upland fragmented grassland. Two were in condition A, four in Condition B and two in Condition C. The main reason for failure of condition assessment was a lack of adiverse age structure of heather *Calluna vulgaris*.

The suitability of sites for creation of species-rich grasslands on arable land and semi-improved grassland can be assessed using Keys 1 and 2c in the FEP manual. In both of these, available phosphorus (P) in the soil is important: sites with a P index of 2 are regarded as having only moderate potential and an index of 3 or more as having low potential, unless other factors increase their suitability. Only 5 of the 73 sites in this study had a P index of 3 or more and, of these, 3 nevertheless had high potential due to drought-stress or permanent waterlogging. Key 2c assessed the other 2 sites as being of low potential and their botanical composition reflected this. The FEP keys appear to be a useful guide to suitability for creation and restoration of species-rich grassland.

Recommendations for further work include surveying further examples of under-represented grassland and heathland types, further analysis of the data, modifications to FEP methods and use of the collected data as a basis for case studies of best practice.

Contents

Introduction

Among the principal aims of the agri-environment schemes (HigherLevel Stewardship [HLS] and EntryLevel Stewardship [HLS], Countryside Stewardship and Environmentally Sentive Areas) in Britain have been to increase the areas of habitats identified in the UK Biodiversity Action Plan as priority habitat types. These include several grassland and heathland communities (Table 1). More than 80,000 ha of grassland have been created or restored under agri-environment schemes since 1998. Approximately 40,000 ha of lowland heathland are in re-creation and restoration options in agri-environment schemes.

Despite these schemes having been in place since 1989, successive UKBAP reporting rounds have continued to note declines in the area and condition of priority grassland and heathland. There has however been a lack of systematic assessment of the area and condition of these habitats created and restored under agri-environment schemes. It is probable that this has led to underestimates of the area of UKBAP priority grassland and heathland.

Previous work has suggested that the development of UKBAP priority grassland on former arable land has been limited and slow (Hewins and others, 2008; Kirkham and others, 2006), but anecdotal evidence indicates that this is not always the case, and that grasslands of considerable conservation value can be restored or created over a relatively short period. A preceding survey in 2010 (Hewins, 2012) showed that of 42 stands of lowland calcareous grassland and lowland meadow surveyed, 36 contained grassland that conformed to the definitions in the Farm Environment Plan (FEP) manual (Natural England, 2010). This survey was however was carried out late in the year, and could therefore not include fields cut for hay or lowland dry acid grassland where survey is constrained by summer drought conditions and the presence of a large proportion of early-flowering ephemerals in the sward.

The aim of the work described here is to extend the dataset created in 2010 to include further examples of the grassland types sampled then, and to include additional habitat types such as lowland dry acid grassland, purple moor-grass and rush-pasture, upland hay meadow and lowland heathland. This information can then be used to contribute towards the UKBAP inventory of priority grasslands and heathlands, to inform future England Biodiversity Strategy reporting rounds, to provide a starting point for the development of case studies, and to provide information on best practice for grassland and heathland creation and restoration.

Table 1. UKBAP grassland and heathland types included in this project.

HLS code	UKBAP name	Principal NVC stand types
G02	Semi-improved grassland (nb not a UKBAP type)	MG1, MG6, MG9, MG10
G04	Lowland Calcareous Grassland	CG1-9
G05	Lowland Dry Acid Grassland	U1-4
G06	Lowland Meadows	MG4, MG5
G07	Purple MoorGrass and Rush Pastures	M22-M26
G09	Upland Hay Meadows	MG3
M03	Lowland Heathland	H1-H8 (including stands of M04 upland heath)

Note: In this version of the report all sites are numbered rather than named in order to ensure confidentiality.

Methods

The purpose of this project was to carry out rapid field surveys to determine the botanical quality of grassland and heathland identified by Natural England local advisers as being of possible BAP priority habitat standard.

A list of 60 grassland and seven heathland survey sites was proposed by Natural England. These were sites managed under Higher Level Stewardship, Countryside Stewardship or Environmentally Sensitive Area agreements where restoration or recreation of UKBAP habitats had been attempted. Some of these sites were eliminated from the sample due to unsuitability, and replacements were found (Appendix 1). A total of 73 grassland parcels on 62 farms and nine heathland parcels on seven sites were surveyed. Of the grassland parcels, 43 were under grassland creation (HK8 where under HLS agreement), and 30 were under restoration (HK7 where under HLS agreement). The heathland parcels were all under restoration (HO2 and HO3 where under HLS). Note, removing conifers (H03) is called restoration in HLS, however it is considered re-creation under BAP. This report uses the HLS rather than the BAP terminology.

Relevant Natural England staff members were contacted at the start of the project in order to obtain site maps, access details and contact details for landowners/managers. Insufficient time was available to write to landowners/managers, so in all cases they were contacted by telephone to obtain permission to carry out the survey, arrange a time for the visit and to acquire additional information about the site.

Field survey

Site survey followed standard methods for grassland and heathland assessment as described in the FEP Manual (Natural England, 2010). The whole of the selected land parcel was first walked to determine the extent of the UKBAP priority habitat grassland, and the extent of this was mapped. This stand was then walked, stopping at approximately equidistant intervals to record vegetation parameters. Ten stops were made, with the option of a further 10 in very heterogeneous vegetation. The following measurements were recorded in a $1m^2$ quadrat at each stop:

Grassland

1. A complete list of vascular plant species, bryophytes and terricolous lichens with a subjective DAFOR score for each (D = Dominant, A = Abundant, F = Frequent, O = Occasional, R = Rare).
2. Percentage cover of *Lolium perenne.*
3. Percentage cover of *Trifolium repens.*
4. Combined percentage cover of negative indicator species (*Cirsium arvense, Cirsium vulgare, Rumex crispus, Rumex obtusifolius, Rumex conglomeratus, Senecio jacobaea, Senecio aquaticus, Pteridium aquilinum.*
5. Ratio of herbs (including *Carex spp,* excluding *Ranunculus repens* and *Trifolium repens* and negative indicator species) to grasses (not recorded in purple moor-grass and rushpasture).
6. Percentage cover of reed-grasses (*Phragmites australis, Phalaris arundinacea, Glyceria maxima*) (also over the whole stand).
7. Percentage cover of non-jointed rushes (*Juncus effusus, J. inflexus, J. conglomeratus*) (also over the whole stand).
8. Percentage cover of bare ground.
9. Percentage cover of litter.
10. Percentage cover of scrub (also over the whole stand).

From the lists of vascular plant species, an assessment of the numbers of positive indicator species was made for each site. Lists of these are given for each grassland type in the FEP manual (Appendix 2). Following guidance in the manual, these lists are used interchangeably to account for transitional stands, and stands under creation that are in the early stages of development. Additional indicator species were used in some cases to reflect local distinctiveness. The mean number of species per m^2 was calculated.

Heathland

1. A complete list of vascular plant species, bryophytes and terricolous lichens.
2. Cover of dwarf shrubs.
3. Proportion of *Calluna vulgaris* shrubs in the growth classes (Young 1-5 years old; late mature/degenerate >15 years old) (Natural England, 2010).
4. Combined percentage cover of negative indicator species (*Cirsium arvense, Cirsium vulgare, Rumex crispus, Rumex obtusifolius, Rumex conglomeratus, Senecio jacobaea, Senecio aquaticus, Pteridium aquilinum*).
5. Percentage cover of bare ground.
6. Percentage cover of litter.
7. Percentage cover of scrub/trees (also over the whole stand).

A field assessment of the NVC community present in the stand type was made (Rodwell, 1991; Rodwell, 1992). The presence of adjacent semi-natural habitats that may act as seed sources was noted. At least one digital photograph was taken at each site.

Soil sampling

Soil samples were collected following the protocol for soil sampling described in Natural England Technical Information Note TIN 035 (Tytherleigh, 2008). Soil samples were collected using a pot auger. Thirty samples were taken from each parcel, three from the vicinity of each stopping point, giving a total of approximately 1 kg of soil, although this varied somewhat depending on soil moisture and depth. Samples from each field were bulked, sealed in a plastic bag and labelled. These were submitted for analysis via Natural England's soil submission system. Analysis parameters were:

pH
Extractable phosphorus (Olsen's method)
Total phosphorus content
Potassium content
Magnesium content
Total nitrogen content
Percentage loss on ignition
Organic carbon content

Data analysis

All data were tabulated on an Excel spreadsheet, using a separate worksheet for each sample site. For grasslands, the grassland type and condition of each sample was then determined using Keys 2a and 2b in the FEP manual. Seven of the heathland stands surveyed were M03 Lowland Heath and the remaining two were MO4 Upland Heath.

Key 2a enables grasslands to be identified as semi-improved or species-rich grasslands. Species-rich grasslands have two of the following: cover of *Lolium spp* and *Trifolium repens* <10%, sward with >15 species per m^2, cover of dicotyledonous species (excluding *Ranunculus repens, Trifolium repens* and injurious weeds) >30%. Semi-improved grasslands have two of the following: cover of *Lolium spp* and *Trifolium repens* <30%, sward with 9-15 species per m^2, cover of dicotyledonous species (excluding *Ranunculus repens, Trifolium repens* and injurious weeds) 10% or more.

Key 2b follows on from 2a, with the entry point determined from the outcome from 2a, and uses species of vascular plants to confirm the identification of grasslands as species-rich or semi-improved, and enables identification of species-rich grasslands to UKBAP type: GO4 Lowland Calcareous Grassland, GO5 Lowland Dry Acid Grassland, GO6 Lowland Meadows, GO7 Purple Moor Grass and Rush Pastures, GO9 Upland Hay Meadows (also non-UKBAP GO2 Semi-improved grassland) (Appendix 2).

Condition assessment

The condition of all grasslands and heathlands (apart from semi-improved grasslands) was assessed following guidelines given in the FEP manual. Condition criteria for each habitat are given in Appendix 3. There are three possible condition categories: A – all criteria fulfilled; B – one failed criterion; and C – 2 or more failed criteria, or low frequency of positive indicator species but sufficient species present although rare within the sward.

Map digitisation

The outline of each surveyed land parcel was mapped onto Ordnance Survey Mastermap tiles using Mapinfo. A separate layer was added with information for each polygon including the following: site reference number (Appendix 9), survey date, surveyor name, site name, UKBAP priority habitat and comments. The specification for digitisation provided by Natural England was followed.

Results

A total of 73 grassland parcels at 62 separate sites and nine heathland parcels at seven separate sites were surveyed (Table 2 & 3; Appendix 1). Forty-three grassland sites had been created (by seeding, spreading of green hay and natural regeneration from the seed-bank or adjacent habitat), while 30 grasslands were being restored from permanent grassland in unfavourable condition through management or supplementary seed addition. All heathlands were being restored by clearance of coniferous plantation, woodland or scrub (Appendix 4).

Table 2. Numbers of land parcels of different habitat types (from FEP Manual keys 2a and 2b) under creation or restoration management.

	Habitat type	Number of parcels	Creation	Restoration
GO2	Semi-improved grassland	11	7	4
GO4	Lowland calcareous grassland	15	10	5
GO5	Lowland dry acid grassland	5	1	4
GO6	Lowland meadows	36	22	14
GO7	Purple moor-grass and rush-pastures	4	2	2
GO9	Upland hay meadows	2	1	1
	Total grassland	73	43	30
MO3	Lowland heathland	7		7
MO4	Upland heathland	2		2

Table 3. Numbers of stands of NVC communities in surveyed parcels.

Habitat type	NVC community
Semi-improved grassland	5 x MG6a; 4 x MG6b; 1 x MG5a; 1 x MG10a
Lowland calcareous grassland	1 x CG2; 1 x CG3b; 2 x CG3d; 2 x CG4; 3 x CG5; 2 x MG1e; 2 x MG5b; 2 x not classified
Lowland dry acid grassland	1 x U1c; 1 x U1e; 1 x U3a; 1 x U4a; 1 x U4c
Lowland meadows	4 x MG1; 3 x MG4; 12 x MG5a; 8 x MG5b; 8 x MG5c; 1 x MG6b
Purple moor-grass and rush-pastures	2 x M23a; 2 x M23b
Upland hay meadows	2 x MG3
Lowland heathland	4 x H2a; 1 x H8e; 1 x H9b; 1 x H12c; 2 x M25b

Grassland creation

Of the 43 sites where grassland creation had been attempted, UKBAP grassland habitat was present at 36. Some stands of species-rich MG1 were classified here as UKBAP Lowland Meadows and Lowland Calcareous Grassland rather than the more usual non-UKBAP semi-improved grassland.

There were 29 lowland-meadow creation sites. Grasslands at 22 of these were identifiable as UKBAP Lowland Meadows in condition categories A-C, while seven were semi-improved grassland. The NVC community was MG5b at nine sites, MG5a at eight sites, MG5c at two sites, MG5 at two sites, MG4 at three sites, MG1 at two sites and MG6a at four sites.

A further 10 sites had UKBAP Lowland Calcareous Grassland. A range of NVC communities was present at these sites, including two examples of CG4, one of CG3, one of CG5, two unclassified CG communities and two MG1e and two MG5b where grasslands were transitional to more mesotrophic swards. A single example of UKBAP Upland Hay Meadows with MG3 grassland was created, there were also one Lowland Dry Acid Grassland (U1c) and two Purple Moor Grass and Rush Pastures (M23a and M23b).

The principal method of grassland creation was the use of a species-rich seed mixture of known provenance (harvested from a nearby SSSI or provided by a reputable supplier from native sources) at a total of 16 sites (11 lowland meadows, four calcareous grasslands and one upland hay meadow), while commercial seed mixes were used at nine lowland meadow sites. Green hay (usually from a species-rich meadow on the same site or from a nearby SSSI) was spread on 10 lowland meadows, and natural regeneration from the seed-bank or from adjacent habitats was the management at six lowland calcareous grasslands, three purple moor-grass and Rush pastures and one lowland dry acid grassland (Table 4: Appendix 4).

Table 4. Grassland creation methods.

Target habitat type	Species-rich seed mixture	Natural regeneration	Green hay	Commercial seed mixture
Lowland calcareous grassland	4	6		
Lowland meadows	12		10	9
Upland hay meadows	1			
Lowland dry acid grassland		1		
Total	17	7	10	9

Grassland restoration

Thirty sites were surveyed where grassland had been restored. Starting habitats for each site are given in Appendix 4. In some cases a detailed botanical assessment of the starting condition of these swards was not available so they may already have been of UKBAP quality, albeit perhaps in poor condition. Twenty-six of these sites had grassland that was identifiable as a UKBAP priority habitat. Of these, 14 were Lowland Meadows, five were Lowland Calcareous Grassland, four were Lowland Dry Ac Grassland, two were Purple Moor Grass and Rush Pastures and one was Upland Hay Meadows. There were only four examples of semi-improved grassland. The target grassland type at two of these was Lowland Meadows, at one it was Upland Hay Meadows, and at the fourth it was Purple Moor Grass and Rush Pastures.

The principal means of grassland restoration at 12 sites was the reinstatement of traditional management. It is thought likely that at all of these sites the required number of positive species was present before resumption of management although not at the specified frequency (at sites 61,62 & 63 for example, relics of the former species-rich grassland were present in field-margins). This was principally through the reintroduction of a suitable grazing and hay-cutting regime, although this also included control of *Cirsium arvense* at one site, and the raising of water levels at two purple moor-grass and rush pasture sites. Trees and scrub were cleared from nine sites with subsequent natural regeneration of vegetation, and this was the principal method of restoration at calcareous and acid grassland sites. Seed was added at ten sites, seven of which were lowland meadows, largely by use of species-rich seed-mixtures, but also by spreading green hay at three sites (Table 5; Appendix 4).

Table 5. Grassland restoration methods (note that at some sites more than one method was used).

	Species-rich seed-mixture	Reinstatement of management (no seed added)	Green hay	Tree and scrub clearance
Lowland calcareous grassland	1	3	1	2
Lowland dry acid grassland		3		3
Lowland meadows	4	8	4	2
Purple moor-grass and rush-pastures		3*		1
Upland hay meadows	2			
Total grassland	7	17	5	8

* Includes raising water levels at two sites

Grassland condition

Condition of grasslands and heathlands was assessed using methods described in the FEP manual after first assessing samples using Key 2a to assign them to a UKBAP habitat or to the semi-improved category.

Overall, 36 out of 73 sampled grasslands were in condition A. Only one grassland was in condition B, while 26 were in condition C. Ten of the grasslands were semi-improved. Nine out of 14 lowland calcareous grasslands and 20 out of 45 of lowland meadows were in condition A (Table 6; Appendices 5, 6 and 7).

Eighty-four per cent of created grasslands were in condition A-C, with only 16% considered to be semi-improved. The majority of these were in condition A (Table 7). Similarly, 87% of restored sites were in condition A-C, however more than 50% of these were in condition C. Although sample sizes are small, it appears that there is a higher proportion of restored calcareous grasslands in condition A than there are lowland meadows (Table 8).

Table 6. Condition of grasslands and heathland. Percentage of sites in condition categories (both created and restored sites).

	Condition %			
Habitat type	A	B	C	Semi-improved
Lowland calcareous grassland	9	1	5	
Lowland dry acid grassland	2		3	
Lowland meadows	20		17	8
Purple moor-grass and rush-pastures	3		1	1
Upland hay meadows	2			1
Total grassland	**36**	**1**	**26**	**10**
Lowland (and upland) heathland	2	4	2	1

Table 7. Condition of grasslands. Numbers of created grasslands in condition categories A, B and C and semi-improved (SI).

	A	B	C	SI
Lowland calcareous grassland	6		4	
Lowland meadows	15		8	6
Purple moor-grass and rush-pastures	1		1	
Upland hay meadows	1			
Lowland dry acid grassland	1			
Total grassland	24	0	13	6

Table 8. Condition of grasslands and heathland. Numbers of restored habitats in condition categories A, B and C and semi-improved (SI).

	A	B	C	SI
Lowland calcareous grassland	3	1	1	
Lowland meadows	5		9	2
Lowland dry acid grassland	1		3	
Purple moor-grass and rush-pastures	2			1
Upland hay meadows	1			1
Total grassland	12	1	13	4
Heathland	2	4	2	1*

* Fragmented upland heath

Table 9. Reasons for failure of condition assessment attributes (grasslands).

	Cited reason for failure of condition assessment		
Habitat type	Low frequency of indicator species	Low % cover broadleaves/small *Carex*	>5% scrub
Lowland calcareous grassland	5		1
Lowland dry acid grassland	3		
Lowland meadows	25	7	
Purple moor-grass and rush-pastures	2	1	
Upland hay meadows	1		
Total	36	8	1

The major reason for sampled sites failing the grassland condition assessment was the low frequency of indicator species. Following the standard FEP method, failure of this condition places a grassland in condition category C providing the target number of indicator species are present at lower frequencies. Twenty-seven parcels were placed in category C for this reason. Grasslands that have been assigned to this condition category have the potential for recovery to condition A under suitable management.

Eight samples failed because of the low cover of broad-leaved and small *Carex* species, while a single calcareous grassland restoration (48) failed because the cover of scrub was over five per cent.
It should be noted that a grassland can fail the condition assessment on more than one criterion (Table 9; Appendix 5). There were no failures due to excessive cover of undesirable species, cover of bare ground or cover of large reed-grasses.

Heathland restoration

Nine heathland parcels were surveyed. All of these were being restored by the removal of planted conifers or self-sown woodland. Two of these sites, 81 and 82 were found on survey to be UKBAP habitat M04 Upland Heathland. Site 82 is managed under HLS option HL11 Restoration of Upland Heathland, while Site 81 is managed under ESA Tier 2 Heather Moorland. The other sites are all M03 Lowland Heathland. Sites 75 & 76 managed under HLS option H02 (Restoration of lowland heathland on neglected sites), and all others under H03 (restoration of forestry area to lowland heathland).

Four of the seven samples of lowland heath were H2a (*Calluna vulgaris-ULex minor* dry heath) dry heathland within a small area to the south-east of London. The other dry heath stand was H8e (*Calluna vulgaris-Ulex gallii* heath, *Vaccinium myrtillus* sub-community), Site 80 in Staffordshire. All of these dry heathlands were in condition A or B, the only criterion failed being age structure. At Site 77, most of the heather was at the pioneer stage, while at 78 & 79 and 80, most of the heather was in the building stage. This might be expected from heathlands in an early stage of restoration from former forestry land (Appendix 7).

The areas of heathland at 75 & 76 are wet heathland, closest to M25b. Wet heathlands typically have a lower cover of dwarf shrubs than dry heathlands, and are normally richer in associated species. Both stands surveyed here have a cover of *Calluna vulgaris* that is lower than the target value of 25 per cent. The more-recently-cleared stand has a high cover of scrub that has regenerated in the absence of grazing, while the older grazed stand has much less scrub, and fails the condition assessment only on the cover of dwarf shrubs.

The upland heath at Site 82 was considered to be an example of the upland MO2 Fragmented Heath, and was in the early stages of succession following felling of the conifer plantation. It failed as MO3 because the cover of *Calluna vulgaris* was below 25 per cent. Site 81 was considered to be MO4 Upland Heath which was in condition B due to the heather having an even-aged structure. This site was particularly notable for its large population of the uncommon *Lycopodium clavatum*.

Soil analyses (Tables 10 and 11; Appendix 8).

pH As expected the pH values of calcareous grassland soils were considerably higher than those of other habitats. Created and restored calcareous sites had similar pH values, but overall created grassland soil pH values were generally higher than those of restored grassland. Mean heathland soil pH was lower than for other habitats.

Nitrogen Total nitrogen was the single measure of nitrogen content recorded. For both calcareous grasslands and lowland meadows, mean total nitrogen was higher in restored grassland samples. Levels in created and restored semi-improved grasslands were similar. Nitrogen levels were highest in lowland calcareous grasslands, and lowest in semi-improved grasslands and restored heathlands.

Phosphorus Extractable phosphorus (Olsen's method) and total phosphorus were measured. The two measures showed no obvious close relationship to each other. In general, phosphorus levels were higher in created grasslands than in restored grasslands. Extractable phosphorus was lowest in heathland samples and was also very low in both created and restored lowland calcareous grasslands. Only five samples had a high phosphate index of 3. Total phosphorus levels however

were highest in lowland calcareous grassland, and while lowest in heathland samples, were also very low in semi-improved grasslands.

Potassium Extractable potassium levels were highest in both created and restored lowland calcareous grasslands, lower in lowland meadows and lowest in lowland heathland. In only two of 82 sites was the potassium level below the threshold of 61mg/l specified for suitability for botanical enhancement of species-poor grassland where phosphorus levels are high.

Magnesium Extractable magnesium levels were generally high, with 65 of the 82 samples having an index of 3 or higher. There was no clear relationship to habitat type.

Loss on Ignition This is a simple approximation of soil organic matter. This was higher in all restored habitats than in created habitats; values were highest in calcareous and acid grasslands.

Organic carbon Levels were higher in restored grassland samples than in created grasslands for the three grassland types where comparison was possible. All restored habitats apart from semi-improved grasslands had a mean higher level of organic carbon than created habitats. The highest levels were in lowland calcareous grasslands and lowland dry acid grasslands.

Table 10. Soil analyses. Summary of results for all grassland and heathland sites. There were fewer than four sites for created or restored purple moor-grass and rush pastures, created acid grasslands and upland hay meadow, so these are not shown here.

	pH	**Olsen's Phosphorus mg/l**	**Phosphorus index**	**Total phosphorus mg/kg**	**Potassium mg/l**	**Potassium index**	**Magnesium mg/l**	**Magnesium index**	**Total nitrogen % (w/w)**	**Loss on ignition % (w/w)**	**Organic carbon % (w/w)**
Created sites											
Lowland calcareous grassland	7.8	9.4	0.4	1028	296	3.4	153	3.2	0.70	14.9	6.79
Lowland meadows	6.6	13.4	1.1	875	188	2.2	163	3.1	0.47	12.7	5.39
Semi-improved grassland	6.3	20.7	1.9	731	225	2.8	237	4	0.44	12.5	5.36
Restored sites											
Lowland calcareous grassland	7.8	7.2	0	958	252	2.6	289	4.4	0.77	21.0	8.17
Lowland dry acid grassland	4.9	13.5	1	528	174	1.8	120	3.8	0.66	21.7	8.90
Lowland meadows	5.8	10.8	0.8	828	147	1.7	224	4.1	0.68	19.2	7.57
Semi-improved grassland	5.5	10.0	0.5	699	182	2.3	150	3.3	0.48	17.0	6.14
Heathland	4.7	6.8	0.2	409	125	1.0	116	2.7	0.44	16.36	7.88

Table 11. Soil analyses. Comparison of created and restored grasslands – all types.

	pH	**Olsen's Phosphorus mg/l**	**Total phosphorus mg/kg**	**Potassium mg/l**	**Magnesium mg/l**	**Total nitrogen % (w/w)**	**Loss on ignition % (w/w)**	**Organic carbon % (w/w)**
Created grasslands	6.8	14.0	874	213	171	0.52	13.4	5.8
Restored grasslands	5.99	11.7	809	171	213	0.66	19.5	7.7

Discussion

A total of 43 created grasslands, 30 restored grasslands and nine restored heathlands were surveyed. Of these, 37 of the created grasslands, 26 of the restored grasslands and all of the heathlands were judged to be BAP habitat in conditions A-C, and management was considered to have been successful. When taken together with the previous survey (Hewins, 2012), there is a total data resource of 35 Lowland Calcareous Grassland land parcels, 49 Lowland Meadows, 16 Semi-improved Grasslands (largely from Lowland Meadow target sites), five Lowland Dry Acid Grasslands, four Purple MoorGrass and Rush Pastures, two Upland Hay Meadows and nine heaths (a total of 110 land parcels).

The sample of sites was not randomised, as the majority were selected by Natural England advisers because they believed management to have been successful. It is not therefore possible to state whether this is a representative sample, or to extrapolate from these results in order to derive a national figure for the area of restored/created habitat. At the same time as this survey however, a random sample of 36 grasslands under HLS Option HK8 (creation of species-rich semi-natural grassland) was also surveyed (Hewins, Pinches & Cooke, 2012; Hewins in prep), but results of this are not yet available.

It is evident, however, from the results of this survey and the preceding survey carried out in 2010 (Hewins, 2011), that options for habitat creation and restoration available under Higher Level Stewardship and its predecessor schemes are capable of delivering the objectives of increasing the area of UKBAP priority grassland and heathland types present in England. Although some of this vegetation is well established and of extremely high quality, in many sites successional processes were in a relatively early stage, and while vegetation could be identified as a UKBAP priority habitat, there were frequently considerable differences from semi-natural communities.

Grassland creation

Four major methods were used for grassland creation. Successful results were achieved from the use of species-rich seed mixtures, spreading green hay from species-rich donor sites and natural regeneration where there were species-rich adjacent habitats and a residual seed-bank.
Only seven grasslands were created by natural regeneration, yet these included four of the best sites surveyed (2, 7, 67 and 6). Three of these were lowland calcareous grasslands and the other (67) was a lowland dry acid grassland. The two purple moor-grass and rush-pasture sites created by natural regeneration and raising water levels (34 & 71) have been slower to establish, but contain patches of species-rich vegetation and have potential for development of species-rich swards. The previous survey (Hewins, 2012) reported only limited success at sites where natural regeneration was the creation method. For the greatest likelihood of success a species-rich seed source must be present, soil nutrient levels should be low, management by cutting and grazing should be in place and grazing animals should ideally range over both seed-source and receptor sites to facilitate seed transfer.

Seven created grasslands (including 71 described above) were assessed as semi-improved. Without further investigation it is not possible to account for this relative failure, but in some cases it may be due to the use of relatively species-poor seed mixtures, while at others (37, 39, 40, 42) high soil phosphate levels may play a role.

Of the created grasslands that passed the condition assessments in categories A-C, more than a third were in category C as a result of the indicator species being present in lower frequencies than required for condition A or B grasslands. Many of these grasslands are species-rich with other

indicator species present at lower frequencies in the sward, but are in the early stages of succession, and with continuation of suitable management under agri-environment schemes are likely to develop into condition A grasslands.

It is probable that there is a correlation between the length of time since the start of grassland creation and the species-richness of grassland. It is worth noting that the exceptional sites at 4, 26, 1, 2 and 7 had all been established for longer than 10 years.

In the majority of cases, seed mixtures appeared moderately well suited to the sites, although there is a tendency to uniformity, with what appear to be very similar seed mixtures being applied to many sites. The widely used Emorsgate mixtures are dominated by a few species that germinate readily and produce flowers after relatively few years (eg *Centaurea nigra, Galium verum, Leucanthemum vulgare, Achillea millefolium, Ranunculus acris, Lotus corniculatus*). These mixtures also contain typically only 20 per cent dicotyledonous species and no *Cyperaceae* or *Juncaceae*. In the long term it is probable that ecological processes will cause divergence of community composition, but it would be preferable for seed mixtures to be customised to site conditions. Spreading of green hay can be a very good means of introducing variety between sites, and seemed to give very good results. The composition of green hay can however be skewed by the time of cutting. An early cut can miss late-flowering species, while a late cut can miss those that flower early. Application of green hay cut on different dates can give a more complete spectrum of species. Overall, the use of seed mixtures in grassland creation seems to have improved greatly since the 1980s when there was considerable concern about the provenance of some species, grasses and *Papillionaceae* in particular.

Grassland restoration

Grassland restoration took two major forms: supplementing seed supply using a species-rich seed mixture or green hay after disturbance of the existing sward, and reintroduction of suitable management (including clearance of scrub and woodland). Both of these resulted in the development of species-rich vegetation. The best example of a seed-supplemented site was 57, where a species-rich mixture had been slot-seeded into an existing semi-improved sward in 1989, with subsequent spreading of seed and addition of plug-grown plants. In general however, seeding into established swards appears to have been less successful than other means of improving or creating grasslands, although without an initial survey it is not possible to be certain of this.

There are several sites where reintroduction of suitable management has restored UKBAP priority habitats. Scrub has been cleared from limestone grassland at 48 and 46 in Yorkshire, and although there has been some regeneration of scrub at these sites, species-rich calcareous grassland has re-established. Another calcareous grassland site where clearance of trees, in this case planted woodland, has been very successful is 47, while scrub cleared at 68 has restored an area of wet fen meadow. At 61, 62 & 63, a hay-cutting and mixed-grazing regime with native breeds of cattle and ponies has resulted in the restoration of species-rich MG5c from species-poor semi-improved grassland, while at 50 near Morecambe Bay, the introduction of native breed cattle in conjunction with scrub clearance is in the early stages of restoring a complex of wood-pasture, acid grassland and limestone outcrops. At all of these sites, relics of previous species-rich grassland were present before restoration management started.

While only four of the thirty grassland restoration sites were assessed as semi-improved, more than 50 per cent of those that passed the condition assessment were in condition C, largely because of indicator species being present in lower frequencies than required for condition A grasslands. In

common with the created grasslands described above, it is likely that the condition of these sites will improve with continued agri-environment scheme management.

Heathland restoration

Only nine heathland parcels were surveyed, two upland heaths, two lowland wet heaths and five lowland dry heaths. Only one method of restoration, the removal of planted coniferous woodland and self-sown woodland, was considered. This method of heathland recreation appeared very successful, particularly where planted conifers were cleared from lowland dry heath. A relic heathland flora often persists for many years under a planted conifer canopy, requiring only to be released from this heavy shade. The dwarf shrub cover developing after conifer removal appears to be relatively even-aged, and this might be expected if there is much germination of dwarf-shrub seedlings. It is likely that further management is desirable after restoration. At Site 74 the cutting of broad swathes through stands of mature *Calluna* has resulted in large patches of pioneer growth.

The two wet heath samples, 75 & 76 were both at one site, and both had a cover of dwarf shrubs below the target level. Cover of dwarf shrubs in wet heath communities (M16 and M25) is often much lower than that in dry heathlands, but they are frequently more species-rich. It is possible that wet heathland needs a different set of condition assessment attributes to dry heathland, specifying a minimum number of species per m^2 and a lower target level for dwarf-shrub cover. Additional survey of wet heathland is required.

A major problem in all heath types after restoration is regeneration of scrub and conifers, and this was seen at several sites. At 74, 77, 75, 76, and 78 & 79 there are programmes of intensive scrub control. At 80 a scrubby heath/woodland interface is managed for the UKBAP moth species Argent and Sable, the larvae of which require two-year old Betula pubescens as a food plant. A mixed-grazing regime could be the ideal way of controlling scrub regrowth, but it can frequently be difficult to obtain grazing animals for heathland sites.

Soil analyses

Soil samples were analysed to determine nitrogen, phosphorus, potassium, magnesium and organic matter content. A statistical analysis of these results was not carried out, but it is possible to make some general observations. Overall, soils at created sites had higher levels of extractable phosphate, total phosphorus and potassium, while restored sites had higher levels of total nitrogen and organic matter across all habitats where comparison was possible (lowland calcareous grassland, lowland meadow and semi-improved grassland). The pH of lowland meadow and semi-improved grassland samples was higher for created sites than for restored sites. These differences may reflect the residual effect of previous arable agriculture on soil chemistry. Past management may also be responsible for the higher levels of total nitrogen and organic carbon in restored grasslands compared to those created on former arable land.

Lowland calcareous grassland samples had the highest values for pH, total phosphorus, potassium, total nitrogen and loss of mass on ignition. Mean extractable phosphorus was however lowest in lowland calcareous grasslands. Lowland heathland samples had the lowest extractable and total phosphorus, extractable potassium and magnesium and joint lowest (with created semi-improved grasslands) total nitrogen of all of the restored habitat types.

The level of extractable phosphorus is important in determining whether a species-poor grassland is a suitable target for management for botanical enhancement. To be considered a high potential candidate site soil must usually have a low phosphorus index, of 0 (0-9 mg/l) or 1 (10-15 mg/l) (Keys 1 and 2c in Natural England, 2010). Of the sites surveyed, 15 of 43 created grasslands had a phosphorus index of 2 or higher, while only six out of 30 restored sites had a phosphorus index of 2 or higher. No heathland site had an index of higher than 1.

Table 12. Sites with extractable phosphorus index of 2 or higher.
(**P index**: 3 = >25 mg/l; 2 = 16-25 mg/l; 1 = <16 mg/l. **K index**: 1 = 61-120 mg/l; 2 = 121-240 mg/l; 3 = 241-400 mg/l. **Drought stress**: shallow stony or light-textured soil. **Waterlogging**: V = wet for long periods into the growing season; IV = waterlogged for long periods in the winter. **Grazing stock**: S = sheep; C = cattle. Potential: H = high, M = medium, L = low, U = unsuitable).

Site	P index	K index	Drought stress	Water-logging	Grazing stock	Potential	Condition
67	3	2-	Y	N	S	H	A
12	2	2+	Y	N	S	H	C
51	3	2+	Y	N	S	H	C
11	3	2-	N	V	C	H	A
68	2	1	N	V	S & C	H	A
13	2	2+	N	IV	S	M	A
17	2	2-	N	IV	S	M	A
23	2	2+	N	IV	S	M	A
24	2	2+	N	IV	S	M	A
28	2	2-	N	IV	C	M	A
55	2	2-	N	IV	S	M	C
19	2	2	N	N	S & C	M	A
43	2	2-	N	N	S & C	M	A
54	2	1	N	N	S or C	M	C
64	2	2-	N	N	S or C	M	C
73	2	2-	N	N	S & C	M	A
20	2	3	N	N	S	L	C
42	2	2-	N	N	S	L	B
40	2	1	N	N	N	L	SI
37	3	2-	N	N	S & C	U	SI
39	3	2-	N	N	N	U	SI

Soil analysis results were examined for each site using Key 2c of the FEP Manual (Natural England, 2010). This key considers soil characteristics as well as grazing and weed abundance. To have a high potential for success of botanical enhancement measures, sites should provide a stressed environment (*sensu* Grime and others, 1988) through low phosphorus levels (P index <2), drought stress or waterlogging; stock should be available for grazing; and there should be a low frequency of competitive "weedy" species. Of the 73 sites surveyed, 21 had a high phosphorus index, of 2 or 3 (Table 12). Of these however, three were considered to have soils under drought stress, and two under permanent waterlogging (wetness class V) and therefore a high potential for botanical enhancement. A further six had had seasonally high water tables (wetness class IV), while five others were regularly cut for hay and had available cattle for aftermath grazing, and these all therefore had moderate potential. Only three sites were considered to have low potential, and a further two to be unsuitable. Sites are only considered unsuitable where soils have a P index of 3 or higher and there are no factors imposing high stress on plant growth. Of the low-potential sites, 20 had moderately species-rich MG5 grassland with frequent *Orchis morio,* and 42 had a moderately

species-rich created sward. These were only considered of low potential because the aftermath is grazed by sheep rather than cattle. The other low-potential and unsuitable sites (39, 40 and 37) all had species-poor semi-improved grassland .

It should be noted that a high phosphorus level alone is not necessarily a predictor for failure of grassland restoration or creation. Site 67, for example, is one of the richest grasslands surveyed. Neither are potassium levels alone a good predictor, the highest recorded potassium levels were from very successfully created and restored grasslands at Sites 1 & 2, where phosphorus levels however were very low. It is clear that relationships between soil chemistry, water retention and botanical composition are complex and require more detailed analysis.

Constraints

There were several limitations to the coverage of the survey. Geographical spread was constrained by the response of Natural England advisers and others to the initial appeal for location of survey sites. There were for instance several grassland sites in Oxfordshire, Lincolnshire/South Yorkshire, Shropshire/Staffordshire and Lancashire, yet none in Surrey/Sussex/Kent, Norfolk/Cambridgeshire or Northumberland/Durham. Six of the lowland heath stands were in Surrey/Berkshire, and the other three in Shropshire/Staffordshire. Some UKBAP priority habitats were well represented, while others were less so. There were 38 Lowland Meadows samples (including semi-improved stands where the target community was Lowland Meadows) and 15 Lowland Calcareous Grassland samples, while there were few examples of Lowland Dry Acid Grassland, Upland Hay Meadows, Purple Moor Grass and Rush Pastures and Lowland Heathland (two heathland sites proposed for survey were in fact upland heathland).

In some cases it was not immediately clear which UKBAP habitat type was present at a site. This was particularly so for sites under creation using seed mixtures, where the composition of the sward in the early stages of succession will be primarily determined by the composition of the seed mixture and only secondarily by environmental conditions at the receptor site. With grasslands that were intermediate between Lowland Calcareous Grassland and Lowland Meadows it can be difficult to determine against which set of FEP guidelines the grassland should be assessed. This can also be a problem in semi-natural swards of MG5b, CG3b, CG4b and mesotrophic variants of CG5a where a relatively deep brown earth soil is derived from calcareous drift or overlies calcareous strata. In some cases this led to sites where the target community was calcareous grassland but the community surveyed was closer to lowland meadow (eg 1, 2 & 18). In this survey the dilemma was resolved by following the guidance in the FEP handbook and using the lists of indicator species flexibly and interchangeably. Some additions were made to the lists of indicator species to allow for locally distinctive grassland types. These included *Filago vulgaris, Filago minima, Hypochoeris glabra* and *Ornithopus perpusillus* in Lowland Dry Acid Grassland, *Oenanthe pimpinelloides* and *Potentilla erecta* hybrids in Lowland Meadows, and *Linum bienne* in Lowland Calcareous Grassland. In practice however, these additions made little significant difference to results.

Recommendations

1. Survey of additional sites in habitats which were undersampled.

   Only four sites with dry acid grassland, four sites with purple moor-grass and rush-pasture, three sites for upland hay meadow and seven sites (including nine separate parcels) of lowland heathland were surveyed. This sample size is insufficient for reaching any reliable

conclusions about the success of restoration or creation of these habitats, although indications from this project are that habitat restoration and creation can be as successful as for lowland meadows and calcareous grassland if appropriately targeted, and if environmental conditions and management are suitable. At least ten further sites for these habitats should be surveyed.

All heathland restorations involved removal of planted conifers or secondary woodland, and it would be desirable to extend the sample to include other forms of restoration, e.g. reintroduction of grazing, and heathland recreation including seeding and soil acidification. Several sites would be available for further survey. For example, acid grassland creation on former arable is being carried out around Poole Harbour in Dorset, in the East Anglian Breckland and in the Suffolk Sandlings. There are lowland heathland restoration and recreation sites in the East Anglian Breckland, the Suffolk Sandlings (eg RSPB Minsmere reserve), the Blackdown Hills and the New Forest.

2. Adoption of sites as case studies of best practice in grassland creation and restoration.

While it is clear that overall, existing methods of grassland and heathland creation and restoration under Higher Level Stewardship and its predecessor schemes can be very successful, specific examples of best practice would be extremely valuable for farmers and land managers when they are considering management options, and would also be useful to Natural England advisers.

Case studies should include examples of different methods of grassland creation and restoration, including the use of bespoke seed mixtures, green hay from species-rich sites, natural regeneration, reintroduction of appropriate grazing and cutting regimes, invasive weed control and scrub/woodland removal. Examples of all UKBAP lowland grasslands and heathlands should be included. Case study sites will ideally have a history of botanical monitoring and will allow comparison of different establishment conditions (management, establishment method, soil type, time elapsed since creation/restoration start).

Table 10. Possible case study sites.

Creation	Site Number	
Lowland meadow	28 &29	Three fields in the Thames floodplain either sown with an Emorsgate seed mixture or spread with green hay. Successful establishment of species-rich lowland meadows close to MG5a, MG5b and MG4.
	21	A large floodplain field with alluvial and peaty soils. Species-rich grassland until 1970s, seeded with a mixture from Derwent Ings. Successful establishment of species-rich MG5b and MG4 including *Oenanthe silaifolia*.
	26	A series of meadows and other parcels of land on heavy clay. Part of an SSSI scheduled for the large population of great crested newts. Seeded with a mixture from a nearby SSSI but with some recruitment from the seed-bank. Now has large areas of species-rich MG5c.
Lowland calcareous grassland	4	Owner is proprietor of Emorsgate Seeds. A large number of former arable fields sown with seed harvested from adjacent species-rich calcareous grasslands. Excellent possibilities for

		comparing fields sown in different years from 1995 to 2011. Some species-rich calcareous grassland comparable with semi-natural swards.
	1 & 2	Several fields on Jurassic limestone within 1 km of the sea and with substantial areas of existing species-rich grassland. Half of the fields have been sown with seed harvested from the site, and half allowed to develop by natural succession. Both methods have resulted in species-rich swards of differing compositions.
	8	Two large fields on chalk including a branched valley. Sown with seed from the adjacent calcareous grassland SSSI. A variable but locally species-rich calcareous sward has developed with CG3 and CG4 grasslands and several species typical of well-established communities.
Lowland dry acid grassland	67	A large, former arable field on gravelly moraine with a very freely-draining soil. A grassland seed mixture was sown with little success, but very species-rich U1 acidic grassland has since developed by natural regeneration with several uncommon species including *Hypochoeris glabra*.
Upland hay meadow	43	A large field on a river terrace once managed as in-bye grazing, but agriculturally improved. Reseeded in 2006 using seed from a nearby SSSI with restoration of stone walls and traditional management. Now a substantial area of species-rich upland meadow with affinities to MG3.
Purple moor-grass and rush-pasture	34	Former fen, drained in the 1970s and under arable cultivation until 2000, when entered into the Countryside Stewardship Scheme. Species-rich M23 rush-pasture has been allowed to develop by natural regeneration from the seed-bank.
Restoration		
Lowland meadow	61, 62 &63	A group of six small fields. These were species-poor grassland with relics of MG5 in field margins, managed under Countrysdie Stewardship Scheme by reducing inputs, taking an annual late hay-cut and grazing the aftermath with a traditional cattle breed. Species-rich MG5 is developing in all fields. Adjacent MG5c being restored by scrub clearance was not covered in this survey.
Lowland meadow and lowland dry acid grassland	52 &65	A Breckland SSSI with grassland on freely draining acidic sands and deeper more mesotrophic soil. It includes numerous periglacial ponds and hollows. Much of this had become covered by mixed scrub and *Betula pubescens* woodland. A large area of this has been cleared, and grazing by sheep has been introduced, with the re-establishment of U1 and species-rich MG5 grassland and opening-up of wetland and fen communities.
Lowland calcareous grassland	47	This was formerly one of the richest calcareous grassland sites in the area. There are two fields. The fields were planted with trees in the 1950s, with the gradual loss of grassland. Trees were cleared in 1994 and hay, cut from relics of grassland on the site and from nearby sites, was spread. Species-rich grassland is now present over the whole site.

Lowland heathland	80	This former conifer plantation is situated between blocks of woodland SSSI. The conifers have been felled over several years in blocks and a substantial area of H8 heathland is now present although this is still rather even-aged in each block. This site is being managed for multiple objectives, as there is a population of the rare argent and sable moth which requires stands of young *Betula pubescens* as a larval food-plant.
	78, 79	This is part of a larger heathland site owned by RSPB. The whole site was formerly a conifer plantation, but compartments have been felled and cleared, resulting in blocks of heathland of different ages. The site is now very important for breeding birds.

3. Amendments to guidance in the FEP Manual. Some additions are recommended to the lists of indicator species in the FEP Manual. These include *Filago vulgaris, Filago minima, Ornithopus perpusillus* and *Hypochoeris glabra* in Lowland Dry Acid Grassland, *Oenanthe pimpinelloides*, *Potentilla anglica* and *Potentilla erecta* hybrids in Lowland Meadows and *Linum bienne* in Lowland Calcareous Grassland.

4. Lowland Heath M03 should be subdivided into Lowland Wet Heath and Lowland Dry Heath. These types of heath have widely differing compositions and structures. Wet heathland frequently has a lower cover of dwarf shrubs than dry heathland, but a higher component of graminoids. A critical determinant of condition is the frequency and density of *Molinia caerulea.* It is also frequently much more species-rich than dry heathland. A survey of wet heathland stands is recommended in order to determine condition assessment attributes and thresholds. Some simple means should be sought for incorporating lower plant attributes into heathland assessments.

5. Review the use of soil characteristics as predictors of the success of the botanical enhancement of species-poor grasslands.

6. The dataset should be analysed using multivariate statistics, for example Canonical Correspondence Analysis, in order to study relationships between vegetation composition and environmental variables such as soil chemistry and management factors.

Acknowledgements

Thanks are due to all Natural England staff who helped in locating sites for this survey and who supplied maps and management information. They included the following in no particular order: Des Sussex, Mary Tomlinson, Anne Newson, Alison Muldal, Nick Squirrell, Adam Kwolek, Kate Fagan, Dave Prichard, Yvonne Jones, Carol Paterson, Harley Goodwin, Frances McCullagh, David Ragbourne, Ann-Marie Jones, Wayne Davies, Tom Holland, Emily Ledder, Fiona Quick, Ian Bowes, Graham Walsh, Ian Slater, Simon Stainer, Bev Nichols, Emily Deacon, Janet Lambert, Phil Gibson, Georgina Terry, Donna Gowler, Graham Walker, Roger Griffin and Julian Key. Other NE staff who provided invaluable assistance included Steve Peel, Brian Crumley and especially Pete Stevens who helped with the submission of soil samples. Other individuals and representatives of organisations who were of great help were Donald McIntyre, Sue Everett, Peter Bowman, Bill Grayson, Markus Wagner, Stewart Cocker, Mike Coates, Katie Black, Dave Bromwich, Chris Tomlinson, Darrell Stevens, Helena Buckley, Brian Ward and Eleanor Hewins. The greatest thanks must go to all of the landowners and managers who allowed access to their land and provided information on history and management.

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Appendix 1. Location of surveyed sites.

Grassland				
	Site number	County		Creation or restoration
	4	Bath and NE Somerset		Creation
	23	Berkshire		Creation
	24	Berkshire		Creation
	70	Cumbria		Restoration
	73	Cumbria		Restoration
	43	Cumbria		Creation
	61	Devon		Restoration
	62	Devon		Restoration
	63	Devon		Restoration
	1	Dorset		Creation
	2	Dorset		Creation
	7	Dorset		Creation
	10	Dorset		Creation
	26	Dorset		Creation
	5	Dorset		Creation
	6	Dorset		Creation
	45	Dorset		Restoration
	54	Lancashire		Restoration
	55	Lancashire		Restoration
	69	Lancashire		Restoration
	50	Lancashire		Restoration
	39	Lancashire		Creation
	40	Lancashire		Creation
	68	Lancashire		Restoration
	37	Lancashire		Creation
	53	Leicestershire		Restoration
	31	Leicestershire		Creation
	58	Lincolnshire		Restoration
	59	Lincolnshire		Restoration
	47	Lincolnshire		Restoration
	9	Lincolnshire		Creation
	8	Lincolnshire		Creation
	12	Lincolnshire		Creation
	44	Lincolnshire		Restoration
	3	Lincolnshire		Creation
	36	Lincolnshire		Creation
	41	Lincolnshire		Creation
	38	Lincolnshire		Creation
	57	Lincolnshire		Restoration
	20	Lincolnshire		Creation
	51	Norfolk		Restoration
	52	Norfolk		Restoration
	65	Norfolk		Restoration
	18	Northamptonshire		Creation

	33	Northamptonshire		Creation
	19	Northamptonshire		Creation
	13	Northamptonshire		Creation
	22	Oxfordshire		Creation
	15	Oxfordshire		Creation
	28	Oxfordshire		Creation
	29	Oxfordshire		Creation
	17	Oxfordshire		Creation
	16	Oxfordshire		Creation
	32	Oxfordshire		Creation
	56	Oxfordshire		Restoration
	66	Shropshire		Restoration
	35	Shropshire		Creation
	30	Shropshire		Creation
	42	Shropshire		Creation
	34	Shropshire		Creation
	71	Shropshire		Creation
	72	Shropshire		Restoration
	41	Staffs		Restoration
	60	Staffs		Restoration
	14	Staffs		Creation
	67	Suffolk		Creation
	11	Suffolk		Restoration
	25	Yorkshire		Creation
	27	Yorkshire		Creation
	46	Yorkshire		Restoration
	21	Yorkshire		Creation
	64	Yorkshire		Restoration
	48	Yorkshire		Restoration
Heathland				
	74	Berkshire		Restoration
	82	Shropshire		Restoration
	81	Shropshire		Restoration
	80	Staffordshire		Restoration
	77	Surrey		Restoration
	75	Surrey		Restoration
	76	Surrey		Restoration
	78	Surrey		Restoration
	79	Surrey		Restoration

Appendix 2. Positive indicator species and abundance thresholds for UKBAP grassland types.

Grassland type	Positive indicator species	Additional species	Species abundance threshold
Semi-improved grassland	*Leontodon autumnalis, Medicago lupulina, Cardamine pratensis, Ranunculus bulbosus, Hypochoeris radicata, Rumex acetosa, Luzula campestris, Veronica chamaedrys, Trifolium dubium, Plantago lanceolata, Ranunculus acris, Trifolium pratense, Prunella vulgaris, Achillea millefolium*		At least 4 occasional in the sward
Lowland calcareous grassland	*Stachys officinalis, Lotus corniculatus, Geranium sanguineum, Carlina vulgaris, Campanula glomerata, Helianthemum nummularium, Primula veris, Filipendula vulgaris, Succisa pratensis, Euphrasia spp, Linum catharticum, Knautia arvensis, Gentianella spp, Centaurea scabiosa, Viola hirta, Campanula rotundifolium, Plantago media, Helianthemum canum, Hippocrepis comosa, Anthyllis vulneraria, Galium verum, Origanum vulgare, Polygala spp, Pilosella officinarum, Orchidaceae, Leucanthemum vulgare, Astragalus danicus, Ononis spp, Leontodon hispidus, Leontodon saxatilis, Sanguisorba minor, Serratula tinctoria, Scabiosa columbaria, Asperula cynanchica, Cirsium acaule, Arenaria serpylifolium, Calamintha acinos, Thymus spp, Blackstonia perfoliata*	*Linum bienne*	At least two frequent and three occasional in the sward
Lowland dry acid grassland	*Stachys officinalis, Lotus corniculatus, Succisa pratensis, Euphrasia spp, Campanula rotundifolium, Galium verum, Polygala spp, Pilosella officinarum, Astragalus danicus, Leontodon hispidus, Leontodon saxatilis, Serratula tinctoria, Thymus spp, Erica cinerea, Vaccinium myrtillus, Sedum acre, Vicia orobus, Erigeron acer, Plantago coronopus, Centaurium erythraea, Erodium cicutarium, Helianthemum nummularium, Veronica officinalis, Calluna vulgaris, lichens, Pedicularis sylvatica, Dianthus deltoids, Aphanes spp, Conopodium majus, Jasione montana, Rumex acetosella, Teesdalia nudicalis, Potentilla erecta, Viola spp, Fragaria vesca, Anemone nemorosa, Teucrium scorodonia*	*Filago vulgaris, Filago minima, Ornithopus perpusillus, Hypochoeris glabra*	At least one frequent and three occasional in the sward
Lowland meadows	*Stachys officinalis, Lotus corniculatus, Primula veris, Filipendula vulgaris, Succisa pratensis, Euphrasia spp, Knautia arvensis, Gentianella spp, Galium verum, Polygala spp, Orchidaceae, Leucanthemum vulgare,*	*Oenanthe pimpinelloides, Potentilla erectaXreptans*	At least two frequent and two occasional in the sward

	Leontodon hispidus, Leontodon saxatilis, Sanguisorba minor, Serratula tinctoria, Conopodium majus, Potentilla erecta, Anemone nemorosa, Agrimonia eupatorium, Vicia orobus, Centaurea nigra, Ajuga reptans, Pimpinella saxifrage, Polygonum bistorta, Thalictrum flavum, Genista tinctoria, Tragopogon pratense, Sanguisorba officinalis, Lotus uliginosus, Alchemilla spp, Galium palustre, Galium uliginosum, Caltha palustris, Valeriana dioica, Lathyrus pratense, Filipendula ulmaria, Oenanthe silaiifolia, Silaum silaus, Conopodium majus, Lychnis flos-cuculi, Achillea ptarmica, Geum rivale, Mentha aquatic, Rhinanthus minor, Carex flacca/nigra/panicea		
Purple moor-grass and rush pastures	*Succisa pratensis, Orchidaceae, Leontodon hispidus, Serratula tinctoria, Potentilla erecta, Ajuga reptans, Lotus uliginosus, Galium palustre, Galium uliginosum, Caltha palustris, Valeriana dioica, Valeriana officinalis, Filipendula ulmaria, Lychnis flos-cuculi, Achillea ptarmica, Geum rivale, Mentha aquatica, Narthecium ossifragum, Sphagnum spp, Anagallis tenella, Erica tetralix, Trollius europaeus, Sanguisorba officinalis, Eupatorium cannabinum, Juncus acutiflorus/articulatus/subnodulosus, Ranunculus flammula, Berula erecta, Pedicularis sylvatica, Potentilla palustris, Crepis paludosa, Hydrocotyle vulgaris, Viola palustris, Thalictrum flavum, Cirsium dissectum, Carum verticillatum, Angelica sylvestris, Carex flacca/nigra/panicea*		At least two frequent and two occasional in the sward
Upland hay meadows	*Lotus corniculatus, Succisa pratensis, Euphrasia spp, Knautia arvensis, Orchidaceae, Serratula tinctoria, Conopodium majus, Potentilla erecta, Anemone nemorosa, Centaurea nigra, Ajuga reptans, Polygonum bistorta, Sanguisorba officinalis, Alchemilla spp, Caltha palustris, Valeriana dioica, Lathyrus pratense, Filipendula ulmaria, Conopodium majus, Lychnis flos-cuculi, Achillea ptarmica, Geum rivale, Rhinanthus minor, Carex flacca/nigra/panicea, Pimpinella saxifraga, Trollius europaeus, Cirsium heterophyllum, Geranium sylvaticum*		At least two frequent and two occasional in the sward

Appendix 3. Condition assessment criteria.

	Cover of undesirable species	Cover of dicot and *Carex spp**	Cover of bare ground	Cover of invasive trees and shrubs	Cover of other negative species	Positive indicator species
Semi-improved grassland	No condition assessment					
Lowland calcareous grassland	[1]<5%	>30%	<10%	<5%		At least 2 species frequent, 3 species occasional
Lowland dry acid grassland	[2]<5%		<10%	<5%	*Pteridium aquilinum* <20%	At least 1 species frequent, 3 species occasional
Lowland meadows	[3]<5%	>20%	<10%	<5%	Reed-grasses, large *Carex* etc <30%	At least 2 species frequent, 2 species occasional
Purple moor-grass and rush pastures	[4]<10%			<5%	Large *Carex* <30%, reed-grasses and *Deschampsia cespitosa* <20%	At least 2 species frequent, 2 species occasional
Upland hay meadows	[5]<10%	>30%	<10%		Non-jointed *Juncus* spp <50%	At least 2 species frequent, 2 species occasional
		Dwarf shrubs	Age classes of *Calluna vulgaris*			
Lowland heath	[6]<10%	25%-95% cover, at least 2 species	10%-25% pioneer, 10%-30% late-mature/degenerate	<15%	<1% *Rhododendron ponticum* and other exotic species	

[1] *Cirsium arvense, Cirsium vulgare, Rumex crispus, Rumex obtusifolius, Senecio jacobaea, Urtica dioica*; [2] *Cirsium arvense, Cirsium vulgare, Rumex crispus, Rumex obtusifolius, Senecio jacobaea, Urtica dioica, Chamaenerion angustifolium, Cirsium palustre, Carduus nutans, Plantago major*; [3] *Cirsium arvense, Cirsium vulgare, Rumex crispus, Rumex obtusifolius, Senecio jacobaea, Urtica dioica, Senecio aquatica, Anthriscus sylvestris, Pteridium aquilinum*; [4] *Cirsium arvense, Cirsium vulgare, Rumex crispus, Rumex obtusifolius, Senecio jacobaea, Urtica dioica, Anthriscus sylvestris, Cirsium palustre, Senecio aquatica*; [5] *Cirsium arvense, Cirsium vulgare, Rumex crispus, Rumex obtusifolius, Senecio jacobaea, Urtica dioica, Anthriscus sylvestris*; [6] *Cirsium arvense, Cirsium vulgare, Rumex crispus, Rumex obtusifolius, Senecio jacobaea, Urtica dioica, Pteridium aquilinum*. * Excluding undesirable species, *Trifolium repens* and *Ranunculus repens*.

Appendix 4. Methods used for grassland and heathland creation and restoration. UKBAP type: LCG Lowland Calcareous Grassland, LM Lowland Meadow, UM Upland Meadow, LAG Lowland Dry Acid Grassland, PMRP Purple Moor-Grass and Rush Pasture, SI Semi-Improved Grassland.

Site number	UKBAP type	Previous habitat	Scheme	Years since start	Method
4	LCG	Arable	HLS	16	Drilled with seed harvested from nearby species-rich grassland
1	LCG	Arable	HLS	15	Drilled with seed harvested from nearby species-rich grassland
2	LCG	Arable, Set-aside	HLS	15	Natural regeneration (adjacent species-rich grassland)
7	LCG	Arable, Set-aside	HLS	21	Natural regeneration (adjacent species-rich grassland)
10	LCG	Conifer plantation	HLS	15	Natural regeneration
8	LCG	Arable	HLS	15	Natural regeneration
5	LCG	Arable	HLS	3	Drilled with seed brush-harvested from adjacent species-rich grassland
6	LCG	Arable, Set-aside	HLS	21	Natural regeneration (adjacent species-rich grassland)
9	LCG	Arable	HLS	10	Seeded with a calcareous grassland mixture
3	LCG	Arable	HLS	3	Natural succession
23	LM	Arable	HLS	5	Drilled with seed harvested from nearby species-rich grassland
24	LM	Arable	HLS	5	Drilled with a species-rich seed mixture
26	LM	Improved grassland	HLS	25	Drilled with seed harvested from nearby species-rich grassland
31	LM	Arable	HLS	10	Drilled with seed harvested from nearby species-rich grassland
33	LM	Arable	HLS	2	Seeded with a neutral meadow mixture and some green hay from an adjacent SSSI spread
19	LM	Arable	CSS	9	Drilled with seed harvested from nearby species-rich grassland
13	LM	Arable	CSS	8	Green hay from two nearby SSSIs
15	LM	Arable	ESA	7	Green hay from adjacent SSSI
28	LM	Arable	ESA	3	Green hay from nearby SSSI, also planted with *Fritillaria* bulbs
29	LM	Arable	ESA	8	Seeded with a species-rich meadow mixture
17	LM	Arable	HLS	6	Green hay from nearby SSSI
16	LM	Arable	CSS	9	Seeded with a neutral meadow mixture
32	LM	Arable	ESA	9	Seeded with a neutral meadow mixture
21	LM	Arable	HLS	10	Drilled with seed harvested from nearby species-rich grassland
12	LM	Arable	CSS	13	Seeded with a calcareous grassland mixture
20	LM	Unmanaged grassland	HLS	8	Green hay from adjacent SSSI

18	LM	Arable	CSS	3	Seeded with a neutral/calcareous meadow mixture
22	LM	Arable	HLS	11	Seeded with a neutral meadow mixture
30	LM	Arable and quarry	HLS	8	Green hay from nearby SSSI
14	LM	Arable	HLS	6	Green hay from adjacent species-rich meadow
25	LM	Arable	HLS	11	Drilled with seed harvested from nearby species-rich grassland
27	LM	Arable	HLS	4	Drilled with seed harvested from nearby species-rich grassland
35	LM	Arable and quarry	HLS	8	Green hay from nearby SSSI
34	PMRP	Arable	HLS	11	Natural regeneration and raised water-level
42	LM	Arable	HLS	5	Seeded with a neutral meadow mixture
39	SI	Arable	CSS	7	Green hay
40	SI	Arable	CSS	7	Green hay
37	SI	Arable	HLS	5	Drilled with lowland meadow seed mixture
36	SI	Arable	HLS		Landscaped for breeding birds. Seeded with a grassland mixture
41	SI	Improved grassland	HLS	9	Drilled with seed harvested from nearby species-rich grassland
38	SI	Arable	HLS		Landscaped for breeding birds. Seeded with a grassland mixture
71	SI	Arable	HLS	11	Natural regeneration and raised water-level
43	UM	Semi-improved grassland	HLS	5	Drilled with seed harvested from nearby species-rich grassland
45	LCG	Semi-improved grassland	WES	Approx 18	Green hay
41	LCG	Plantation woodland	CSS	17	Removal of trees, spreading green hay from grassland relics within the field
46	LCG	Undermanaged grassland	HLS	3 ?	Cleared of scrub and grazed by sheep
48	LCG	Scrub	HLS	20	Scrub cleared. Natural regeneration
44	LCG	Calcareous grassland	HLS	11	Thistle control, introduction of suitable grazing
67	LAG	Arable, set-aside	HLS	20	Natural regeneration
50	LAG	Scrub and woodland	CSS	10	Scrub clearance and grazing with traditional-breed cattle
51	LAG	Conifer plantation	HLS	18	Trees cleared gradually under ESA and HLS
52	LAG	Scrub and woodland	HLS	18	Trees cleared gradually under ESA and HLS
61	LM	Semi-improved grassland	CSS	8	Cessation of fertiliser inputs; hay-cutting, grazing of aftermath with traditional-breed cattle
57	LM	Semi-improved grassland	HLS	22	Slot seeded with a species-rich grassland mixture
65	LM	Scrub & undermanaged grassland	HLS	18	Trees cleared gradually under ESA and HLS

56	LM	Improved grassland	HLS	4	Seeded with a neutral meadow mixture
66	LM	Improved grassland	HLS	>10	Green hay
47	LAG	Undermanaged grassland	No scheme	18	Reinstatement of management
62	LM	Semi-improved grassland	CSS	8	Cessation of fertiliser inputs; hay-cutting, grazing of aftermath with traditional-breed cattle
63	LM	Semi-improved grassland	CSS	8	Cessation of fertiliser inputs; hay-cutting, grazing of aftermath with traditional-breed cattle
54	LM	Semi-improved grassland	HLS	15	Green hay
55	LM	Improved grassland	HLS	5	Disced and reseeded with seed from nearby species-rich grassland
53	LM	Species-rich grassland	CSS	10	Grazing by cattle
58	LM	Semi-improved grassland	HLS	10	Hay-cutting and aftermath grazing
59	LM	Semi-improved grassland	HLS	10	Hay-cutting and aftermath grazing
60	LM	Arable	HLS	4	Green hay from nearby SSSI
64	LM	Scrub	HLS	20	Scrub cleared. Natural regeneration
68	PMRP	Scrub and grassland	HLS	2	Scrub clearance and grazing with sheep and cattle
11	PMRP	Undermanaged grassland	HLS	12	Grazing by cattle
73	UM	Semi-improved grassland	HLS	2	Drilled with seed harvested from nearby species-rich grassland
72	SI	Improved grassland	HLS	5	Green hay from adjacent species-rich meadow
70	SI	Semi-improved grassland	HLS	6	Drilled with seed harvested from nearby species-rich grassland
69	SI	Semi-improved grassland	HLS	5	Disced and reseeded with seed from nearby species-rich grassland
Heathlands					
74	LH	Conifer plantation	No scheme	13	Conifer clearance, subsequent scrub control
80	LH	Conifer plantation	CSS	6	Conifer clearance
82	FH	Conifer plantation	HLS	5	Conifer clearance
81	UH	Conifer plantation	HLS	6	Conifer clearance, sheep grazing
77	LH	Conifer plantation	HLS	4	Conifer clearance, subsequent scrub control
78	LH	Conifer plantation	HLS	6	Conifer clearance, subsequent scrub control
79	LH	Conifer plantation	HLS	5	Conifer clearance, subsequent scrub control
75	LH	Secondary woodland	HLS	10	Gradual clearance of secondary woodland
76	LH	Secondary woodland	HLS	20	Gradual clearance of secondary woodland, cattle grazing

Appendix 5. Site condition and reasons for failure of condition assessment.

Site number	UKBAP grassland type	NVC Community	Area of stand ha	Site Condition	Creation or restoration	Reason for failure
4	Lowland calcareous grassland	CG3b	3.70	A	Creation	
1	Lowland calcareous grassland	MG5b	1.45	A	Creation	
2	Lowland calcareous grassland	MG5b	1.55	A	Creation	
7	Lowland calcareous grassland	CG4b	10.44	A	Creation	
10	Lowland calcareous grassland	Not determined	0.58	A	Creation	
8	Lowland calcareous grassland	CG5b	12.3	A	Creation	
5	Lowland calcareous grassland	Not determined	4.7	C	Creation	low frequency of indicator species
6	Lowland calcareous grassland	MG1e/CG2c	3.03	C	Creation	low frequency of indicator species
9	Lowland calcareous grassland	CG4c	3.10	C	Creation	low frequency of indicator species
3	Lowland calcareous grassland	MG1e	7.41	C	Creation	low frequency of indicator species
23	Lowland meadow	MG5a	8.21	A	Creation	
24	Lowland meadow	MG5b	9.36	A	Creation	
26	Lowland meadow	MG5c	9.22	A	Creation	
31	Lowland meadow	MG5a	3.25	A	Creation	
33	Lowland meadow	MG5b	4.49	A	Creation	
19	Lowland meadow	MG5a	8.17	A	Creation	
13	Lowland meadow	MG4	14.59	A	Creation	
15	Lowland Meadow	MG1a	13.03	A	Creation	
28	Lowland meadow	MG5a	11.16	A	Creation	
29	Lowland meadow	MG5b	11.36	A	Creation	
17	Lowland meadow	MG5a	16.67	A	Creation	
16	Lowland meadow	MG5b	4.92	A	Creation	
32	Lowland meadow	MG5b	9.59	A	Creation	
21	Lowland meadow	MG5a&MG4	12.46	A	Creation	
12	Lowland meadow	MG5b	15.35	C	Creation	low frequency of indicator species
20	Lowland meadow	MG5	3.10	C	Creation	low frequency of indicator species
18	Lowland meadow	MG1e	5.00	C	Creation	low frequency of indicator species
22	Lowland meadow	MG5b	11.2	C	Creation	low frequency of indicator species

30	Lowland meadow	MG5c	1.65	C	Creation	low frequency of indicator species
14	Lowland meadow	MG5a	5.57	C	Creation	low frequency of indicator species
25	Lowland meadow	MG5a	6.89	C	Creation	low frequency of indicator species
27	Lowland meadow	MG4	3.04	C	Creation	low frequency of indicator species, >10% *Trifolium repens,* low cover of dicot spp
35	Purple moor-grass/rush pasture	M23b	1.20	A	Creation	
34	Purple moor-grass/rush pasture	M23b	3.20	C	Creation	low frequency of indicator species
42	Semi-improved lowland meadow	MG5	6.34	B	Creation	>10% *Trifolium repens*
39	Semi-improved lowland meadow	MG6a	3.0		Creation	low frequency of indicator species, , low species-richness, low cover of dicot spp
40	Semi-improved lowland meadow	MG6a	5.7		Creation	low frequency of indicator species, , low species-richness, low cover of dicot spp
37	Semi-improved lowland meadow	MG5a	1.20		Creation	low frequency of indicator species, low species-richness, >10% *Trifolium repens*
36	Semi-improved lowland meadow	MG6a	21.04		Creation	low frequency of indicator species, low cover of dicot spp
41	Semi-improved lowland meadow	MG6a	2.27		Creation	low frequency of indicator species, low cover of dicot spp
38	Semi-improved lowland meadow	MG6a	6.56		Creation	low frequency of indicator species, >10% *Trifolium repens*
71	Semi-improved Purple moor grass & rush pasture	MG10a	9.27		Restoration	low frequency of indicator species, low cover of dicot spp
43	Upland meadow	MG3	3.2	A	Creation	
45	Lowland calcareous grassland	CG3d		A	Restoration	
41	Lowland calcareous grassland	CG3d + CG5a	2.11	A	Restoration	
46	Lowland calcareous grassland	CG5a	1.9	A	Restoration	
48	Lowland calcareous grassland	CG5a	0.93	B	Restoration	Scrub cover >5%
44	Lowland calcareous grassland	CG2c	2.50	C	Restoration	low frequency of indicator species
67	Lowland dry acid grassland	U1c	13.92	A	Restoration	
50	Lowland dry acid grassland	U4a		C	Restoration	low frequency of indicator species
51	Lowland dry acid grassland	U3a	11.9	C	Restoration	low frequency of indicator species, low species-richness

52	Lowland dry acid grassland	U1e	12.88	C	Restoration	low frequency of indicator species, low species-richness
61	Lowland meadow	MG5c	0.76	A	Restoration	
57	Lowland meadow	MG5c	1.37	A	Restoration	
65	Lowland meadow	MG5b	6.87	A	Restoration	
56	Lowland meadow	MG1e	2.31	A	Restoration	
66	Lowland meadow	MG1a	5.76	A	Restoration	
47	Lowland dry acid grassland	U4c	1.99	A	Restoration	
62	Lowland meadow	MG5a	0.52	C	Restoration	low frequency of indicator species
63	Lowland meadow	MG5a	0.73	C	Restoration	low frequency of indicator species
54	Lowland meadow	MG5a	1.14	C	Restoration	low frequency of indicator species, low species-richness
55	Lowland meadow	MG6b	1.5	C	Restoration	low frequency of indicator species
53	Lowland meadow	MG5c	5.19	C	Restoration	low frequency of indicator species
58	Lowland meadow	MG5c	1.51	C	Restoration	low frequency of indicator species, low species-richness
59	Lowland meadow	MG5c	7.41	C	Restoration	low frequency of indicator species, low species-richness
60	Lowland meadow	MG5c	2.01	C	Restoration	low frequency of indicator species
64	Lowland meadow	MG5a	0.74	C	Restoration	low frequency of indicator species, low cover of dicot spp, low species-richness
68	Purple moor-grass/rush pasture	M23a	2.78	A	Restoration	
11	Purple moor-grass/rush pasture	M23a	1.91	A	Restoration	
73	Upland meadow	MG3	3.78	A	Restoration	
72	Semi-improved Lowland Meadow	MG6b	1.75		Restoration	low frequency of indicator species, low cover of dicot spp, low species-richness
70	Semi-improved Upland meadow	MG6b	6.08		Restoration	>10% *Trifolium repens,* low frequency of indicator species
69	Semi-improved Lowland Meadow	MG6b	1.0		Restoration	low frequency of indicator species, low species-richness, >10% *Trifolium repens*

Heathlands						
74	Lowland heath	H2c	22.30	A	Restoration	
80	Lowland heath	H8e	7.20	A	Restoration	
82	Fragmented upland heath	H12c	12.87		Restoration	<25% cover of dwarf shrubs
81	Upland heath	H9b	6.08	B	Restoration	*Calluna vulgaris* is even-aged
77	Lowland heath	H2a	3.30	B	Restoration	*Calluna vulgaris* is even-aged
78	Lowland heath	H2a	9.70	B	Restoration	*Calluna vulgaris* is even-aged
79	Lowland heath	H2a	9.69	B	Restoration	*Calluna vulgaris* is even-aged
75	Lowland heath	M25b	0.57	C	Restoration	<25% cover of dwarf shrubs,
76	Lowland heath	M25b	0.25	B	Restoration	<25% cover of dwarf shrubs,

Appendix 6. Summary of grassland site attributes.

	Positive indicator species			%	%	%	%		
Site number	Frequent	Occasional	Rare	Lolium perenne	Trifolium repens	Grass/herb ratio	Negative indicator species	No of species/M^2	Condition
4	6	5	6	0	8	60	0	28	A
1	11	2	3	<1	<1	76	0	26	A
2	5	2	8	1	1	66	<1	24	A
7	4	3	7	<1	3	53	0	24	A
10	3	2	1	2	<1	62	1	25	A
8	4	3	11	0	2	56	0	14	A
5	2	0	5	<1	26	46	0	19	C
6	2	0	12	0	7	56	<1	21	C
9	2	1	5	0	6	49	0	12	C
3	0	2	3	2	5	51	1	15	C
23	3	1	3	1	<1	46	1	14	A
24	4	3	1	2	1	55	<1	15	A
26	5	3	8	0	3	45	1	18	A
31	3	2	4	1	4	46	0	22	A
33	4	0	0	<1	1	61	1	19	A
19	3	1	2	7	6	53	0	16	A
13	3	1	4	3	1	70	<1	18	A
15	2	2	4	1	7	44	<1	17	A
28	3	1	3	2	10	54	0	15	A
29	4	2	2	5	3	60	0	17	A
17	5	0	2	5	9	61	<1	18	A
16	2	4	4	2	21	50	0	17	A
32	4	0	2	1	10	53	2	16	A
21	3	3	10	1	8	66	0	18	A
12	2	2	6	0	13	55	0	19	C
20	2	0	4	5	10	65	0	16	C
18	1	4	2	<1	10	69	7	14	C

22	3	0	2	<1	3	63	<1	17	C
30	3	1	4	0	1	64	0	13	A
14	3	0	2	1	6	66	<1	15	C
25	1	1	4	1	3	60	0	15	C
27	1	1	6	0	14	21	2	13	C
35	3	1	8	<1	3	55	0	15	A
34	1	5	2	0	<1	32	2	13	C
42	3	1	1	4	18	40	<1	15	A
39	0	0	1	0	0	2	<1	8	SI
40	0	0	1	0	5	4	0	11	SI
37	1	2	1	8	72	11	0	14	SI
36	1	0	1	0	<1	13	0	14	SI
41	1	0	1	3	11	29	0	18	SI
38	0	0	1	6	19	40	1	14	SI
71	0	1	3	1	8	12	0	11	C
43	5	1	2	0	5	59	0	19	A
45	5	1	7	0	<1	35	0	23	A
41	5	1	10	<1	<1	55	<0.1	18	A
46	6	0	15	0	0	37	1	14	A
48	5	1	6	0	1	51	0	20	B
44	0	5	3	2	1	32	2	18	C
67	5	3	3	0	0	44	1	18	A
50	1	3	3	0	0	25	1	17	C
51	2	0	3	0	0	51	2	9	C
52	1	2	3	0	0	39	0	12	C
61	2	3	3	1	8	40	1	20	A
57	4	3	6	<1	1	61	0	20	A
65	1	4	5	0	4	44	2	21	A
56	4	1	3	1	0	45	1	16	A
66	3	2	0	<1	0	64	1	14	A
47	4	1	6	0	1	28	2	17	A
62	2	0	2	5	10	45	0	19	C

63	2	1	3	1	7	45	0	16	C
54	1	1	5	1	1	43	0	13	C
55	2	0	5	1	10	33	<1	15	C
53	2	2	4	5.6	7.3	34	0.1	16.8	C
58	2	1	4	<1	0	33	0	12	C
59	4	0	2	<1	0	31	0	12	C
60	3	0	3	<1	7	62	<1	16	C
64	1	1	4	1	14	41	2	14	C
68	2	3	4	0	0	44	<1	17	A
11	4	0	2	0	0	39	1	16	A
73	2	2	4	1	1	52	1	17	A
72	1	0	0	6	4	15	<1	11	SI
70	2	0	2	3	26	33	0	16	SI
69	1	2	2	1	23	25	0	15	SI

Appendix 7. Summary of heathland site attributes.

Site number		*Calluna vulgaris* growth stage %						
	Cover of dwarf shrubs	Pioneer	Building/ early mature	Late mature/ degenerate	% Negative indicator species	% Pteridium aquilinum	Cover of woody species	Bare soil
74	59.5	20	64	16	0	4.1	4.2	1.7
82	18.7	12.5	0	0	0.2	0	5.8	15.7
81	86	3	97	0	0	0	0.8	0
80	65	12	88	0	<1	5.6	5.5	7.9
77	64.5	61	35.5	3.5	0	4.5	3.5	9.5
75	20.5	4	36.5	59.5	0	0	19.3	0.5
76	20	21	42	37	0	1.9	3.7	4.7
78	71	2.3	97.7	0	0	0	0.5	<1
79	41.2	15	0	0	0	2.5	6.6	15.7

Appendix 8. Results of soil analyses.

Sample number	pH	Olsens P	Index P	K	Index K	Mg	Index Mg	Total N	Loss on ignition	Total P	Organic carbon	Soil texture	Soil association
		mg/l		mg/l		mg/l		% w/w	% w/w	mg/kg	% w/w		
Grasslands													
4	7.7	6	0	261	3	129	3	1.6	26	1525	12.1	Sandy Loam	Evesham1
1	7.8	7	0	625	5	252	5	0.7	17.2	766	7.71	Sandy Clay Loam	Sherborne
2	7.8	6	0	431	4	231	4	0.7	17.3	797	7.77	Sandy Clay Loam	Sherborne
7	7.7	6	0	234	2+	208	4	0.6	15.9	743	6.04	Sandy Loam	Frilsham
10	7.6	9	0	135	2-	156	3	0.8	18	1194	7.59	Sandy Clay Loam	Icknield
8	8.1	13	1	264	3	76	2	0.47	10.7	1232	5.45	Clay Loam	Andover1
5	8	9	0	169	2-	100	2	0.46	9.2	1007	4.51	Clay	Blewbury
6	8.2	10	1	263	3	80	2	0.41	9.9	953	4.54	Clay	Blewbury
9	7.7	13	1	294	3	102	3	0.67	9.9	946	7.26	Clay	Andover1
3	7.6	15	1	281	3	192	4	0.56	15.1	1122	4.9	Clay Loam	Elmton1
23	6.1	23	2	214	2+	115	3	0.47	13.7	905	5.63	Clay Loam	Thames
24	5.7	18	2	189	2+	117	3	0.46	11.3	702	4.92	Clay Loam	Thames
26	5.4	9	0	217	2+	187	4	0.46	13.9	603	6.57	Clay Loam	Denchworth
31	6.8	9	0	125	2-	236	4	0.99	17.4	1057	9.14	Sandy Clay Loam	Beccles3
33	5.5	7	0	68	1	134	3	0.4	12.2	994	6.08	Clay Loam	Oxpasture
19	7.1	16	2	237	2+	142	3	0.38	10.9	813	4.43	Clay Loam	Hanslope
13	6.8	23	2	185	2+	120	3	0.47	14.5	993	5.32	Clay Loam	Wickham2
15	7.9	12	1	280	3	99	2	0.32	9.2	1179	3.51	Clay Loam	Kelmscot
28	6.2	16	2	178	2-	156	3	0.45	14.1	1131	5.42	Sandy Clay Loam	Kelmscot
29	6.6	10	1	162	2-	173	3	0.52	16.3	1068	6.44	Clay Loam	Kelmscot

17	6.9	17	2	150	2-	145	3	0.47	12.6	830	5.06	Clay Loam	Kelmscot
16	7.7	13	1	176	2-	99	2	0.41	10.8	1154	4.21	Clay Loam	Thames
32	6.6	11	1	277	3	234	4	0.68	15.3	980	7.33	Clay Loam	Denchworth
21	7	12	1	178	2-	575	6	0.49	17.7	860	5.48	Clay Loam	Denchworth
12	7.9	18	2	217	2+	96	2	0.43	10.1	1279	4.14	Sandy Clay Loam	Swaffham Prior
20	6.9	17	2	297	3	177	4	0.49	10.5	746	4.92	Clay Loam	Holderness
18	7.6	15	1	268	3	89	2	0.51	12.5	1089	4.98	Clay	Ragdale
22	6.5	14	1	168	2-	121	3	0.51	13.6	1038	6.36	Clay Loam	Oxpasture
30	4.6	6	0	50	0	60	2	0.61	18.1	185	8.2	Sandy Loam	Wick1
14	6.2	10	1	206	2+	219	4	0.28	6.7	399	3.58	Sandy Loam	Brockhurst2
25	6.4	8	0	142	2-	157	3	0.31	9.3	629	3.48	Clay Loam	Bardsey
27	7.3	10	1	156	2-	130	3	0.27	9.4	617	3.35	Clay Loam	Foggathorpe2
35	6.1	12	1	118	1	102	3	0.36	11.9	499	5.03	Sandy Silt Loam	Wick1
34	4.9	8	0	75	1	201	4	0.77	26.3	607	10.6	Sandy Loam	Ellerbeck
42	5.9	16	2	178	2-	147	3	0.67	18.4	816	8.67	Sandy Silt Loam	Ellerbeck
39	5.6	39	3	133	2-	124	3	0.44	13.7	952	6.68	Sandy Loam	Sollom1
40	5.5	25	2	80	1	124	3	0.35	12.6	398	4.45	Sandy Loam	Sollom1
37	5.2	27	3	145	2-	131	3	0.25	8.2	591	2.79	Clay Loam	Flint
36	7.8	12	1	401	4	331	5	0.34	7	775	3.61	Clay Loam	Wallasea2
41	6.8	13	1	279	3	347	5	0.69	17.7	832	7.41	Sandy Loam	Holderness
38	7.6	13	1	363	3	455	6	0.37	10.1	750	3.9	Clay Loam	Wallasea2
71	6.5	8	0	214	2+	200	4	0.79	35.3	831	10.8	Sandy Clay Loam	Adventurers1
43	4.4	22	2	163	2-	166	3	0.71	15.1	1216	7.94	Sandy Loam	Manod
45	7.5	7	0	300	3	177	4	0.88	30.5	850	10.2	Sandy Loam	Andover1
41	8	6	0	192	2+	95	2	0.52	13.3	755	5.77	Sandy Loam	Elmton3
46	7.9	9	0	262	3	391	6	0.98	24.6	885	9.37	Sandy Loam	Aberford
48	8	7	0	197	2+	672	7	1.01	23.3	1273	10.6	Sandy Loam	Aberford
44	7.8	7	0	309	3	111	3	0.44	13.3	1028	4.92	Clay Loam	Banbury

67	7.2	26	3	144	2-	110	3	0.16	4.4	601	2.39	Sandy Loam	Ludford
50	4.9	8	0	213	2+	171	3	0.77	20	708	10.5	Sandy Loam	Crwbin
51	5.1	27	3	227	2+	114	3	0.47	16.5	438	7.18	Sand	Worlington
52	4.6	12	1	172	2-	105	3	0.66	31.2	376	9.6	Loamy Sand	Isleham2
61	6	7	0	229	2+	268	5	0.5	13.6	691	6.46	Clay Loam	Whimple3
57	7	11	1	175	2-	255	5	0.8	18.9	822	7.52	Sandy Loam	Holderness
65	5.2	10	1	118	1	118	3	0.41	11.9	327	5.38	Loamy Sand	Isleham2
56	6.8	14	1	151	2-	164	3	0.67	18.4	1085	6.84	Clay Loam	Fladbury1
66	5.6	6	0	46	0	159	3	1.5	55.2	977	15.7	Loamy Sand	Adventurers1
47	5.2	7	0	83	1	90	2	0.72	19.2	588	8.32	Sandy Loam	Onecote
62	5.6	10	1	169	2-	266	5	0.6	14.1	839	6.68	Sandy Silt Loam	Whimple3
63	5.5	8	0	158	2-	248	4	0.57	14.6	764	6.17	Sandy Loam	Whimple3
54	4.9	16	2	63	1	103	3	0.26	9.8	633	3.08	Sandy Loam	Flint
55	5	16	2	144	2-	122	3	0.57	15.4	1227	6.78	Sandy Loam	Brickfield2
53	6.8	10	1	207	2+	374	6	1.33	21.9	1351	11.3	Sandy Loam	Brockhurst1
58	6	7	0	148	2-	254	5	0.68	18	781	7.02	Clay Loam	Denchworth
59	5.6	7	0	132	2-	221	4	0.74	17.3	969	7.75	Clay Loam	Denchworth
60	5	7	0	200	2+	132	3	0.6	13.4	985	7.02	Sandy Silt Loam	Wetton1
64	6.7	22	2	123	2-	446	6	0.28	26.3	140	8.25	Sandy Loam	Dale
68	5.2	16	2	95	1	349	5	0.83	25.3	812	13.3	Sandy Loam	Enborne
11	7.1	34	3	162	2-	300	5	0.67	21.7	1345	6.91	Sandy Loam	Wallasea1
73	4.5	20	2	131	2-	84	2	0.34	9.9	830	3.98	Sandy Loam	Waltham
72	5.6	7	0	124	2-	160	3	0.35	10.2	598	4.74	Clay Loam	Bromyard
70	4.8	14	1	148	2-	126	3	0.39	11.3	661	4.23	Sandy Loam	Waltham
69	5.2	11	1	241	3	115	3	0.4	11.3	706	4.78	Sandy Loam	Brickfield2
Heathlands													
74	4.3	6	0	115	1	83	2	0.32	22.8	141	8.87	Loamy Sand	Southampton
80	5.4	8	0	210	2+	368	6	0.28	8.3	464	5.27	Clay Loam	Delamere
82	4.1	11	1	137	2-	66	2	0.62	21.2	771	10.1	Clay Loam	Revidge

77	4.6	4	0	61	1	55	2	0.42	13.8	170	8.81	Loamy Sand	Holidays Hill
81	4.4	11	1	133	2-	77	2	0.7	24.8	712	13.9	Sandy Loam	Withnell2
78	4.7	5	0	73	1	75	2	0.44	19.4	545	7.75	Sandy Loam	Shirrell Heath2
79	4.4	5	0	90	1	116	3	0.39	11.4	304	5.53	Sandy Loam	Shirrell Heath2
75	5	5	0	129	2-	123	3	0.3	11.5	275	4.4	Sandy Loam	Windsor
76	5	6	0	175	2-	82	2	0.52	14	303	6.32	Sandy Loam	Windsor

Appendix 9. Site accounts.

Grasslands

1 & 2 Dorset

1 SZ029775 This is one of several former arable fields here that have been seeded with a mixture harvested from existing unimproved SSSI grasslands in the park. This field is immediately adjacent to the SSSI. The whole site is situated over very drought-prone oolitic limestone, and is within 500m of the sea. It is cut for hay and the aftermath is grazed.

This is a species-rich grassland with 26.3 species per m^2, and a cover of broad-leaved species of 75.5%. This is comparable to many better long-established semi-natural grasslands. The NVC community corresponds most closely to MG5b (*Centaurea nigra-Cynosurus cristatus* grassland, *Galium verum* sub-community), a grassland intermediate between calcareous and mesotrophic types, and not uncommon on base-rich soils near the sea. No single species is dominant, although the grasses *Dactylis glomerata, Festuca rubra, Trisetum flavescens* and *Cynosurus cristatus,* and the broad-leaved species *Medicago lupulina, Trifolium pratense, Rhinanthus minor, Leontodon hispidus, Linum bienne, Leucanthemum vulgare, Daucus carota, Primula veris, plantago lanceolata, Centaurea nigra, Lotus corniculatus* and *Agrimonia eupatorium* and *Prunella vulgaris* are abundant. UKBAP Lowland Calcareous Grassland indicators include frequent *Rhinanthus minor, Leontodon hispidus, Linum bienne, Leucanthemum vulgare, Primula veris, Centaurea nigra, Lotus corniculatus, Agrimonia eupatorium, Kanutia arvensis, Tragopogon pratense* and *Ononis repens*, and occasional *Lathyrus pratensis* and *Linum catharticum*. *Anacamptis pyramidalis, Centaurea scabiosa* and *Carex flacca* are rare.

This species-rich grassland fulfils the criteria for UKBAP Lowland Calcareous grasslands, and is difficult to distinguish from nearby long-established grasslands. It is in condition category A. Current management appears ideal for the maintenance of ecological interest of this field.

2 SZ029774 This is one of several former arable fields here that have been allowed to revert to semi-natural grassland by natural regeneration. This field is immediately adjacent to the SSSI. The whole site is situated over very drought-prone oolitic limestone, and is within 500m of the sea. It is cut for hay and the aftermath is grazed.

This grassland is species-rich and similar in many respects to the adjacent re-seeded field 1. There is a mean of 23.5 species per m^2, and the mean cover of broad-leaved species is 66%. The grassland contains a greater proportion of mesophytic and "weedy" species than the re-seeded field 1, and although the NVC community is similar to that of Field 1 (MG5b) it is closer to UKBAP Lowland Meadow than Lowland Calcareous Grassland. The most abundant species are *Dactylis glomerata, Trifolium pratense, Rhinanthus minor, Linum bienne, Plantago lanceolata, Prunella vulgaris, Arrhenatherum elatius, Trisetum flavescens, Lolium perenne, Medicago lupulina, Convolvulus arvensis, Heracleum sphondylium, Bromus commutatus* and *Bromus hordaceus*. Indicator species include frequent *Rhinanthus minor, Linum bienne, Lotus corniculatus, Leontodon hispidus* and *Tragopogon pratense*, occasional *Linum catharticum* and *Centaurea scabiosa* and rare *Primula veris, Lathyrus pratensis*, *Leucanthemum vulgare, Anacamptis pyramidalis, Agrimonia eupatorium, Anthyllis vulneraria* and *Genista tinctoria*. The uncommon *Lathyrus aphaca* was recorded here.

This species-rich grassland fulfils the criteria for UKBAP Lowland Meadows. It is in condition category A. Current management appears ideal for the maintenance of ecological interest of this field.

3 Lincolnshire

This field is situated on the gentle north-facing slope of a valley in the oolitic limestone to the east of the small hamlet of Wyville. A small stream flows through the valley, and the field on the opposite side of the valley has species-rich calcareous grassland. A small part of the north-western corner of the field is on a steeper slope, and appears to have not been ploughed in recent years and has slightly more species-rich grassland.

The field was previously in arable cultivation, and has been allowed to revert to grassland by natural succession. The most abundant species are *Medicago lupulina, Poa trivialis, Lolium perenne, Bromus hordaceus, Trisetum flavescens, Veronica chamaedrys, Arrhenatherum elatius, Agrostis stolonifera, Trifolium repens, Bromus sterilis, Festuca rubra* and *Brachythecium rutabulum*. This is a grassland in the early stages of succession, and is closest to the NVC community MG1e (*Arrhenatherum elatius* grassland, *Centaurea nigra* sub-community). Two indicator species of lowland meadow BAP habitat *Knautia arvensis* and *Tragopogon pratense* are occasional, and a further three*, Lathyrus pratensis, Lotus corniculatus* and *Rhinanthus minor* are present.

While this grassland is not particularly species-rich, it fulfils the requirements for the Lowland Meadow UKBAP habitat, although it is likely that the target community is Lowland Calcareous Grassland. The frequency of indicator species is low however, and the grassland is in Condition C. Condition is likely to improve with continued suitable management.

4 Bath and NE Somerset

This is a gently sloping, north-facing field on oolitic limestone. The slope is steeper in the north-east corner, and it levels out to form a plateau in the south. It is one of several fields on this farm that have been restored to calcareous grassland since the mid-1990s. The field was sown with seed harvested from a nearby species-rich grassland in 1995. The field is cut for hay and the aftermath is grazed by sheep and horses.

The majority of the grassland is species-rich CG3b (*Bromus erectus* grassland, *Centaurea nigra* sub-community), grading into poorer MG1e (*Arrhenatherum elatius* grassland, *Centaurea nigra* sub-community) on the deeper soils of the plateau. CG3b is a calcareous grassland type transitional to more mesotrophic grasslands on relatively deep limestone soils. The CG3b has a mean number of species of 27.6 per m^2, with a cover of broad-leaved species of 59.5%. It is dominated by a mixture of grasses and broad-leaved species including *Festuca rubra, Dactylis glomerata, Anthoxanthum odoratum, Cynosurus cristatus, Holcus lanatus, Arrhenatherum elatius, Bromus erectus, Trifolium pratense, Ranunculus acris, Plantago lanceolata, Primula veris, lathyrus pratensis, Rhinanthus minor, Trifolium repens, Centaurea nigra, Leontodon hispidus, Vicia cracca, Heracleum sphondylium, Calliergon* cuspidatum and Lotus *corniculatus*. UKBAP Lowland Calcareous Grassland indicator species include frequent *Primula veris, Leontodon hispidus, Lotus corniculatus, Rhinanthus minor, Centaurea nigra* and *Leucanthemum vulgare*, occasional *Anacamptis pyramidalis, Carex flacca, Linum catharticum* and *Dactylorhiza fuchsia*, and rare *Tragopogon pratense, Agrimonia eupatorium, Sanguisorba minor, Ophrys apifera, Listera ovata* and *Centaurea scabiosa*. Several plants of *Ophioglossum vulgatum* were recorded. The MG1e grassland is much less rich, dominated by *Arrhenatherum elatius, Dactylis glomerata* and *Festuca rubra*.

This was one of the best examples of grassland restored from arable land recorded during this survey. It is one of several fields on the farm in various stages of restoration. It fulfils the criteria for UKBAP Lowland Calcareous Grassland and it is difficult to distinguish this grassland from long-established swards in similar situations, although there is a relatively high frequency of “weedy” species including *Heracleum sphondylium, Vicia cracca, Convolvulus arvensis* and *Taraxacum sp*. It is

in condition category A, and current management appears ideal for maintenance and enhancement of the ecological interest.

5 & 6 Dorset

1 ST736023 This former arable field was seeded in 2008 with a mixture brush-harvested from SSSI calcareous grassland on adjacent slopes. The grassland is grazed by sheep in spring and autumn.

The grassland is species-rich with a mean of 19 species per m^2 and a cover of broad-leaved species of 40.5%. There is no single dominant species, but the grasses *Trisetum flavescens, Dactylis glomerata, Festuca rubra, Phleum bertolonii, Holcus lanatus, Arrhenatherum elatius* and *Bromus hordeaceus* and broad-leaved species including *Trifolium repens, Medicago lupulina, Odontites verna, Leontodon hispidus, Crepis capillaris* and *Plantago lanceolata* are abundant. UKBAP Lowland Calcareous Grassland indicator species include frequent *Leontodon hispidus* and *Rhinanthus minor* and rare *Anthyllis vulneraria, Knautia arvensis, Plantago media, Leucanthemum vulgare* and *Centaurea nigra*.

The grassland fulfils the criteria for UKBAP Lowland Calcareous Grassland, although the frequencies of indicator species are low. Condition is in category C. This grassland is in the early stages of succession, and it is likely that additional species will appear, and that those already present will spread. Current management is likely to be suitable for grassland re-establishment, although cattle may be preferred to sheep, and when established, light summer grazing should be introduced.

2 ST737023 A broad strip around the edge of this field was converted from arable to set-aside in the late 1980s. Vegetation has been allowed to regenerate naturally by colonisation from the seed-bank and adjacent SSSI calcareous grassland. This field is grazed by sheep in spring and autumn together with area 1 above.

The grassland is species-rich with 21.3 species per m^2 and 60% cover of broad-leaved species (excluding *Trifolium repens*) of 55.5%. The closest NVC community is MG1e (*Arrhenatherum elatius* grassland, *Centaurea nigra* sub-community), although it is probably transitional to CG2c (*Festuca ovina-Avenula pratense* grassland, *Holcus lanatus-Trifolium repens* sub-community). There is no dominant species, but the grasses *Holcus lanatus, Dactylis glomerata, Festuca rubra, Trisetum flavescens, Arrhenatherum elatius* and *Brachypodium sylvaticum* and the broad-leaved species

Leontodon hispidus, Medicago lupulina, Trifolium repens, Plantago lanceolata, Odontites verna, Taraxacum sp and *Linum catharticum* are abundant. Seedlings of *Fraxinus excelsior (g)* are frequent. While undesirable species are uncommon, *Trifolium repens* has a cover of 6.5%. UKBAP indicator species include frequent *Leontodon hispidus* and *Linum catharticum,* and rare *Plantago media, Rhinanthus minor, Euphrasia nemorosa, Lotus corniculatus, Cirsium acaule, Blackstonia perfoliata, Carex flacca, Ophrys apifera, Clinopodium vulgare, Origanum vulgare, Galium verum* and *Agrimonia eupatorium.*

The grassland fulfils the criteria for UKBAP Lowland Calcareous Grassland, but although several indicator species are present, their frequencies are low. Condition is therefore in category C. Condition may improve if light grazing is introduced during the summer in order to decrease the cover of grasses, particularly the tussock forming species *Arrhenatherum elatius, Dactylis glomerata* and *Holcus lanatus*. Cattle would be a better grazing animal to sheep, as they will open up the sward more and create more space for seedling establishment.

7 Dorset

This field was arable until 1989, when it was set-aside and allowed to regenerate natural to calcareous and maritime grassland. There is a narrow strip of species-rich calcareous and maritime

grassland between the former field boundary and the sea. The geology is chalk, although this may grade into Tertiary clay or sand to the north. This area is much used by the public for recreation.

Species-rich calcareous grassland has developed over the whole of the field. This ranges from MC11c (*Festuca rubra-Daucus carota ssp gummifer* maritime grassland, *Sanguisorba minor* sub-community), a community transitional to maritime grassland in the south-west (30% of the field), with CG4b (*Brachypodium pinnatum* grassland, *Centaurea nigra-Leontodon hispidus* sub-community) over 50% of the field, grading into a more mesotrophic CG2c (*Festuca ovina-Avenula pratense* grassland, *Holcus lanatus* sub-community) over less chalky soils in the north. The MC11c includes patches of U1 acid grassland. The maritime grassland was not surveyed.

Mean number of species is 24.1 per m^2, and cover of broad-leaved species is 52.5. The CG4b is dominated by a mixture of *Brachypodium pinnatum, Festuca rubra, Dactylis glomerata, Holcus lanatus, Anthyllis vulneraria, Trifolium pratense* and *Plantago lanceolata* with frequent *Cynosurus cristatus, Centaurea scabiosa, Ranunculus bulbosus, Daucus carota ssp gummifer* and *Linum catharticum*. *Brachypodium pinnatum* is rare in the CG2c and this grassland has a more mesotrophic character with abundant *Agrostis capillaris* and *Anthoxanthum odoratum*. Overall, UKBAP calcareous grassland indicators include frequent *Anthyllis vulneraria, Lotus corniculatus, Linum catharticum, Leontodon hispidus,* occasional *Centaurea scabiosa, Galium verum* and *Hippocrepis comosa*, and rare *Anacamptis pyramidalis, Carex flacca, Rhinanthus minor, Centaurea nigra, Stachys officinalis, Scabiosa columbaria* and *Ononis repens*.

This is an exceptional example of naturally regenerated calcareous grassland . It fulfils the criteria for UKBAP Calcareous Grassland. It is in condition category A, and current management appears ideal for maintaining ecological interest.

8 Lincolnshire

This site is on the south-eastern face of the chalk escarpment south-west of Stenigot, adjacent to a Lincolnshire Wildlife Trust reserve and SSSI, but separated from it by a minor road. It was purchased by the Lincolnshire Wildlife Trust in 1996 and allowed to return to grassland after arable cultivation.

It consists of two fields, the northern of which only was surveyed. It includes two shallow dry valleys, an escarpment slope and an area of plateau. Initial restoration was by spreading green hay from the adjacent SSSI, and this was later supplemented with plug-grown plants. Green hay was further spread within the site.

Lowland Calcareous Grassland BAP habitat was present on the steeper slopes of the valleys and the escarpment and also over much of the plateau. There are areas of dense scrub on the valley slopes, while the flatter parts of the valley bottoms where soils are likely to be deeper had species-poor CG6 (*Avenula pubescens* grassland) dominated by *Festuca rubra* and *Trifolium repens* with *Lotus corniculatus, Plantago lanceolata, Medicago lupulina* and *Poa trivialis*.

Species-rich calcareous grassland recognisable as NVC community CG5b (*BRachypodium pinnatum* grassland, *Centaurea nigra-Leontodon hispidus* sub-community) occupies approximately 50% of this field. Four indicator species of this habitat, *Anthyllis vulneraria, Lotus corniculatus, Knautia arvensis* and *Linum catharticum* were frequent, and three, *Leontodon hispidus, Carex flacca* and *Primula veris* were occasional. In addition, *Centaurea nigra* was frequent and *Rhinanthus minor* was occasional, these species are characteristic of lowland meadows. A range of other species characteristic of long-established calcareous grasslands were also recorded including *Blackstonia perfoliata*, *Centaurea scabiosa, Gentianella amarella, Scabiosa columbaria*, *Campanula rotundifolia* and *Hippocrepis comosa* which was locally frequent. The most abundant grasses were *festuca rubra* and *Cynosurus cristatus*, and the typical chalk grassland species *Bromus erectus* and B*rachypodium pinnatum* were

locally frequent. Mean percentage of broad-leaved species was 56% and scrub and undesirable species were absent.

A substantial area of grassland in this field can now be considered calcareous grassland BAP habitat in Condition A, even though it is still readily distinguishable from long-established swards. Given continued suitable management it is likely that there will be further progress towards the formation of species-rich CG5a and possibly CG2.

9 Lincolnshire

This site consists of a broad margin along the southern and eastern sides of an arable field. This is located immediately to the west of a Lincolnshire Wildlife Trust reserve, one of the few remaining areas of unimproved calcicolous grassland in the county. It was managed under the Countryside Stewardship Scheme for 10 years, and is now in HLS.

The grassland is not particularly species-rich with a mean of 13 species per m^2, although the mean cover of broad-leaved species is 49%. There is very little scrub and few undesirable species. Two indicator species of lowland calcareous grassland, *Origanum vulgare* and *Anthyllis vulneraria* are frequent, and *Lotus corniculatus* is occasional. The typical dominant grass of the adjacent unimproved grassland, *Brachypodium pinnatum* is frequent and *Bromus erectus* is present. Other indicator species of lowland calcareous grassland grasslands include *Galium verum, Ononis repens, Leontodon hispidus*, L*inum catharticum* and *Anacamptis pyramidalis*. *Rhinanthus minor* is also frequent. The NVC community is CG4c (*Brachypodium pinnatum* grassland, *Holcus lanatus* sub-community).

While this grassland qualifies as the UKBAP habitat lowland calcareous grassland, the frequencies of indicator species are low, and it is in Condition C. A good number of calcareous grassland indicator species are present and it is likely that given continued suitable management, condition will improve and the site will become a significant addition to the county resource of this habitat.

10 Dorset

This is a small field surrounded by woodland. It was cleared of trees in 1996 and allowed to regenerate naturally to calcareous grassland. It is situated on a steep, east-facing slope over chalk and it is grazed by sheep and cattle.

The grassland is species-rich with 24.9 species per m^2 and a cover of broad-leaved species of 62.5%. *Holcus lanatus, Dactylis glomerata, Festuca rubra, Prunella vulgaris, Plantago lanceolata, Leontodon autumnalis, Calliergon cuspidatum*, *Medicago lupulina, Lolium perenne, Ranunculus repens* and *Taraxacum sp* are abundant with frequent *Cerastium fontanum, Senecio jacobaea, Phleum bertolonii, Centaurium erythraea, Leontodon hispidus* and *Carex flacca*. UKBAP Lowland Calcareous Grassland indicator species include frequent *Viola hirta, Leontodon hispidus* , *Carex flacca,* occasional *Lotus corniculatus* and *CLinopodium vulgare* and rare *Origanum vulgare*. There is limited opportunity for colonisation from adjacent calcareous grassland here, and it is possible that the species present have re-established from the seed-bank. It is difficult to assign this early-successional grassland to an NVC community.

This site fulfils the criteria for UKBAP Lowland Calcareous Grassland. It is in condition category A. Current management appears suitable for maintenance and enhancement of the ecological interest.

12 Lincolnshire

This former arable field is situated on the south-west facing slope of a chalk ridge between the villages of Bigby and Grasby. It has been managed under the Countryside Stewardship Scheme since 1998, when it was seeded with a calcareous grassland mixture. It is cut for hay annually and the aftermath is grazed by sheep. Rabbits are plentiful.

The grassland is quite uniform throughout, and is closest to MG5b (*Centaurea nigra-Cynosurus cristatus* grassland, *Galium verum* sub-community), dominated by the grasses *Festuca rubra, Trisetum flavescens, Cynosurus cristatus, Dactylis glomerata* and *Poa humilis*, with *Taraxacum sp* and *Trifolium repens*. The south-west corner of the field is steeper, including a small pit and a rabbit warren. The sward in this area is shorter. Although it is likely that the intended UKBAP habitat type is calcareous grassland, the resulting grassland is closer to lowland meadow. The indicator species *Tragopogon pratense* and *Lotus corniculatus* are frequent, and *Leucanthemum vulgare* and *Leontodon autumnalis* are occasional. Other species that are present locally include *Primula veris, Sanguisorba minor, Centaurea nigra, Leontodon hispidus* and *Knautia arvensis*. Several of these species are also typical of calcareous grasslands, and the calcareous grassland indicator *Anthyllis vulneraria* is present.

While this grassland qualifies as the UKBAP habitat Lowland Meadow, the frequencies of indicator species are low, with only four being frequent or occasional, although a further five species are present. The grassland is therefore in Condition C, and it is likely that with continued suitable management, condition will improve.

13 Northamptonshire

A large field bordering the river Tove, which was in arable production 7–8 years ago, has been restored. The aim was to recreate flood meadow. The field was put into set-aside for one year, then the resulting natural regeneration sprayed off. Green hay was used as the seed source; green hay from the adjacent Grafton Regis meadow (NVC MG4 *Alopecurus pratensis–Sanguisorba officinalis* grassland) was used to seed the western end; hay from Millcrook SSSI the eastern end (NVC MG8 *Cynosurus cristatus–Caltha palustris* grassland). Both meadows types are flood/water meadow communities. The plant community that has established following seeding shows greatest affinity with the MG4 of Grafton Regis meadow although is species-poor on the flood-meadow species.

The grass component of the sward is moderately species rich with 14 species recorded within the meadow. Perennial rye-grass (*Lolium perenne*) is abundant in this meadow, with constant and abundant crested dog's-tail (*Cynosurus cristatus*) and constant (but lower cover) yellow oat-grass (*Trisetum flavescens*). Yorkshire fog (*Holcus lanatus*) and cock's-foot (*Dactylis glomerata*) are locally abundant, whilst red fescue (*Festuca rubra*), soft brome (*Bromus hordeaceus*) and sweet vernal-grass (*Anthoxanthum odoratum*) are patchy in their appearance. False oat-grass (*Arrhenatherum elatius*) – a species indicative of under-management – is quite frequent, whilst old-meadow species typical of floodplains meadow barley (*Hordeum secalinum*) and meadow foxtail (*Alopecurus pratensis*) are occasional to locally frequent.

The mean cover of broad-leaved species is high at 69.5%, which is higher than the condition assessment criterion of >20% cover for lowland meadow. The sward is moderately species rich with a mean number of species per m^2 of 18.3. UKBAP Lowland Meadow indicator species yellow-rattle (*Rhinanthus minor*) and black knapweed (*Centaurea nigra*) are abundant, goat's-beard (*Tragopogon pratensis*) is frequent, bird's-foot-trefoil (*Lotus corniculatus/L. pedunculatus*) occasional, whilst meadow vetchling (*Lathyrus pratensis*) and autumn hawkbit (*Leontodon autumnalis*) are rare. Great burnet (*Sanguisorba* officinalis) – a typical floodplain species – was recorded in several locations within the meadow but was rare overall. Additional species of species-rich semi-improved grassland

are also present including ribwort plantain (*Plantago lanceolata)*, meadow buttercup (*Ranunculus acris*), and red clover (*Trifolium pratense*) – which is abundant.

Perennial rye-grass is constant at low–moderate cover (0–8%, mean 3.3%), whilst white clover (*Trifolium repens*) is patchy at low cover (0–5%, mean 1.3%). Undesirable species were restricted to occasional creeping thistle (*Cirsium arvense*), although other ruderals were occasional over the field.

The sward meets the criteria for BAP (G06) Lowland Meadow habitat, condition A (although great burnet is currently insufficiently frequent to qualify as BAP lowland floodplain grassland). The field is cut for hay in mid–late July then hard aftermath grazed with sheep. The sward may benefit from more intensive grazing following baling to further reduce coarser grasses and encourage the spread of scarcer herb species. Grazing may continue from late-July to late-March.

14 Staffordshire

One of three adjoining fields that have entered arable reversion this was the first field to enter the scheme. In 2005 green hay from a good semi-improved field on another part of the estate was strewn over the field. The field may also have had an additional sowing with yellow rattle in a 1 ha area as this species was absent in 2005–6 but is now locally frequent and was proposed as an 'after-sowing' using commercial seed. The field has suffered from some dock infestation but otherwise the resulting community is good. The field is mildly damp, occurring on a thin, slightly clayey loam. The plant community that has established shows greatest affinity with NVC MG5a *Cynosurus cristatus-Centaurea* nigra grassland, *Lathyrus pratensis* sub-community.

The grass component of the sward is quite species rich with 12 species recorded within the meadow. Dominant species include abundant red fescue (*Festuca rubra*), Yorkshire fog (*Holcus lanatus*), crested dog's-tail (*Cynosurus cristatus*) and sweet vernal-grass (*Anthoxanthum odoratum*). Meadow foxtail (*Alopecurus pratensis*), meadow-grass species (*Poa* spp.), perennial rye-grass (*Lolium perenne*), and common bent (*Agrostis capillaris*) are also frequent. Other grass species present are rare or localized within the sward.

The mean cover of broad-leaved species is high at 66%, which is higher than the condition assessment criterion of >20% cover for lowland meadow. The sward is moderately species rich with a mean number of species per m^2 of 14.7. UKBAP Lowland Meadow indicator species black knapweed (*Centaurea nigra*), meadow vetchling (*Lathyrus pratensis*) and greater bird's-foot-trefoil (*Lotus pedunculatus*) are frequent, whilst autumn hawkbit (*Leontodon* autumnalis) and yellow-rattle (*Rhinanthus minor*) are rare to locally frequent. Additional species of species-rich semi-improved grassland are also present including ribwort plantain (*Plantago lanceolata)*, meadow buttercup (*Ranunculus acris*), and red clover (*Trifolium pratense*) – which is abundant.

Perennial rye-grass is present but at low cover (1–3%), and white clover (*Trifolium repens*) is constant at low cover (mean cover of 6%) and rarely greater than 10%. Undesirable species were largely absent from the random stops but were present in localized, disturbed areas and on the perimeters of the field. Dock infestation appear lower than in the early years of establishment

The sward meets the criteria for BAP (G06) Lowland Meadow habitat, condition B (with 3 frequent and two rare indicator species). The field is cut for hay in mid–late July then aftermath grazed with sheep. This management is suitable. Continue to spot-treat dock as needed.

15 Oxfordshire

This is one of three fields at this BBOWT nature reserve, that have been restored to permanent grassland from former arable land. The field has been spread with green hay (in 2004) harvested

from existing wet grassland habitat within the larger nature reserve site. The fields are shut up for hay then hay-cut and baled in July/August; they are aftermath grazed with sheep. The field is situated away from the River Thames (several fields separate it) and is probably damp in winter but not generally inundated. The plant community that has established shows greatest affinity with a rather damp variant of NVC MG1a *Arrhenatherum elatius* grassland, *Festuca rubra* sub-community.

False oat-grass (*Arrhenatherum elatius*) dominated the grass component of the sward, with much meadow fescue (*Festuca pratensis*), sweet vernal-grass (*Anthoxanthum odoratum*), red fescue (*Festuca rubra*) and Cock's-foot (*Dactylis glomerata*). Other frequent grasses include Yorkshire fog (*Holcus lanatus*), perennial rye-grass (*Lolium perenne*) and smooth meadow-grass (*Poa pratensis*). Crested dog's-tail (*Cynosurus cristatus*), meadow barley (*Hordeum secalinum*) tufted hair-grass (*Deschampsia cespitosa*) – a species indicative of damp conditions – are occasional to locally frequent. Other species such as yellow oat-grass (*Trisetum flavescens*), quaking grass (*Briza media*) and soft brome (*Bromus hordeaceus*) are rare within the sward.

The mean cover of broad-leaved species is moderately high at 44%, which is higher than the condition assessment criterion of >20% cover for lowland meadow. The sward is moderately species rich with a mean number of species per m^2 of 17.2. Two UKBAP Lowland Meadow indicator species are frequent within the meadow, yellow rattle (*Rhinanthus minor*) and cowslip (*Primula veris*), and two further species are occasional – glaucous sedge (*Carex flacca*) and meadow vetchling (*Lathyrus pratensis*). Other indicator species that are present (but rare within the sward) include oxeye daisy (*Leucanthemum vulgare*), bird's-foot-trefoil (*Lotus pedunculatus*), pepper-saxifrage (*Silaum silaus*), autumn hawkbit (*Leontodon autumnalis*) and fairy flax (*Linum catharticum*). Additional species of species-rich semi-improved grassland are also present including ribwort plantain (*Plantago lanceolata)* meadow buttercup (*Ranunculus acris*), and red clover (*Trifolium pratense*).

Perennial rye-grass is constant at low cover (0–2%). However, white clover (*Trifolium repens*) can be quite abundant with up to 40% cover in some areas (mean 6.5%). There are no undesirable species within the main sward, although the boundaries beyond the grassland stand support ruderals such as creeping thistle (*Cirsium arvense*).

This grassland meets the criteria for BAP (G06) Lowland Meadow habitat, condition A, although. The hay-cut/aftermath grazing regime is suitable and hopefully in time ill further increase the spread of the rare herb species within the sward.

16 Oxfordshire

This is one of three fields within the ESA here that have been sown with a seed mix to recreate permanent grassland on former arable land. The field surveyed (4480), of the three, lies closest to the river – a small tributary of the River Thames. The field was sown with a commercial Emmorsgate Seeds EM8 (F) wildflower for wetlands mixture with EG8 wet meadow grass mixture. The fields are shut up for hay then hay-cut and baled in July/August; they are aftermath grazed—mainly by sheep but occasionally by a few suckler cows. The fields are generally winter-wet but aren't inundated, with the exception of 2010 when they were under >0.3 m water during a local flooding event. The plant community that has established shows greatest affinity with a rather damp variant of NVC MG5b *Cynosurus cristatus-Centaurea* nigra grassland, *Galium verum* sub-community, rather than the MG4 *Alopecurus pratensis-Sanguisorba officinalis* grassland aimed at.

Red fescue (*Festuca rubra*), meadow foxtail (*Alopecurus pratensis*), sweet vernal-grass (*Anthoxanthum odoratum*) and crested dog's-tail (*Cynosurus cristatus*) are constant, whilst perennial rye-grass (*Lolium perenne*), smooth meadow-grass (*Poa pratensis*) and tufted hair-grass (*Deschampsia cespitosa*) – a species indicative of damp conditions – are frequent to locally

abundant. Other species such as Yorkshire fog (*Holcus lanatus*), timothy (*Phleum pratense sens. lat.*), quaking grass (*Briza media*) and soft brome (*Bromus hordeaceus*) are occasional or rare.

The mean cover of broad-leaved species is moderately high at 50%, which is higher than the condition assessment criterion of >20% cover for lowland meadow. The sward is moderately species rich with a mean number of species per m^2 of 17.1. UKBAP Lowland Meadow indicator species lady's bedstraw (*Galium verum*) is constant within the sward, whilst black knapweed (*Centaurea nigra*) is frequent and locally abundant. Occasional to locally frequent indicator species included oxeye daisy (*Leucanthemum vulgare*), bird's-foot-trefoil (*Lotus pedunculatus*), yellow rattle (*Rhinanthus minor*) and ragged robin (*Lychnis flos-cuculi*) – which favours wet meadows. Additional indicators of quality habitat recorded outside the quadrats included glaucous sedge (*Carex flacca*) and cowslip (*Primula veris*). Additional species of species-rich semi-improved grassland are also present including yarrow (*Achillea millefolium*), ribwort plantain (*Plantago lanceolata)*, black medick (*Medicago lupulina*), meadow buttercup (*Ranunculus acris*), and red clover (*Trifolium pratense*).

Perennial rye-grass is constant at low cover (0–5%). However, white clover (*Trifolium repens*) is quite abundant with up to 35% cover in some areas (mean 21.3%); this species was not part of the seed mix. There are no undesirable species within the main sward, although the boundaries beyond the grassland stand support ruderals.

Whilst this grassland does not meet the criteria for floodplain grassland, it does qualify as BAP (G06) Lowland Meadow habitat, condition A, although this is borderline due to the local abundance of white clover. The hay-cut/aftermath grazing regime is suitable, although more intensive grazing in late winter/early spring – a critical time in the development and establishment of white clover – may help reduce the vigour of this species which is of higher value for grazing than it is for conservation.

17 Oxfordshire

One of four arable fields here which are under HLS; two fields were sown with a commercial seed mix before 2005, whilst the remaining two fields (including the one surveyed) were spread with green hay from Chimney Meadows SSSI and Nature Reserve in *c.* 2005. The field is now established and thus the HLS agreement was for 'maintenance' rather than 'creation or restoration'. The former arable headlands (30 m grass margin) were not sown but are now colonizing naturally. The field is now registered as organic. The fields are shut up for hay then hay-cut and baled in July; they are aftermath grazed with sheep for 120 days maximum. The field is situated away from the River Thames but is bounded by a smaller tributary. It is probably damp in winter but not generally heavily inundated. The plant community that has established shows greatest affinity with NVC MG5a *Cynosurus cristatus-Centaurea* nigra grassland, *Lathyrus pratensis* sub-community although there are elements of floodplain grassland present.

The grass component of the sward is dominated by red fescue (*Festuca rubra*), cock's-foot (*Dactylis glomerata*), sweet vernal-grass (*Anthoxanthum odoratum*), perennial rye-grass (*Lolium perenne*) and crested dog's-tail (*Cynosurus cristatus*). False oat-grass (*Arrhenatherum elatius*) and Yorkshire fog (*Holcus lanatus*) are both locally abundant but not constant, whilst bromes (*Bromus hordeaceus, B. commutatus*) and patchily frequent with occasional yellow oat-grass (*Trisetum flavescens*) and meadow foxtail (*Alopecurus pratensis*). Meadow barley (*Hordeum secalinum*), tufted hairgrass (*Deschampsia cespitosa*) (a damp-loving species), quaking grass (*Briza media*) and meadow fescue (*Festuca pratensis*) are rare within the sward.

The mean cover of broad-leaved species is high at 61%, which is higher than the condition assessment criterion of >20% cover for lowland meadow. The sward is species rich with a mean number of species per m^2 of 18.4. Four BAP Lowland Meadow indicator species occur frequently to locally abundantly – black knapweed (C*entaurea nigra*), bird's-foot-trefoil (*Lotus corniculatus*),

yellow rattle (*Rhinanthus minor*) and oxeye daisy (*Leucanthemum vulgare*). Autumn and rough hawkbit are occasional to locally frequent, whilst some very scattered species were not present in the quadrats at all such as pepper-saxifrage and goat's-beard. Additional species of species-rich semi-improved grassland are also present including ribwort plantain (*Plantago lanceolata)* meadow buttercup (*Ranunculus acris*), and red clover (*Trifolium pratense*) – which was abundant. Perennial rye-grass is constant at low moderately cover (0–20%m mean 5.2%). However, white clover (*Trifolium repens*) can be quite abundant with up to 50% cover in some areas (mean 8.5%). Undesirable species are rare within the main sward, but included spear thistle (*Cirsium vulgare*) and docks (*Rumex* spp.) although the boundaries beyond the grassland stand support more ruderals.

This grassland meets the criteria for BAP (G06) Lowland Meadow habitat, condition A, although this could be threatened if white clover continues to spread. The hay-cut/aftermath grazing regime is suitable for the conservation of biodiversity, but the land owner is concerned that the land is being depleted too much of nutrients by the current regime that precludes the use of fertilizers, which has been flagged up by other organic farmers.

18 Northamptonshire

This amendment to the existing CSS was carried out *c.* 3 years ago. A large arable field was sub-divided by the planting of a new hedge separating a large strip of land at the north-western end, which was then taken out of arable production. The recreation of calcareous grassland was attempted using a native seed mix from Emmorsgate Seeds (50% EM18 – St Catherine Mixture for limestone grassland; 50% bespoke mix). Although the seed sown was from a calcareous hay-meadow, the variation in success and establishment rate of the species in the mixture, combined with the natural colonization by local species from field margins has resulted in a sward which has some affinities with a calcareous grassland (e.g. NCV CG3 *Bromus erectus* grassland), but is closer to a calcareous variant of mesotrophic grasslands such as MG1 (*Arrhenatherum elatius* grassland) or a species poor MG5 (*Cynosurus cristatus-Centaurea nigra* grassland).

The grass component of the sward is dominated by red fescue (*Festuca rubra*) with frequent sweet vernal-grass (*Anthoxanthum odoratum*), Yorkshire fog (*Holcus lanatus*) and cock's-foot (*Dactylis glomerata*). Occasional grass species included false oat-grass (*Arrhenatherum elatius*), quaking grass (*Briza media*), upright brome (*Bromus erectus*), crested dog's-tail (*Cynosurus cristatus*), perennial rye-grass (*Lolium perenne*) and soft brome (*Bromus hordeaceus*).

The mean cover of broad-leaved species is 69.5%, which is quite high and largely due to large patches of red clover. The sward is moderately species rich with a mean number of species per m^2 of 13.9. Wildflower indicator species common bird's-foot-trefoil (*Lotus corniculatus*) is frequent within the sward, whilst oxeye daisy (*Leucanthemum vulgare*) and rough hawkbit (*Leontodon hispidus*) are occasional to locally frequent; all three species are indicators for both UKBAP Lowland Meadow and BAP Calcareous Grassland habitat. BAP Lowland Meadow species black knapweed (*Centaurea nigra*) and yellow-rattle (*Rhinanthus minor*) are occasional whilst BAP Lowland Calcareous Grassland species field scabious (*Knautia arvensis*) and kidney vetch (*Anthyllis vulneraria*) are present but rare in the sward. Additional species of species-rich semi-improved grassland are also present including ribwort plantain (*Plantago lanceolata)*, meadow buttercup (*Ranunculus acris*), black medick (*Medicago lupulina*) and red clover (*Trifolium pratense*) – which is abundant. Perennial rye-grass is present at low cover whilst white clover (*Trifolium repens*) is frequent, with a mean cover of 10.3% and in some stands as high as 50% cover. The undesirable species creeping thistle (*Cirsium arvense*) is occasional; docks (*Rumex* spp.) are rare, but the invasive species field horsetail (*Equisetum arvense*) can be overwhelmingly abundant.

The sward is intermediate between Lowland Calcareous Grassland and Lowland Meadow habitat; it supports the typical calcareous grass upright brome at low cover but does not meet the criteria for

BAP (G04) Lowland Calcareous Grassland habitat. The sward is closer to BAP (G06) Lowland Meadow habitat, condition C (failing on condition 5). The field is suitable for further restoration. The field is cut for hay in late July then aftermath grazed with sheep. The sward may benefit from more intensive grazing following baling to further reduce coarser grasses and encourage the spread of herb species. Grazing may continue from late-July to late-March.

19 Northamptonshire

A large arable field was sub-divided by the planting of a new hedge creating two fields. In 2002 both fields were sown with seed harvested from a local SSSI. The owner reports that the herb component was very rich in years 3, 4 and 5 but has declined recently. He is particularly concerned with the abundance of yellow-rattle in the sward which he feels is detrimental to the persistence of other herb species. The eastern-most of the two fields was surveyed. The sward in this field was found to be more herb rich in the central and northern areas and weedier in the eastern corner. The plant community that has established shows greatest affinity with NVC MG5a *Cynosurus cristatus-Centaurea* nigra grassland, *Lathyrus pratensis* sub-community.

The grass component of the sward is quite species rich with 17 species recorded within the meadow. Crested dog's-tail (*Cynosurus cristatus*) is constant at moderate cover, with abundant red fescue (*Festuca rubra*) and frequent sweet vernal-grass (*Anthoxanthum odoratum*) and Yorkshire fog (*Holcus lanatus*). Cock's-foot (*Dactylis glomerata*), perennial rye-grass (*Lolium perenne*), common bent (*Agrostis capillaris*), false oat-grass (*Arrhenatherum elatius*), smooth meadow-grass (*Poa pratensis*) and soft brome (*Bromus hordeaceus*) are occasional to locally frequent. Grass species that were present but rare within the sward included quaking grass (*Briza media*), meadow barley (*Hordeum secalinum*) and yellow oat-grass (*Trisetum flavescens*); these three are old-meadow species.

The mean cover of broad-leaved species is 53%, which is higher than the condition assessment criterion of >20% cover for lowland meadow. The sward is moderately species rich with a mean number of species per m^2 of 15.8. BAP Lowland Meadow indicator species yellow-rattle (*Rhinanthus minor*) is constant and abundant, whilst indicators common bird's-foot-trefoil (*Lotus corniculatus*) and black knapweed (*Centaurea nigra*) are frequent. Oxeye daisy (*Leucanthemum vulgare*) and rough hawkbit (*Leontodon hispidus*) are occasional, whilst lady's bedstraw (*Galium verum*) is rare. Additional species of species-rich semi-improved grassland are also present including ribwort plantain (*Plantago lanceolata)*, meadow buttercup (*Ranunculus acris*), and red clover (*Trifolium pratense*) – which is abundant. Perennial rye-grass is present, and in the south-western part of the field at quite high cover (40%) but is mostly at low cover (mean 7.1%), whilst white clover (*Trifolium repens*) is constant at low cover (mean cover of 5.5%) and rarely greater than 10%. Undesirable species were absent from the random stops but were present in localized, disturbed areas in the eastern area and on the perimeter.

The sward meets the criteria for BAP (G06) Lowland Meadow habitat, condition A. The field is cut for hay in mid–late July then aftermath grazed with sheep or cattle (traditional breed, low intensity). The sward may benefit from more intensive grazing following baling to further reduce coarser grasses and encourage the spread of scarcer herb species such as lady's bedstraw. Grazing may continue from late-July to late-March.

As indicated by the owner, yellow rattle is abundant within this field. I believe that the owner has observed less yellow-rattle in the adjacent field, which is lightly grazed throughout the year. The difference in density of this species is probably due to the constant, although light, grazing pressure reducing seed-set of this annual species.

20 Lincolnshire

This small field is adjacent to an SSSI and nature reserve which contains the best example of species-rich meadow remaining in Lincolnshire. It had been unmanaged for approximately 20 years until entry into the Countryside Stewardship Scheme. It was seeded with green hay harvested from Bratoft Meadows. It is cut for hay annually in July. The field includes three small ponds.

The grassland is dominated by the grasses *Festuca rubra, Anthoxanthum odoratum, Lolium perenne* and *Holcus lanatus* with *Trifolium pratense, Leucanthemum vulgare, Trifolium dubium, Plantago* lanceolata and Trifolium *repens*. The NVC community is MG5 (*Centaurea nigra-Cynosurus cristatus* grassland). It is moderately species-rich with 16 species per m^2, but only two UKBAP Lowland Meadow indicator species, *Leucanthemum vulgare* and *Rhinanthus minor,* are frequent or occasional. A further four species, *Orchis moris, Lychnis flos-cuculi , Lotus corniculatus* and *Centaurea nigra* are rare. The owner reports that large numbers of *Orchis morio* were present in April.

This field fulfils the criteria for the UKBAP Lowland Meadow habitat. The frequency of indicator species is low however, although several species are present, and the site is therefore in condition category C. Current management appears ideal, and with continued suitable management it is likely that condition will improve.

21 Yorkshire

This field is situated in the floodplain of the Burnby Beck. It had species-rich unimproved grassland until the 1970s when it was ploughed, although relics of the former grassland survived in the margins. It was seeded with a seed-mixture from the Derwent Ings between 2003 and 2006. It is now managed by an annual hay-cut and grazing by Aberdeen angus cattle. *Rumex spp* and *Cirsium spp* are controlled by spot-spraying. There are two linked ponds in the centre of the field, and seasonally inundated patches in the south. Soils vary from river gravels in the north through clay in the centre to peaty in the south.

Composition of the grassland varies according to soil type. The more freely-draining gravels in the north have MG5a (*Centaurea nigra-Cynosurus cristatus* grassland, *Lathyrus pratensis* sub-community), grading into MG4 (*Alopecurus pratensis-Sanguisorba officinalis* grassland) further south on clay and peaty soils. These grasslands are species-rich with a mean of 18 species per m^2 and 66% cover of broad-leaved species and sedges. Grasses including *Festuca pratensis, Festulolium Xloliaceum, Holcus lanatus, Cynosurus cristatus, Poa trivialis, Bromus Lepidus, Dactylis glomerata* and *Festuca rubra* are dominant, with abundant broad-leaved species including *Rhinanthus minor, Ranunculus acris, Trifolium pratense, Trifolium repens, Plantago lanceolata, Trifolium dubium, Centaurea nigra* and *Lathyrus pratensis*. The UKBAP Lowland meadow indicator species *Rhinanthus minor, Centaurea nigra* and *Lathyrus pratensis* are frequent, *Silaum silaus, Leontodon autumnalis* and *Carex flacca* are occasional, while *Sanguisorba officinalis*, *Leucanthemum vulgare, Lotus corniculatus, Lychnis flos-cuculi, Galium uliginosum, Filipendula ulmaria, Oenanthe silaiifolia, Achillea ptarmica, Dactylorhiza praetermissa* and *Succisa pratensis* are all present but rare.

This grassland fulfils all criteria for the UKBAP Lowland Meadow habitat in condition category A, and is an extremely good example of grassland recreation from seed in a very short period. Current management appears suitable for maintenance and improvement of grassland quality.

22 Oxfordshire

This field is situated in the flood-plain of the Evenlode, between the river and the now-disused railway line. It is divided into four paddocks which are grazed rotationally by easycare sheep and

British white cattle. The field was seeded with a meadow seed mixture under a Countryside Stewardship agreement by the previous owners. The southernmost section of the field and the southern part of the adjacent paddock was seeded but there had been little germination. These areas were not surveyed.

The two northern paddocks and the northern half of the third paddock have moderately species-rich grassland with a mean of 17.2 species per m^2. It is close to the NVC community MG5b (*Centaurea nigra-Cynosurus cristatus* grassland, *Galium verum* sub-community). It is dominated by the grasses *Cynosurus cristatus, Festuca rubra, Holcus lanatus* and *Festuca pratensis* with *Ranunculus acris, Leucanthemum vulgare, Centaurea nigra, Achillea millefolium, Trifolium repens, Plantago lanceolata, Trifolium dubium* and *Vicia hirsuta*. Three UKBAP Lowland Meadow indicator species were frequent, *Leucanthemum vulgare, Centaurea nigra* and *Galium verum*. Two additional species, *Lathyrus pratensis* and *Leontodon autumnalis* were present but rare.

The grassland fulfils the criteria for the UKBAP Lowland Meadow habitat, although the frequency of indicator species was low. The grassland is in condition category C, but this is likely to improve with continued suitable management.

23 & 24 Oxfordshire

Two adjacent fields bordering the River Pang, to the south of the river on the flat floodplain. Poor gravelly soil with a high water table.

1 The western-most of the two fields was sown in 2006 with seed harvested from Bernwood Meadows by Sue Everett. The sward in this field has closest affinities with NVC community MG5a (*Centaurea nigra-Cynosurus cristatus* grassland, *Lathyrus pratensis* sub-community), although lacking several of the preferential herbs of this community.

The grass component of the sward is dominated by creeping bent (*Agrostis capillaris*) with frequent sweet vernal-grass (*Anthoxanthum odoratum*), Yorkshire fog (*Holcus lanatus*), red fescue (*Festuca rubra*), perennial ryegrass (*Lolium perenne*) and soft-brome (*Bromus hordeaceus*). Occasional grass species included quaking grass (*Briza media*), crested dog's-tail (*Cynosurus cristatus*), Cock's-foot (*Dactylis glomerata*), smooth meadow-grass (*Poa pratensis*) and yellow oat-grass (*Trisetum flavescens*). All other grasses were rare or locally patchy.

The mean cover of broad-leaved species is 45.5% and the mean number of species per m^2 is 14. Three indicator herb species for the UKBAP Lowland Meadow habitat are frequent; black knapweed (*Centaurea nigra*), oxeye daisy (*Leucanthemum vulgare*) and yellow-rattle (*Rhinanthus minor*). In addition common bird's-foot-trefoil (*Lotus corniculatus*) is occasional and rough hawkbit (*Leontodon hispidus*) plus two floodplain grassland indicator species, meadowsweet (*Filipendula ulmaria*) and great burnet (*Sanguisorba officinalis*), are rare components of the sward. Additional species of species-rich semi-improved grassland are also present including ribwort plantain (*Plantago lanceolata*), meadow buttercup (*Ranunculus acris*), lesser trefoil (*Trifolium dubium*) and red clover (*Trifolium pratense*) – which is abundant. Although both perennial ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*) are frequent, cover for both is low at less than 5%. The undesirable species creeping thistle (*Cirsium arvense*) is occasional; spear thistle (*Cirsium vulgare*), common nettle (*Urtica dioica*), ragwort (*Senecio jacobaea*) and docks (*Rumex* spp.) are rare.

This grassland meets the standards for the Lowland Meadow BAP habitat (condition A). There is also potential for improvement as the grassland is still of recent origin, given continued favourable management. Some species, particularly the floodplain indicator species, currently at low frequency within the field may continue to spread. The field is cut for hay in late July then aftermath grazed with sheep until December/January. This is ideal management.

2 The eastern-most of the two fields was sown with a bespoke mix of native wildflower seeds from Emmorsgate Seeds in 2006. As a sown grassland the sward does not closely match any NVC community but has closest affinities with MG5b (*Centaurea nigra-Cynosurus cristatus* grassland, *Galium verum* sub-community), although lacking several of the preferential herbs of this community.

The grass component of the sward is dominated by common bent and crested dog's-tail with frequent red fescue and soft-brome. Occasional grass species included Yorkshire fog, cock's-foot, smooth meadow-grass, perennial rye-grass and small timothy (*Phleum bertolonii*). All other grasses were rare and scattered.

The mean cover of broad-leaved species is 55% and the mean number of species per m^2 is 15.3. Four indicator species for the BAP Lowland Meadow habitat are frequent, lady's-bedstraw (*Galium verum*), oxeye daisy, common bird's-foot-trefoil and yellow-rattle. A further two are occasional, black knapweed and cowslip (*Primula veris*), whilst hoary plantain (*Plantago media*), an indicator species for BAP Lowland Calcareous grassland habitat was also occasional. All of these herb species were included in the sown seed mix. Additional species of species-rich semi-improved grassland are also present including yarrow (*Achillea millefolium*), common cat's-ear (*Hypochaeris radicata*), ribwort plantain (*Plantago lanceolata*), common sorrel (*Rumex acetosa*), meadow buttercup, lesser trefoil and red clover – which is abundant. The grassland does not support any indicator species for species-rich floodplain grasslands. Cover of perennial rye-grass and white clover is low, generally less than 5%. The undesirable species creeping thistle is occasional and docks are rare.

This grassland meets the standards for the Lowland Meadow BAP habitat. There is also high potential for improvement given continued favourable management, as the grassland is still of recent origin and there is potential for additional species to colonize from the neighbouring grassland in Field 1. The field is cut for hay in late July then aftermath grazed with sheep until December/January. This is ideal management.

25 Yorkshire

This field covers approximately 7ha on a gentle south-facing slope leading down to the River Moss. The valley bottom woodland is an SSSI, and the adjacent field to the north appears to have Lowland Dry Acid Grassland. The field is divided into three by two former hedges with ditches. These old hedges have mature *Fraxinus excelsior* and *Quercus robur* with scattered *Crataegus monogyna* and *Rubus fruticosus*. There are also two small patches of *Acer pseudoplatanus, Fraxinus excelsior* and *Quercus robur* woodland. The field was formerly arable, and was sown with seed harvested from a local source around 2000. It is cut annually for hay.

The grassland is moderately species-rich with a mean of 14.5 species per m^2, although a total of only 29 species was recorded from the whole field. The NVC community is MG5a (*Centaurea nigra-Cynosurus cristatus* grassland, *Lathyrus pratensis* sub-community), dominated by grasses including *Cynosurus cristatus, Dactylis glomerata, Holcus lanatus, Anthoxanthum odoratum, Agrostis capillaris* and *Festuca rubra*. Other abundant species include *Centaurea nigra***,** *Trifolium pratense, Ranunculus acris, Plantago lanceolata* and *Trifolium repens*. Mean cover of broad-leaved species is 59.5%. The Lowland Meadow habitat indicator species *Centaurea nigra* is abundant and *Leucanthemum vulgare* is occasional. Other indicator species present include *Lathyrus pratensis, Rhinanthus minor, Lotus corniculatus* and *Dactylorhiza fuchsii*.

The grassland fulfils the criteria for UKBAP Lowland Meadow habitat, although the frequency of indicator species is low. Condition category is C, although with continued suitable management indicator species should spread and condition improve.

26 Dorset

This field is part of a complex of restored grasslands and associated habitats managed largely for the benefits to butterflies. It is part of an SSSI, scheduled for the exceptional population great crested newts that breed in ponds within the site. Scrub was cleared from the field in the 1950s and it was converted to an improved ley. In 1986, a large "R"-shaped ditch and bank was created in the centre of the field to create a system of hedges and ditches with intervening areas of meadow which were seeded using a mixture from a nearby SSSI. The soil is very heavy Oxford Clay. The field is grazed by water buffalo in spring and late summer, with approximately 20% cut for hay each year.

The grassland is species-rich MG5c (*Centaurea nigra-Cynosurus cristatus* grassland, *Danthonia decumbens* sub-community), with a mean of 18.4 species per m^2, and a mean cover of broad-leaved species of 44.5%. No single species dominates, but *Holcus lanatus, Agrostis capillaris, Lotus pedunculatus, Oenanthe pimpinelloides, Lathyrus pratensis, Senecio erucifolius, Ranunculus repens* and *Centaurea nigra* are abundant, and tussocks of *Deschampsia cespitosa* are locally prominent. *Genista tinctoria* is also locally abundant, but is thought to have re-established from the seed-bank, and this may be the case for other species here. UKBAP Lowland Meadow indicator species include frequent *Lotus pedunculatus, Oenanthe pimpinelloides, Lathyrus pratensis, Centaurea nigra, Genista tinctoria,* occasional *Stachys officinalis, Lathyrus nissolia* and *Agrimonia eupatorium* and rare *Serratula tinctoria, POtentilla erecta (*and *anglica*), *Succisa pratensis, Galium palustre, Ajuga reptans, Silaum silaus* and *Dactylorhiza fuchsii*.

This grassland fulfils the criteria for UKBAP Lowland Meadows. It is condition category A. Current management appears to be suitable for maintenance of ecological interest, although the abundance of *Deschampsia cespitosa* tussocks may be a cause for concern.

27 Yorkshire

This is a former arable field that is likely once to have been wet heathland similar to the nearby Strensall Common before 18^{th}-19^{th} century enclosure. The field is more or less rectangular and flat with hedges on three sides and woodland to the east. Seeding with a grassland mixture was carried out in 2008-9.

The grassland is in a very early stage of succession, and is dominated by *Agrostis capillaris* and *Poa trivialis.* The target community is MG4 (*Alopecurus pratensis-Sanguisorba officinalis* grassland) and the current grassland already resembles this. There are large clonal patches of *Trifolium repens*, and other abundant species include *Taraxacum sp, Brachythecium rutabulum, Holcus lanatus* and *Centaurea nigra*. UKBAP Lowland Meadow indicator species include frequent *Centaurea nigra,* occasional *Leucanthemum vulgare* and rare *Sanguisorba officinalis*, *Stachys officinalis, Filipendula ulmaria, Lotus corniculatus, Carex flacca* and *Lychnis flos-cuculi*.

Although this grassland was only seeded in 2006/2007, it can already be classed as Lowland Meadow in condition category C. The frequency of indicator species is low, but a total of nine species are present throughout the sward, and it is likely that these will increase with time. *Trifolium repens* is locally abundant, but this may decrease as soil phosphate declines. *Cirsium* arvense is occasional and other weedy species are remarkably uncommon.

28&29 Oxfordshire

1 This is one of three fields within the ESA here that have been sown with a seed mix to recreate permanent grassland on former arable land. This field, the westernmost, was spread with green hay cut harvested from Cricklade North Meadow National Nature Reserve in 2008. No snake's head

fritillary (*Fritillaria meleagris*) resulted from this, so 1000 bulbs were planted which resulted in a total of 30 fritillary plants appearing this year. The plant community that has established shows affinities with the seasonally flooded alluvial meadow community MG4 *Alopecurus pratensis-Sanguisorba officinalis* grassland, but lacks some of the normal constants typical of flood-meadow and due to the increased abundance of some herbs also shows some affinity with a rather damp variant of NVC MG5a *Cynosurus cristatus-Centaurea* nigra grassland, *Lathyrus pratensis* sub-community.

The grass component of the sward has constant red fescue (*Festuca rubra*) with soft-brome (*Bromus hordeaceus*) and perennial ryegrass (*Lolium perenne*) – although the latter is mostly at low cover. Other frequent species include sweet vernal-grass (*Anthoxanthum odoratum*), Yorkshire fog (*Holcus lanatus*) and crested dog's-tail (*Cynosurus cristatus*), plus occasional meadow barley (*Hordeum secalinum*), meadow brome (*Bromus commutatus*), quaking grass (*Briza media*), yellow oat-grass (*Trisetum flavescens*), cock's-foot (*Dactylis glomerata*), smooth meadow-grass (*Poa pratensis*) and meadow foxtail (*Alopecurus pratensis*). All other grasses were rare or locally patchy.

The mean cover of broad-leaved species is high at 59.5%, which is higher than the condition assessment criterion of >20% cover for lowland meadow. The sward is moderately species rich with a mean number of species per m^2 of 16.7. UKBAP Lowland Meadow indicator species autumn hawkbit (*Leontodon autumnalis*) is constant within the sward, whilst black knapweed (*Centaurea nigra*), oxeye daisy (*Leucanthemum vulgare*) and bird's-foot-trefoil (*Lotus corniculatus*) are frequent and locally abundant. Yellow rattle (*Rhinanthus minor*) and rough hawkbit (*Leontodon hispdus*) are occasional within the sward, whilst typical 'damp-loving' species pepper-saxifrage (*Silaum silaus*) and greater burnet (*Sangiosorba officinalis*) are rare. Additional species of species-rich semi-improved grassland are also present including ribwort plantain (*Plantago lanceolata)*, black medick (*Medicago lupulina*), meadow buttercup (*Ranunculus acris*), and red clover (*Trifolium pratense*) – which is constant and abundant.

Perennial rye-grass is constant at low–moderate cover (1–20%, mean 4.9%). White clover (*Trifolium repens*) is scarce but occasionally present at high cover (up to 30% cover in some areas (mean 3.2%). There are no undesirable species within the main sward, although the boundaries beyond the grassland stand support ruderals.

Whilst this grassland does not meet the criteria for floodplain grassland, which was the aim with the Cricklade North Meadow green hay, supporting too few/scarce floodplain herbs, it does qualify as BAP (G06) Lowland Meadow habitat, condition A. The hay-cut/aftermath grazing with cattle regime currently employed is suitable.

2 The middle of the three restored fields was sown with a bespoke mix of native wildflower seeds from Emmorsgate Seeds in *c.* 2003. As a sown grassland the sward does not closely match any NVC community but has closest affinities with MG5b (*Centaurea nigra-Cynosurus cristatus* grassland, *Galium verum* sub-community), although lacking several of the preferential herbs of this community.

The grass component of the sward is dominated by red fescue and Yorkshire fog with much crested dog's-tail and frequent perennial rye-grass, Timothy, sweet vernal-grass and soft-brome. Occasional grass species include meadow brome, meadow barley, cock's-foot, common bent, rough meadow-grass (*Poa trivialis*), perennial rye-grass and meadow fescue (*Festuca pratensis*). All other grasses were rare and scattered.

The mean cover of broad-leaved species is 53.5% and the mean number of species per m^2 is 14.5. Three indicator species for the BAP Lowland Meadow habitat are frequent, oxeye daisy, black knapweed and yellow-rattle. A further three are occasional, lady's-bedstraw (*Galium verum*), greater bird's-foot-trefoil (*Lotus pedunculatus*) and ragged robin (*Lychnis flos-cuculi*). All of these herb species were included in the sown seed mix. Additional species of species-rich semi-improved grassland are also present including yarrow (*Achillea millefolium*), ribwort plantain (*Plantago*

lanceolata), common sorrel (*Rumex acetosa*), meadow buttercup, lesser trefoil and red clover. Cover of perennial rye-grass is low (1–10%, mean 2.1%) but cover of white clover is very variable, generally less than 5% but occasionally up to 40%..

This grassland meets the standards for the Lowland Meadow BAP habitat. There is also high potential for improvement given continued favourable management, as the grassland is still of recent origin and there is potential for additional species to colonize from the neighbouring grassland in Field 1. The field is cut for hay in late July then aftermath grazed with cattle until December/January. Spreading some green hay from field 6951 may increase species diversity.

31 Leicestershire

A ridge and furrow field on a gentle north-facing slope on the northern side of the valley of a small stream. The field has been sown with a species-rich grassland mixture, and it is cut annually for hay with aftermath grazing by cattle. It is one of a group of fields on this farm that are being restored to species-rich grassland.

The grassland is species-rich with a mean of 21.8 species per m^2 and a cover of broad-leaved species of 46%. The NVC Community is MG5a (*Centaurea nigra-Cynosurus cristatus* grassland, *Lathyrus pratensis* sub-community). It is dominated by a range of species including the grasses *Arrhenatherum elatius, Poa trivialis, Festuca rubra, Anthoxanthum odoratum, Lolium perenne* , *Agrostis capillaris ,Bromus hordaceus* and *Holcus lanatus* with broad-leaved species including *Trifolium pratense, Ranunculus acris, Rhinanthus minor,Heracleum sphondylium, Centaurea nigra, Plantago lanceolata* and *Cerastium fontanum*. The UKBAP Lowland Meadow indicator species *Rhinanthus minor, Centaurea* nigra and Lathyrus *pratensis* are frequent, while *Lotus corniculatus* and *Conopodium majus* are occasional and *Galium verum, Primula veris, Filipendula vulgaris* and *Leucanthemum vulgare* are rare.

This grassland fulfils the criteria for UKBAP Lowland Meadows, and is in condition category A. Current management appears ideal for maintenance and enhancement of grassland quality.

32 Oxfordshire

This is one of five fields within the ESA here that have been sown with a seed mix to recreate grassland on former arable land. The field surveyed was selected because it had a uniform drilling of seed, whereas the largest field had a variable drilling rate and some of the smaller fields have problems with ragwort. The field supports an herb-rich, tall sward resulting from a commercial seed mix, sown 9 years ago. The fields are sometimes hay-cut and sometimes grazed during the summer, although 9810 has not been grazed this year. The herbs are more diverse in the southern part, and coarser grasses and white clover more abundant in the northern part. The plant community that has established shows greatest affinity with NVC MG5b *Cynosurus cristatus-Centaurea* nigra grassland, *Galium verum* sub-community.

Red fescue (*Festuca rubra*) and Yorkshire fog (*Holcus lanatus*) dominate the grass component, with constant crested dog's-tail (*Cynosurus cristatus*) and frequent meadow fescue (*Festuca pratensis*), perennial rye-grass (*Lolium perenne*), timothy (*Phleum pratense sens. lat.*), smooth meadow-grass (*Poa pratensis*) and occasional meadow foxtail (*Alopecurus pratensis*), sweet vernal-grass (*Anthoxanthum odoratum*) and cock's-foot (*Dactylis glomerata*). All other grasses are rare in the sward.

The mean cover of broad-leaved species is moderately high at 53%, which is higher than the condition assessment criterion of >20% cover for lowland meadow. The sward is moderately species rich with a mean number of species per m^2 of 16.1. UKBAP Lowland Meadow indicator species

lady's bedstraw (*Galium verum*), bird's-foot-trefoil (*Lotus corniculatus*), black knapweed (*Centaurea nigra*) and oxeye daisy (*Leucanthemum vulgare*) are all frequent to locally abundant. Ragged robin (*Lychnis flos-cuculi*) – which favours wet meadows – is a rare component of the sward, as is meadow vetchling (*Lathyrus pratensis*). Additional species of species-rich semi-improved grassland are also present including yarrow (*Achillea millefolium*), self-heal (*Prunella vulgaris*), ribwort plantain (*Plantago lanceolata)*, meadow buttercup (*Ranunculus acris*), and red clover (*Trifolium pratense*). Perennial rye-grass is constant at low cover (0–3%). However, white clover (*Trifolium repens*) is quite abundant with up to 30% cover in some areas (mean 9.8%). Undesirable species, creeping and spear thistle (*Cirsium arvense, C. vulgare*), were also quite frequent (0–10% cover, mean 2.1%).

The sward meets the criteria for BAP (G06) Lowland Meadow habitat, condition, although this is borderline due to the local abundance of white clover. The programme to reduce thistles should also continue. Management recommended is to shut-up for hay until mid-July, and hard aftermath graze until late March.

33 Northants

The site is an arable field which was put into reversion under CSS and is now in HLS. Natural regeneration didn't work, so the field was levelled then surfaced, and sown with an adapted lowland meadow seed mix from Emmorsgate Seeds in October 2009. Additionally, some brush-harvested material from a flood-meadow in Grafton Regis was added. The seed was precision drilled and topped in the first year. The field is shut up for hay on 01 April and then grazed through autumn/winter with sheep following the July hay-cut. The plant community that has established shows greatest affinity with NVC MG5b *Cynosurus cristatus-Centaurea* nigra grassland, *Galium verum* sub-community, although several typical associates are missing. Arable headland left to regenerate naturally and is species-poor – it was excluded from the survey.

The grass component of the sward is of moderate species richness with 14 species recorded within the meadow. Crested dog's-tail (*Cynosurus cristatus*), sweet vernal-grass (*Anthoxanthum odoratum*), red fescue (*Festuca rubra*) and Yorkshire fog (*Holcus lanatus*) are constant and abundant. False oat-grass (*Arrhenatherum elatius*) – a species indicative of under-management – is frequent, with smaller cat's-tail (*Phleum bertolonii*), rough meadow-grass (*Poa trivialis*) and yellow oat-grass (*Trisetum flavescens*). Occasional species include soft brome (*Bromus hordeaceus*), meadow barley (*Hordeum secalinum*); common bent (*Agrostis capillaris*), perennial rye-grass (*Lolium perenne*) and smooth meadow-grass (*Poa pratensis*).

The mean cover of broad-leaved species is 60.5%, which is higher than the condition assessment criterion of >20% cover for lowland meadow. The sward is moderately species rich with a mean number of species per m^2 of 18.6. BAP Lowland Meadow indicator species oxeye daisy (*Leucanthemum vulgare*) is constant and patchily abundant, whilst black knapweed (*Centaurea nigra*), lady's bedstraw (*Galium verum*) and yellow-rattle (*Rhinanthus minor*) are frequent, the latter locally abundant. Additional species of species-rich semi-improved grassland are also present including ribwort plantain (*Plantago lanceolata)*, meadow buttercup (*Ranunculus acris*), and red clover (*Trifolium pratense*) – which is frequent to locally abundant. The herb component did not support a typical flood-meadow flora.

Perennial rye-grass is present, but at very low cover. White clover (*Trifolium repens*) is occasional at low cover (mean cover of 1%) and rarely greater than 3%. Undesirable species spear thistle (*Cirsium vulgare*), creeping thistle (*C. arvense*) and broad-leaved dock (*Rumex obtusifolius*) are occasional only. Weedier species are generally associated with the margins.

The sward meets the criteria for BAP (G06) Lowland Meadow habitat, condition A. The field is cut for hay in mid–late July then aftermath grazed with sheep. The sward may benefit from more intensive

grazing following baling to further reduce coarser grasses such as false oat-grass, and encourage the spread of scarcer herb species such as lady's bedstraw.

34 Shropshire

This area of rush-dominated pasture was a fen that was drained over 30 years ago in the late 1970s. It is situated in an area in Shropshire where meres and fens are a frequent feature of the landscape – the site lies near to Colemere, Clarepool Moss and Wixall Moss. The field was formerly in arable rotation but entered stewardship in 2000. The pumps were turned off and natural regeneration from the seedbank has been allowed, with no over-sowing. The lower lying central area of the site has developed into a rush pasture, whilst the higher land is semi-improved grassland. It is the rush pasture area that was surveyed. The current plant community shows greatest affinity with NVC M23b *Juncus effusus* rush pasture.

Soft rush (*Juncus effusus*) dominates the sward with smaller quantities of sharp-flowered (*Juncus acutiflorus*). Sweet-grass (*Glyceria* sp.), velvet bent (*Agrostis canina*), rough meadow-grass (*Poa trivialis*), creeping bent (*Agrostis stolinifera*) are the most frequent grasses although Yorkshire fog, marsh foxtail (*Alopecurus geniculatus*) and false oat-grass (*Arrhenatherum elatius*) are occasional to locally frequent. The mean cover of broad-leaved species is 32%, with a mean number of species per m^2 of 12.7. BAP priority habitat (G07) Purple moor-grass and rush pastures indicator species marsh bedstraw (*Galium palustre*) is frequent with locally frequent areas of sharp-flowered rush (*Juncus acutiflorus*). Gipsywort (*Lycopus europaeus*), lesser spearwort (*Ranunculus flammula*) and greater bird's-foot-trefoil (*Lotus pedunculatus*) are also occasional within the sward, whilst ragged robin (*Lychnis flos-cuculi*) is rare, and water mint (*Mentha aquatica*) is localized. Additional species typical of rush pasture and fen are also present including common spike-rush (*Eleocharis palustris*), bog stitchwort (*Stellaria uliginosa*), marsh horsetail (*Equisetum palustre*) and marsh willowherb (*Epilobium palustre*). Cover of non-jointed rushes such as soft rush, the community dominant here, is just under 50% on average, although it attains much higher dominance in places. Bare ground is less than 10% - which is a requisite of this habitat type – and scrub is generally low with grey willow (*Salix cinerea*) and alder (*Alnus glutinosa*) occurring occasionally as coppice but covering less than 5% of the total area. Weedy species such as thistles (*Cirsium* spp.) are rare within the stand.

With one frequent and five occasional indicator species, and low cover of undesirable species and scrub, this rush pasture meets the criteria for BAP (G05) Purple moor-grass and rush pasture habitat, condition C (failing on condition 5). The habitat is considered to be rush pasture rather than fen habitat as it lacks the tall sedges, tall herbs and bryophytes that fen habitat generally supports. The field is lightly grazed with beef cattle (1 livestock unit per ha in this 9 ha field) and 1/3 of the rushes are topped on rotation in July/August. The management and condition of the meadow are good and the sward will hopefully continue to become more diverse with a greater proportion of jointed rushes in time. .

35 & 30 Shropshire

This 9 ha area is owned and managed by the Shropshire Ornithological Society (SOS) who purchased it in 1999. The fields were arable but have since been subject to hay-strewing with hay cut from several different sites. Two areas were surveyed: an enclosed field that received hay from Mottey Meadows NNR, a series of wildflower rich floodplain meadows in Staffordshire; and a field that received hay from Little Stocking near Oreton.

1 Mottey Meadows NNR hay source. The plant community of interest is confined to the lower area of the enclosed field. The current plant community here shows greatest affinity with NVC M23b *Juncus effusus* rush pasture. On the upper terrace the community is dry semi-improved grassland.

Rushes dominate this wet meadow; soft rush (*Juncus effusus*) dominates the sward with smaller quantities of hard rush (*Juncus inflexus*). Jointed rush (*Juncus articulatus*) and toad rush (*Juncus bufonius*) are occasional. Grass species include much sweet vernal-grass (*Anthoxanthum odoratum*), velvet bent (*Agrostis canina*), common bent (*Agrostis capillaris*) and red fescue (*Festuca rubra*). Other grasses include less frequent rough meadow-grass (*Poa trivialis*), creeping bent (*Agrostis stolonifera*), Yorkshire fog (*Holcus lanatus*) and crested dog's-tail (*Cynosurus cristatus*) amongst others.

The mean cover of broad-leaved species is 55%, with a mean number of species per m^2 of 14.7. UKBAP priority habitat (G07) Purple moor-grass and rush pastures indicator species greater bird's-foot-trefoil (*Lotus pedunculatus*) is abundant, whilst ragged robin (*Lychnis flos-cuculi*) and various sedges are frequent including carnation sedge (*Carex panicea*), pale sedge (*C. pallescens*), glaucous sedge (*C. flacca*), oval sedge (*C. ovalis*), common sedge (*C. nigra*) and hairy sedge (*C. hirsuta*). Gipsywort (*Lycopus europaeus*) is occasional, whilst marsh bedstraw (*Galium palustre*), black knapweed (*Centaurea nigra*), meadow vetchling (*Lathyrus pratensis*), lesser spearwort (*Ranunculus flammula*), water mint (*Mentha aquatica*) and marsh marigold are rare within the stand. Mean cover of non-jointed rushes such as soft rush, the community dominant here, is just under 20% on average, although it attains higher dominance in some areas. Bare ground is less than 10% - which is a requisite of this habitat type – and scrub is generally low with grey willow (*Salix cinerea*) occurring occasionally but covering less than 5% of the total area. Weedy species such as thistles (*Cirsium* spp.) are rare within the stand. Meadow thistle *Cirsium dissectum* has also established in this field.

With one abundant, two frequent and four rare indicator species, and low cover of undesirable species and scrub, this rush pasture meets the criteria for BAP (G05) Purple moor-grass and rush pasture habitat, condition A. The habitat is considered to be rush pasture rather than fen habitat as it lacks the tall sedges, tall herbs and bryophytes that fen habitat generally supports. The management and condition of the meadow are good, with the exception of the presence of New Zealand Pigmyweed (*Crassula helmsii*), a highly invasive and problematic non-native species.

2 Venus Pool – Little Stocking hay source. The plant community that has established shows affinities with NVC MG5c *Cynosurus cristatus-Centaurea* nigra grassland, *Danthonia decumbens* sub-community, although the hay-source meadow was MG5a (*Lathyrus pratensis* sub-community); the meadow is not truly representative of either with several community preferentials of each missing.

A very short sward in the south-eastern area but taller to the north-west, it is dominated by sweet vernal-grass, common bent, red fescue and Yorkshire fog with lower quantities of yellow oat-grass (*Trisetum flavescens*), crested dog's-tail and cock's-foot (*Dactylis glomerata*), and occasional tufted hair-grass (*Deschampsia cespitosa*) denoting dampness. Hard rush, soft rush are also occasional. Field woodrush (*Luzula campestris*) is frequent. The mean cover of broad-leaved species is high at 64%, which is higher than the condition assessment criterion of >20% cover for lowland meadow. The sward is moderately species rich with a mean number of species per m^2 of 13.2. BAP Lowland Meadow indicator species common bird's-foot-trefoil (*Lotus corniculatus*), black knapweed (*Centaurea nigra*) and yellow-rattle (*Rhinanthus minor*) are all frequent to locally abundant. Meadow vetchling (*Lathyrus pratensis*), eyebright (*Euphrasia* sp.), heath spotted-orchid (*Dactylorhiza maculata*) and autumn hawkbit (*Leontodon autumnalis*) are rare to locally frequent. Additional species of species-rich semi-improved grassland are also present including ribwort plantain (*Plantago lanceolata)*, meadow buttercup (*Ranunculus acris*), and red clover (*Trifolium pratense*) – which is abundant.

Perennial rye-grass is absent and white clover (*Trifolium repens*) is constant at low cover (1–4%). Undesirable species were absent from the random stops but were present (dock, *Rumex* sp.) in localized, disturbed areas and on the perimeters of the field.

The sward meets the criteria for BAP (G06) Lowland Meadow habitat, condition B (with 3 frequent, and four rare indicator species).

36 Lincolnshire

This site is part of a large area that has been landscaped and managed under HLS option HK13 for the benefit of the assemblage of breeding wading birds (including avocet, redshank and lapwing). Long, narrow, shallow scrapes have been created in former arable land which has been seeded with a grassland seed mixture.

The grassland surrounding the scrapes is relatively species-rich, but the cover of broad-leaved species is low. It is dominated by grasses, chiefly *Festuca pratensis, Festuca rubra, Cynosurus cristatus, Agrostis capillaris* and *Poa pratensis* with *Plantago lanceolata, Prunella vulgaris* and *Geranium dissectum.* The only species that are indicators of the UKBAP Lowland Meadow habitat were frequent *Leucanthemum vulgare* and rare *Centaurea nigra.* Species indicative of semi-improved grassland include *Ranunculus acris, Prunella vulgaris* and *Plantago lanceolata*, all of which are frequent. The NVC community is MG6a (*Lolium perenne-Cynosurus cristatus* grassland, typical sub-community.

This grassland does not qualify as a UKBAP priority habitat, however it is a good quality semi-improved grassland with a good variety of species. This grassland provides an important buffer zone to the scrapes, and is probably a valuable feeding area for birds. Maintenance in good condition for breeding waders and feeding winter wildfowl should be a priority here.

38 Lincolnshire

This site is part of a large area that has been landscaped and managed under HLS option HK13 for the benefit of the assemblage of breeding wading birds (including avocet, redshank and lapwing). Long, narrow, shallow scrapes have been created in former arable land which has been seeded with a grassland seed mixture. There are several fields separated by fenced ditches. Only one of these was surveyed.

The grassland surrounding the scrapes is relatively species-rich, and cover of broad-leaved species is high. It is dominated by grasses, chiefly *Festuca pratensis, Lolium perenne, Poa trivialis* and *Festuca rubra,* with *Trifolium pratense, Trifolium repens, Plantago lanceolata, Prunella vulgaris* and *Trifolium dubium.* The only species that indicates the UKBAP Lowland Meadow habitat was rare *Sanguisorba officinalis.* Species indicative of semi-improved grassland include *Ranunculus acris, Trifolium pratense, Trifolium dubium, Prunella vulgaris* and *Plantago lanceolata*, all of which are frequent. The NVC community is MG6a (*Lolium perenne-Cynosurus cristatus* grassland, typical sub-community.

This grassland does not qualify as a UKBAP priority habitat, however it is a good quality semi-improved grassland with a good variety of species. This grassland provides an important buffer zone to the scrapes, and is probably a valuable feeding area for birds. Maintenance in good condition for breeding waders and feeding winter wildfowl should be a priority here.

39 & 40 Lancashire

1 This is the westernmost part of a strip of grassland surrounding the south and east of a newly created wetland area at a Wildfowl and Wetlands Trust reserve. This was formerly arable land and was seeded with green hay in 2003/2004. It is mown, but there is no grazing. It includes three small seasonal ponds.

This is species-poor semi-improved grassland (NVC community MG6a – *Lolium perenne-Cynosurus cristatus* grassland, *Anthoxanthum odoratum* sub-community), with a mean of 7.9 species per m^2 and a cover of broad-leaved species on 2%. The grasses *Anthoxanthum odoratum, Holcus lanatus, Festuca rubra* and *Agrostis capillaris* are dominant forming a dense, closed sward. The only frequent broad-leaved species is *Vicia hirsuta*. The only lowland meadow indicator species present is *Lotus corniculatus* which is rare here. Several semi-improved grassland indicators are present, including *Trifolium dubium, Trifolium pratense, Medicago lupulina, Hypochoeris radicata, Ranunculus acris* and *Plantago lanceolata*, but all of these are rare here.

This grassland fails the criteria for UKBAP Lowland Meadows and good-quality semi-improved grassland. It is possible that grassland quality would improve if cattle grazing were to be introduced, but further restoration may be required.

2 This is the north-eastern part of a strip of grassland surrounding the south and east of a newly created wetland area at a Wildfowl and Wetlands Trust reserve. This was formerly arable land and was seeded with green hay in 2003/2004. It is mown, but there is no grazing.

This is species-poor semi-improved grassland (NVC community MG6a – *Lolium perenne-Cynosurus cristatus* grassland, *Anthoxanthum odoratum* sub-community), with a mean of 10.7 species per m^2 and a cover of broad-leaved species of 3.4%. The grasses *Anthoxanthum odoratum, Holcus lanatus, Festuca rubra, Dactylis glomerata* and *Agrostis capillaris* are dominant forming a dense, closed sward with *Trifolium repens*. The only lowland meadow indicator species present is *Centaurea nigra* which is rare here. Several semi-improved grassland indicators are present, including *Trifolium dubium, Trifolium pratense, Hypochoeris radicata* but all of these are rare here.

This grassland fails the criteria for UKBAP Lowland Meadows and good-quality semi-improved grassland. It is possible that grassland quality would improve if cattle grazing were to be introduced, but it is possible that further restoration is required.

41 Lincolnshire

This is a system of seven small fields on the Lincolnshire coastal plain to the south west of Burgh le Marsh. These have been seeded using a species-rich lowland meadow seed mixture from a nearby SSSI meadow. This farm is close to the Bratoft Meadows SSSI and nature reserve. Three fields were initially assessed and appeared similar. One of these was selected for survey.

The grassland is moderately species-rich, but has few species indicative of the UKBAP Lowland Meadow habitat. *Rhinanthus minor* is frequent and *Lathyrus pratensis* is localy common. There are however several species typical of semi-improved grassland, including *Ranunculus acris, Rumex acetosa, Trifolium dubium, Trifolium pratense* and *Ranunculus bulbosus*, all of which are occasional or frequent. The NVC community is MG6a (*Lolium perenne-Cynosurus cristatus* grassland, typical sub-community). The undesirable species *Cirsium arvense* is occasional.

While this grassland does not fulfil the criteria for the UKBAP Lowland Meadow habitat, it is however species-rich semi-improved grassland, and there is potential for improvement under continued suitable management.

42 Shropshire

Two fields here have been restored. The wetland area was very dry during 2011 and quite heavily grazed so was not surveyed. The grassland was created by sowing a commercial seed mix from Cotswold Seeds. Some cornfield annual species have obviously been included in the seed mix and some of these persist such as corncockle (*Agrostemma githago*) and cornflower (*Centaurea cyanus*).

These are not typical of lowland meadow and will probably disappear over time as the field community stabilizes. The grassland that has been created here currently shows greatest affinity with NVC MG5a *Cynosurus cristatus–Centaurea nigra*, *Lathyrus pratensis* sub-community, although it is still developing and lacks several of the associates of that community.

The sward is dominated by a mixture of grass species comprising abundant Timothy (*Phleum pratense* s.l.), common bent (*Agrostis capillaris*) red fescue (*Festuca rubra*) and Yorkshire fog (*Holcus lanatus*) with frequent crested dog's-tail (*Cynosurus cristatus*) and soft-brome (*Bromus hordeaceus*) Other grass species are present but are scattered. There are some problematic annual grasses present, such as areas of sterile brome (*Anisantha sterilis*), which is quite frequent and is at high cover in some areas on the western side of the field. The mean cover of broad-leaved species is moderately high at 40%, which is higher than the condition assessment criterion of >20% cover for lowland meadow. The sward is moderately species rich with a mean number of species per m^2 of 14.6. UKBAP Lowland Meadow indicator species black knapweed (*Centaurea nigra*), yellow rattle (*Rhinanthus minor*) and oxeye daisy (*Leucanthemum vulgare*) are frequent to locally abundant, whilst common bird's-foot-trefoil (*Lotus corniculatus*) is occasional. Additional species of species-rich semi-improved grassland are also present including ribwort plantain (*Plantago lanceolata)*, meadow buttercup (*Ranunculus acris*), and red clover (*Trifolium pratense*). Perennial rye-grass is present within the site (1–10% cover), whilst white clover (*Trifolium repens*) is abundant (mean 18.3% cover). Weedy and undesirable species are present including the annual grass sterile brome plus creeping thistle (*Cirsium arvense*), some nettle (*Urtica dioica*) and docks (*Rumex* spp.). Cover across the entire field was low.

With a moderately species-rich sward of, on average, 14 species m^2 including two abundant, one frequent and one occasional lowland meadow indicator species, a low cover of undesirable species, but a moderately high cover of white clover this grassland meets the criteria for Condition B Lowland Meadow habitat. The grassland creation has been a success although the community is still establishing and developing. The whole site is hay cut after mid-July and then aftermath grazed by sheep. Eradicating the area of noxious weeds on the western side would benefit this grassland.

43 Cumbria

This property was bought by Friends of the Lake District in 2002, and as part of their work to restore the farm, this meadow was seeded with a mixture harvested from a nearby SSSI in 2006. The majority of the field is in the floodplain of the adjacent river, although the south-eastern corner is raised on a terrace. The field is shut-up for hay between the beginning of April and hay-cutting after 20th July, after which it is grazed.

The grassland is species-rich with a mean of 18.8 species per m^2, and mean cover of broad-leaved species is 59%. The NVC community is recognisable as MG3 (*Anthoxanthum odoratum-Geranium sylvaticum* grassland). The grassland is dominated by *Anthoxanthum odoratum, Agrostis capillaris, Festuca rubra, Trifolium pratense, Ranunculus acris* and *Leucanthemum vulgare*. Other abundant species include *Rhinanthus minor, Plantago lanceolata, Rumex acetosa, Euphrasia arctica, Leontodon hispidus, Trifolium repens, Prunella vulgaris, Holcus lanatus* and *Cerastium fontanum*. UKBAP Upland Meadow indicator species recorded are frequent *Leucanthemum vulgare, Rhinanthus minor, Euphrasia arctica, Leontodon hispidus* and *COnopodium majus* and occasional *Leontodon autumnalis*. *Centaurea nigra* and *Geranium sylvaticum* are rare. Flushed areas in the centre of the site have small areas of species-poor MG9 (*Deschampsia cespitosa-Holcus lanatus* grassland) and M23a (*Juncus acutiflorus-Galium palustre* rush-pasture). The slope of the terrace has a relic stand of MG5c (*Centaurea nigra-Cynosurus cristatus* grassland, *Danthonia decumbens* sub-community) with *Potentilla erecta, Stachys officinallis* and *Conopodium majus*).

This grassland fulfils the criteria for UKBAP Upland Meadows. It is in condition category A, although at present it lacks many of the distinctive upland species characteristic of MG3. This may improve as the restoration proceeds.

44 Lincolnshire

This field is situated on the steep, west-facing escarpment of the Lincolnshire Wolds to the east of Holton-le-Moor. The geology is complex, with the freely-draining, acidic lower greensand overlying chalk. This has given rise to a mosaic of acidic and calcareous grasslands with small areas of calcareous, spring-fed fen below flush-lines. There has been considerable quarrying activity here in the past.

The area surveyed here was the steep limestone slope in the south and centre of the field. The grassland on these slopes is a variable mixture of species-rich calcareous grassland and less rich semi-improved grassland. The NVC Community is closest to CG2c (*Festuca ovina-Avenula pratense* grassland, *Holcus lanatus-Trifolium repens* sub-community). The grasses *Festuca ovina, Lolium perenne, Cynosurus cristatus* and *Dactylis glomerata* are dominant, and the typical calcareous grassland grasses *Koeleria macrantha* and *Avenula pratensis* are frequent. There is a rich variety of broad-leaved species, although few of these are frequent throughout the grassland. Species typical of calcareous grassland include *Galium verum, Lotus corniculatus, Carex flacca, Pilosella officinarum* and *Carlina vulgaris*, all of which are frequent, and *Sanguisorba officinalis* is also present. Indicator species of acidic grasslands including *Aphanes inexspectata* and *Rumex acetosella* are also present.

This grassland qualifies as the UKBAP habitat Calcareous Grassland, although indicator species are relatively infrequent, and for this reason grassland condition is considered as category C. It is however likely that with continued suitable management condition will improve. As a whole however, the site is of considerable conservation value for its mosaic of unimproved grassland and wetland types over a varied topography and geology.

45 Dorset

This field includes 11 tumuli, several of which have species-rich calcareous grassland, and linear earthworks along the eastern boundary. The field is grazed by sheep and occasionally by cattle through the summer. The formerly semi-improved grassland areas between the tumuli have been sown with a calcareous grassland mixture.

The grassland between the tumuli has been sown with a calcareous grassland mixture. It is CG3d (*Bromus erectus* grassland, *Festuca rubra* sub-community), typical of such grasslands in this part of Wessex. It is a mosaic of species-rich and less rich grassland with a mean of 22.6 species per m^2, and a cover of broad-leaved species of 34.5%, dominated by *Bromus erectus, Festuca rubra* and *Arrhenatherum elatius* with C*entaurea nigra, Plantago lanceolata, Primula veris, Lotus corniculatus, Cerastium fontanum, Dactylis glomerata, Trifolium pratense* and *Veronica chamaedrys*. UKBAP Lowland Calcareous Grassland indicator species include frequent C*entaurea nigra, Primula veris, Lotus corniculatus,* occasional *Galium verum*, *Rhinanthus minor* and *Filipendula vulgaris,* and rare *Leucanthemum vulgare, Leontodon hispidus, Linum catharticum, Sanguisorba minor*, *Anthyllis vulneraria, Thymus praecox* and *Carex humilis*. *Carex humilis* and *Thymus praecox* were found only in close proximity to the tumuli, but apart for these species there is little sign of greater species-richness around the tumuli. Grassland near the north-east boundary has frequent *Anthoxanthum odoratum* and *Agrostis capillaris* and here the soils may be less calcareous.

This grassland fulfils the criteria for UKBAP Lowland Calcareous Grassland. It is in condition category A. Current management appears to be suitable for maintaining ecological interest, although this might be improved by a reduced number of sheep in the summer.

46 Yorkshire

This is a low ridge of Jurassic limestone to the north of Kippax. These have been much quarried in the past, leaving a topography of hollows and intervening ridges and hillocks. The eastern part of the site in particular has been invaded by scrub, but a considerable amount of this has been recently cleared. The site is grazed by sheep.

Approximately 40% of the site has species-rich Lowland Calcareous Grassland, 30% is less rich grassland, while a further 30% has been recently cleared of scrub. Recently scrub-cleared areas were not surveyed, but had patchy regeneration of *Crataegus monogyna* and *Rubus fruticosus*. The major grassland NVC community is CG5a (*Brachypodium pinnatum-Bromus erectus* grassland, typical sub-community), which varies from a short, rabbit-grazed species-rich turf on thinner, more drought-prone soils , to a taller, tussocky and less rich grassland where soils are deeper. The grassland is moderately species-rich overall with a mean of 14.5 species per m^2, and the site as a whole is species-rich. The mean cover of broad-leaved species is 36.5%. The grassland is dominated by *Bromus erectus, Brachypodium pinnatum* and *Festuca rubra* and the most abundant associates are *Ranunculus bulbosus, Lotus corniculatus, Centaurea nigra* and *Carex flacca*. Other frequent species include *Primula veris, Briza media, Festuca ovina, Leontodon hispidus, Plantago lanceolata* and *Centaurea scabiosa.* Indicator species of the UKBAP Lowland Calcareous Grassland include frequent *Lotus corniculatus, Centaurea nigra, Carex flacca, Primula veris, Leontodon hispidus* and *Centaurea scabiosa*. Rare indicator species include *Campanula glomerata, Ononis spinosa, Polygala vulgaris, Pilosella officinarum, Stachys officinalis, Linum catharticum, Carex caryophyllea, Leucanthemum vulgare, Ononis repens, Galium verum, Dactylorhiza fuchsia, Helianthemum nummularium, Carlina officinalis, Sanguisorba minor* and *Gentianella amarella*. Undesirable species are infrequent although *Senecio jacobaea* is occasional (the owner reports it to be frequent in some years). *Crataegus monogyna* seedlings are occasional throughout the sward.

The grassland fulfils all of the criteria for the UKBAP Lowland Calcareous Grassland habitat and is in condition category A. The area of grassland has increased since the start of the HLS agreement in 2008, although the most recently cleared area is not yet grassland and there is some regeneration of scrub.

47 Lincolnshire

This small field occupies the bottom and gentle slopes of a shallow dry valley. It was formerly an extremely rich area of limestone grassland, particularly important for butterflies, and was scheduled as an SSSI. It was ploughed and planted with oak and subsequently scots pine in 1957, with a small remnant of species-rich grassland that gradually deteriorated with lack of management. It was denotified as an SSSI in 1987. The remaining grassland was leased by the wildlife trust in 1985 and the whole site in 1991, and entered into the Countryside Stewardship Scheme in 1994. The trees were removed and cuttings from the relic species-rich grassland were spread over the field.

The whole of the field that was surveyed now has moderately species-rich calcareous grassland, with CG3d (*Bromus erectus* grassland, *Festuca rubra* sub-community) in the valley bottom and the south-east facing slope, and richer CG5a (*Bromus erectus-Brachypodium pinnatum* grassland, typical sub-community) on the south-west facing slope. The area of relic grassland in the southern corner of the field is still distinguishable from the rest of the grassland and has abundant *Trifolium medium* and *Helianthemum nummularium. Bromus erectus* is abundant throughout, with *Brachpodium pinnatum*

on the north-west facing slope. Abundant species include *Primula veris, Festuca rubra, Plantago lanceolata, Trifolium pratense, Lotus corniculatus, Dactylis glomerata, Rhinanthus minor, Tragopogon pratense, Brachypodium pinnatum, Viola hirta* and *Pseudoscleropodium purum*.

Five lowland calcareous grassland indicator species *Primula veris, Rhinanthus minor, Clinopodium vulgare, Lotus corniculatus, Galium verum* and *Viola hirta* were frequent or abundant, with a further two, *Carex flacca* and *Centaurea scabiosa* being occasional. The lowland meadow indicator species *Rhinanthus minor, Lathyrus pratensis, Tragopogon pratensis* were also frequent. Mean cover of broad-leaved species is 55% and the mean number of species per m^2 is 18. There has been some recent scrub clearance, and there is some regrowth of small *Crataegus monogyna* and *Rosa canina*. Undesirable species are rare.

This field fulfils the criteria for Lowland Calcareous Grassland BAP Habitat, and is one of the few areas of this habitat type in Lincolnshire. Current management is not known but seems suitable for maintaining the interest of this site. It is currently in condition A.

49 Staffordshire

This is one of a number of fields formerly within the ESA agreement here under tier 2a and 2b; the fields are all moderately damp. The field surveyed supports a (mostly) dry acid grassland community on sloping terrain. The field is enclosed and was restored to traditional grazing and has received no agricultural improvement in recent years. The BAP priority habitat is restricted to the northern part of the field. The community has most affinity with NVC U4c *Festuca ovina–Agrostis capillaris–Galium saxatile* grassland, *Lathyrus montanus-Stachys betonica* sub-community, although there are some similarities with the mesotrophic MG5c *Cynosurus cristatus-Centaurea* nigra grassland, *Danthonia decumbens* sub-community.

The grass component of the sward is dominated by mat-grass (*Nardus stricta*), common bent (*Agrostis stolonifera*) and sweet vernal-grass (*Anthoxanthum odoratum*) with abundant crested dog's-tail (*Cynosurus cristatus*) and frequent red fescue (*Festuca rubra*) and occasional heath grass (*Danthonia decumbens*).. Damper areas also supported tufted hair-grass (*Deschampsia cespitosa*). Other grass species were rare in the sward.

The mean cover of broad-leaved species is 28%, which is marginally higher than the condition assessment criterion of >20% cover for lowland meadow. The sward is quite species rich with a mean number of species per m^2 of 16.7. UKBAP Lowland Dry Acid Grassland indicator species tormentil (*Potentilla erecta*) and devils'-bit scabious (*Succisa pratensis*) are frequent to abundant, whilst autumn hawkbit (*Leontodon autumnalis*) and glaucous sedge (*Carex flacca*) were frequent and spring sedge (*Carex caryophyllea*), pill sedge (*Carex pilulifera*), lady's bedstraw (*Galium verum*), bird's-foot-trefoil (*Lotus corniculatus*), heath milkwort (*Polygala serpyllifolia*), bilberry (*Vaccinium myrtillus*) and mouse-ear hawkweed (*Pilosella orfficinalis*) were rare or occasional. Additional species of species-rich semi-improved grassland are also present including ribwort plantain (*Plantago lanceolata)*, common cat's-ear (*Hypochaeris radicata*), meadow buttercup (*Ranunculus acris*), and yarrow (*Achillea millefolium*). Perennial rye-grass was absent and white clover (*Trifolium repens*) was occasionally present at low cover (up to 5% cover in some areas, mean < 1%). Bare ground is occasional from 1–10%, mean 2.1%. Weedy species were restricted to the margins and the area of grassland outside the U4c stand at the southern end of the field.

This grassland meets the criteria of BAP priority habitat Lowland Dry Acid Grassland (FEP community G05). It supports one abundant, three frequent and several rare indicator species in the sward. The fields are currently pony grazed on rotation. The southern end of the field does not support acid grassland of the same quality – it is damper and has more ruderals.

50 Lancashire

This is an area of limestone pavement over which scrub and young woodland has developed since the cessation of grazing. Part of this woodland has been cleared recently, and grazing by cattle has been reintroduced to the whole area. There has been some strewing of green hay in the south-east of the site.

There is now a large clearing in the centre of the site, with patches of *Pteridium aquilinum,* scrub and outcrops of limestone. There are fragments of relic CG9b (*Sesleria albicans-Galium sterneri* grassland, typical sub-community) around the rock outcrops, but most of the grassland is closer to U4 (*Festuca ovina-Agrostis capillaris-Galium saxatile* grassland) Lowland Dry Acidic grassland, but with similarities to woodland ground flora where soils are deeper.

The surveyed vegetation is moderately species-rich with 16.7 species per m^2 and a cover of 24.5% broad-leaved species but with 14.6% bare soil and 12.9% regenerating scrub. *Brachypodium sylvaticum, Agrostis capillaris, Viola riviniana, Anthoxanthum odoratum, Holcus lanatus,* P*oa humilis, Eurhynchium praelongum, Pseudoscleropodium purum* and *Carex flacca* are the most frequent grassland species, with frequent scrub species including *Fraxinus excelsior, Rubus fruticosus, Lonicera periclymenum, Hedera helix, Crataegus monogyna* and *Pteridium aquilinum*. UKBAP Acid Grassland indicator species include frequent *Viola riviniana,* occasional *Carex flacca, Potentilla erecta* and *Fragaria vesca* and rare *Veronica officinalis, Carex pilulifera* and *Lotus corniculatus*. *Sesleria caerulea*, a characteristic species of calcareous grassland is locally frequent, and several calcicole bryophytes are also present.

The surveyed areas of grassland fulfil the criteria for UKBAP Lowland Dry Acidic Grassland. The frequency of indicator species is however low, and the grassland is therefore in condition category C. This site is in the early stages of restoration to a mosaic of pasture-woodland and open acid grassland with limestone outcrops. It is likely that with further scrub clearance and continued grazing, the area of open grassland will increase and the ecological value of the site will increase.

51 Norfolk

This is a large area of heathland, acidic grassland, wetland and woodland in the Norfolk Breckland owned by the Norfolk Wildlife Trust. A field in the south-eastern corner of the reserve was formerly *Betula sp* woodland and *Pteridium aquilinum*. There are three small pits in the western corner, probably resulting from sand extraction. The woodland and most of the *Pteridium* has been cleared recently with the aim of restoring a grassland/heath mosaic. Woodland remains in the southern corner.

The vegetation is now largely U3a Lowland Dry Acidic Grassland (*Deschampsia flexuosa* grassland, *Festuca ovina-Agrostis capillaris* sub-community), with two large patches of H1 heathland. There are stands of *Pteridium aquilinum* in the margins of the field, and smaller areas of U4 grassland surrounding the small hollows in the western corner. Only the U3a stands were surveyed. U3a is a naturally species-poor grassland, and the stand recorded here had a mean of 8.6 species/m^2. *Deschampsia flexuosa* and *Festuca ovina* are dominant in an open sward with *Pseudoscleropodium purum, Rumex acetosella, Anthoxanthum odoratum, Galium saxatile* and *Agrostis capillaris. T*here is a mean cover of 59% broad-leaved species and mosses. Five indicator species of Lowland Dry Acidic Grassland are present, but only two, *Rumex acetosella* and *Galium saxatile* are frequent or occasional. *Lotus corniculatus, Calluna vulgaris* and *Campanula rotundifolia* are rare. *Pteridium aquilnum* is regenerating locally.

This grassland fulfils the criteria for Lowland Dry Acidic Grassland, although the frequency of indicator species is low. The condition category of this grassland is C, although it is probable that

this will improve with successional processes and continued suitable management. It is likely that this field will develop into an area of very high conservation value.

52 & 65 Norfolk

1 This is a remarkable area including numerous periglacial pingoes , shallow depressions separated by broad ridges of freely-draining sand and gravel. The pingoes themselves have a range of fen and swamp communities and open water, grading into acidic grassland on their banks. There has been much recent clearance of *Ulex europaeus* scrub, and extensive removal of trees in the past, leaving the pingoes within a matrix of acidic grassland. The whole area is grazed by sheep.

The grassland is U1 (*Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland), probably U1e (*Galium saxatile-POtentilla erecta* sub-community). *Festuca ovina, Agrostis vinealis* and *Agrostis capillaris* are dominant in a very short and open sward with abundant *Molinia caerulea, Anthoxanthum odoratum, Carex pilulifera, Rumex acetosella* and *Pseudoscleropodium purum*. *Deschampsia flexuosa* is locally abundant, suggesting a transition to U2 grassland, and there are patches close to H1 (*Calluna vulgaris-Festuca ovina* heathland) where *Calluna vulgaris* is abundant. Two UKBAP Acid Grassland habitat indicators, *Rumex acetosella* and *Calluna vulgaris* are frequent and *Galium saxatile* is occasional. A further three species, *Potentilla erecta, Veronica officinalis* and *Euphrasia anglica* are rare.

Criteria for the UKBAP Acid Grassland habitat are fulfilled, although frequencies of indicator species are low. The grassland is therefore in condition category C. This is normal for grasslands in the earliest stages of restoration, and condition is likely to improve with continued suitable management.

2 This area also includes several pingoes, but here the soils appear to be deeper, less freely-draining and more nutrient-rich. The pingoes themselves also have swamp and fen vegetation grading into grassland on the banks. Scrub has been cleared recently.

The grassland on the ridges between the pingoes is species-rich MG5b (*Centaurea nigra-Cynosurus critatatus* grassland, *Galium verum* sub-community), with a mean of 21species per m^2 and a 44% cover of broad-leaved species. It is dominated by grasses including *Agrostis capillaris, Festuca rubra, Dactylis glomerata, Holcus lanatus , Arrhenatherum elatius* and *Anthoxanthum odoratum*. Other abundant species include *Veronica chamaedrys, Rumex acetosa, Stellaria graminea, Centaurea nigra* and *Plantago lanceolata*. Occasional or frequent UKBAP Lowland Meadow indicator species include *Centaurea nigra, Carex flacca, Galium verum, Lathyrus pratensis, Agrimonia eupatorium*, while *Leontodon hispidus, Leontodon autumnalis, Filipendula vulgaris, Lotus corniculatus* and *Lotus pedunculatus* are all rare. The undesirable species *Cirsium arvense* is locally frequent, but cover is less than 2%.

This grassland fulfils the criteria for UKBAP Lowland Meadow habitat. It is in condition category A. Current management appears suitable for maintenance of ecological interest and further scrub clearance will increase grassland area.

53 Leicestershire

Several fields belong to a charitable trust. The surveyed field includes part of the floodplain of a small stream and a north-east facing slope. The adjacent field to the south-west contains ridge and furrow pasture with species-rich grassland. There has been no recent change of management, and the site has been maintained by low-intensity cattle grazing for several decades.

The southern part of the field has moderately species-rich grassland (NVC community MG5c; *Centaurea nigra-Cynosurus cristatus* grassland *Danthonia decumbens* sub-community) with a mean of 16.8 species per m^2, while the northern part is less-rich MG6. Mean cover of broad-leaved species is 34%. The grassland is dominated by grasses including *Agrostis capillaris, Lolium perenne, Cynosurus cristatus, Holcus lanatus* and *Anthoxanthum odoratum*. *Trifolium repens, Trifolium pratense, Ranunculus acris, Rumex acetosa, Sanguisorba officinalis, Brachythecium rutabulum* and *Centaurea nigra* are all abundant. UKBAP Lowland Meadow indicator species include frequent *Sanguisorba officinalis* and *Centaurea nigra* and occasional *Lathyrus pratensis* and *Stachys officinalis*. Other indicator species include *Leontodon autumnalis, Succisa pratensis, Lotus corniculatus* and *Primula veris*, all of which are rare.

The southern part of this field fulfils the criteria for the UKBAP Lowland Meadow habitat. The frequency of indicator species is low however, and condition is in category C, but given suitable management condition should improve. In all other respects condition is good. The undesirable species *Deschampsia cespitosa* is frequent, but cover is low and it does not form large tussocks. Occasional cutting of the field for hay would allow plants to produce seed, and would allow natural spread.

54 Lancashire

This is one of several fields within the country park where the restoration of lowland meadow is being attempted. This is a small field in the floodplain of the Cuerden Valley, adjacent to the river, but raised above river level on a low terrace. Grassland restoration has been by spreading green hay. The field is managed by cutting for hay.

The grassland is moderately species-rich with a mean of 12.9 species per m^2 and a cover of broad-leaved species of 42.5%. The NVC community is MG5a (*Centaurea nigra-Cynosurus cristatus* grassland, *Lathyrus pratensis* sub-community). It is dominated by the grasses *Holcus lanatus, Anthoxanthum odoratum, Agrostis capillaris, Festuca rubra* and *Cynosurus cristatus*. Frequent broad-leaved species include *Ranunculus acris, Plantago lanceolata, Rumex acetosa* and *Trifolium pratense*. UKBAP Lowland Meadow indicator species include frequent *Rhinanthus minor*, occasional *Conopodium majus* and rare *Dactylorhiza fuchsii, Lathyrus pratensis, Centaurea nigra, Leucanthemum vulgare* and *Polygonum bistorta*. There is a strip of *Fraxinus excelsior* and *Salix capraea* woodland to the west of the field, with patches of *Salix cinerea, Salix viminalis* and *Phalaris arundinacea* by the river.

The grassland fulfils the criteria for UKBAP Lowland Meadows, although it is only moderately species-rich, and the frequencies of indicator species are low. It is in condition category C. While current management is suitable for maintaining the ecological interest of the site, condition could be improved by the introduction of cattle-grazing of the aftermath and before shutting-up in the spring.

55 & 69 Lancashire

1 This field is adjacent to a tributary of the River Lune. It is partly within the floodplain of the river, but also includes a steep slope to the west with species-rich grassland and scrub. The area between the regularly flooded part of the floodplain and the slope was surveyed here. The floodplain grassland was disced and re-seeded in 2006 using a mixture from a nearby SSSI meadow. This part of the field is cut for hay, with sheep grazed in the spring prior to shutting-up.

The grassland is moderately spe cies –rich with 14.9 species per m^2 and a mean cover of broad-leaved species of 33%. The grasses *Cynosurus cristatus, Anthoxanthum odoratum, Agrostis capillaris* and *Holcus lanatus* and the clonal herbs *Trifolium repens* and *Ranunculus repens* are dominant, with

abundant *Rhinanthus minor, Euphrasia arctica, Trifolium pratense* and *Ranunculus acris*. The UKBAP Lowland Meadow indicator species *Rhinanthus minor* and *Euphrasia arctica* are frequent, and *Leontodon hispidus, Leontodon autumnalis, Leucanthemum vulgare, Conopodium majus* and *Lotus corniculatus* are rare.

The grassland fulfils the criteria for the UKBAP Lowland Meadow habitat. It is however only moderately species-rich and the frequencies of indicator species are low. Condition is therefore in category C. Covers of *Trifolium repens* and *Ranunculus repens* are high, but this is likely to be transitory, and these may decline as succession proceeds. This grassland is in the early stages of establishment and it is likely to improve under continued suitable management.

2 This field is on a south-facing slope above a tributary of the River Lune. Approximately 35% of this field is W23 *Ulex europaeus* scrub, largely on the lower slopes. This appears to have increased since 2003. The upper slopes are largely dry, although there are flushes in mid-slope to the west. Grassland on the upper, drier slopes was disced and re-seeded in 2006 using a mixture from a nearby SSSI meadow. The field is grazed by sheep with no hay-cutting.

The grassland varies from moderately species-rich MG5 (*Centaurea nigra-Cynosurus cristatus* grassland) at the eastern end, to less rich MG6 (*Lolium perenne-Cynosurus cristatus* grassland) to the west. Mean number of species is 14.8 species per m^2, and cover of broad-leaved species is 25%. It is dominated by the grasses *Agrostis capillaris, Anthoxanthum odoratum, Holcus lanatus* and *Festuca rubra* with *Trifolium repens* and *Plantago lanceolata*. Other frequent species include *Plantago lanceolata, Ranunculus acris, Cerastium fontanum, Euphrasia arctica* and *Luzula campestris.* UKBAP Lowland Meadow indicator species include frequent *Euphrasia arctica,* occasional *Rhinanthus minor* and *Leontodon autumnalis*, and rare *Centaurea nigra* and *Lotus corniculatus*. There are ten additional species characteristic of semi-improved grassland.

This grassland does not fulfil the criteria for the UKBAP Lowland Meadow habitat. It fails on the low frequency of indicator species, the low number of species per m^2 and the high cover of *Trifolium repens*. It is however good-quality semi-improved grassland, parts of the field are moderately species-rich, at least five indicator species are present, and with continued suitable management may become Lowland Meadow.

56 Oxfordshire

Previously species-poor floodplain meadows, the owner obtained funding to slot seed and plant plug-plants into the fields during 2006–7. The main meadow (surveyed here) was seeded by Charles Flower Wildflowers late in the season; the method involved rotivation followed by drilling with a wildflower mix along linear bands the width of a seed drill. Although the aim with this grassland is NVC MG4 *Alopecurus pratensis-Sanguisorba officinalis* grassland, and there are elements of this community type, the prevalence of other species combinations lead to greater affinities with MG1a *Arrhenatherum elatius* grassland, *Centaurea* nigra sub-community, although a poor fit here too.

The sward is dominated by false oat-grass (*Arrhenatherum elatius*), red fescue (*Festuca rubra*) and meadow barley (*Hordeum secalinum*), which are constant within the sward, with frequent to abundant Yorkshire fog (*Holcus lanatus*), cock's-foot (*Dactylis glomerata*), meadow foxtail (*Alopecurus pratensis*) – a frequent species of floodplain grassland – and occasional yellow oat-grass (*Trisetum flavescens*), perennial rye-grass (*Lolium perenne*), crested dog's-tail (*Cynosurus cristatus*) and rough meadow-grass (*Poa trivialis*).

The mean cover of broad-leaved species is 44.5%, which is higher than the condition assessment criterion of >20% cover for lowland meadow. The sward is moderately species rich with a mean number of species per m^2 of 16. UKBAP Lowland Meadow indicator species yellow rattle (*Rhinanthus minor*) is constant and abundant, whilst BAP indicators goat's-beard (*Tragopogon*

pratensis), oxeye daisy (*Leucanthemum vulgare*) and common bird's-foot-trefoil (*Lotus corniculatus*) are frequent. Lady's bedstraw (*Galium verum*) is occasional whilst black knapweed (*Centaurea nigra*) and meadow vetchling (*Lathyrus pratensis*) are rare. Additional species of species-rich semi-improved grassland are also present including ribwort plantain (*Plantago lanceolata)*, meadow buttercup (*Ranunculus acris*), bulbous buttercup (*R. bulbosus*) and red clover (*Trifolium pratense*). Indicator species for floodplain grassland, such as meadowsweet (*Filipendula ulmaria*) and greater burnet (*Sanguisorba officinalis*) were apparently sown in the seed mix for the restoration project but were not noted during the survey in the area surveyed but may be present on other parts of the site. Perennial rye-grass is present, but at very low cover and frequency (mean 1.1%), whilst white clover (*Trifolium repens*) was absent from the surveyed area. Undesirable species were limited to patchy dock such as clustered dock (*Rumex conglomeratus*) and occasional spear thistle (*Cirsium vulgare*).

With a species-rich sward of, on average, greater than 15 species m^2 including four frequent and three rare–occasional indicator species, and low cover of undesirable species, this grassland meets the criteria for BAP (G06) Lowland Meadow habitat, condition A. However, it does not meet the criteria for the flood plain meadows habitat as it lacks the community associates. The whole site is hay cut after mid-July and then aftermath grazed by three ponies in rotation until February. Cattle have been used in the past but none are currently available. The abundance of false oat-grass is probably an indication that the site is currently under-grazed. The sward may benefit from more intensive grazing following baling to further reduce coarser grasses and encourage the spread of scarcer herb species. Grazing may continue from late-July to late-March. The seed mix had variable success and many species sown appear to be missing. Plug plants may be more successful for establishing desirable species such as saw-wort (*Serratula tinctoria*), devil's-bit scabious (*Succisa pratensis*) and greater burnet.

57 Lincolnshire

This field is one of a group of small fields belonging to this farm. All of these were formerly species-poor, improved grassland with a ridge and furrow topography. They were slot-seeded in 1989 with a species-rich meadow mixture, and subsequently seed was collected and spread within the fields, and additional species planted as plug-plants. Fields are cut annually for hay.

The surveyed field now has species-rich MG5 (*Centaurea nigra-Cynosurus cristatus* grassland), probably closest to MG5c (*Danthonia decumbens* sub-community). There are over 20 species per m^2. It is dominated by the grasses *Anthoxanthum odoratum, Agrostis capillaris, Holcus lanatus* and *Festuca rubra,* with *Trifolium pratense, Leucanthemum vulgare, Ranunculus acris,* and *Plantago lanceolata*. Frequent and occasional species indicative of Lowland Meadows include *Leucanthemum vulgare, Rhinanthus minor, Conopodium majus, Primula veris, Stachys officinalis, Centaurea nigra* and *Sanguisorba officinalis,* with less frequent *Lotus corniculatus, Lathyrus pratensis, Silaum silaus, Carex flacca, Galium verum* and *Knautia arvensis*. *Lolium perenne* and *Trifolium repens* are rare, and the mean cover of broad-leaved species is greater than 60%.

This field fulfils the criteria for the UKBAP Lowland Meadow habitat. Restoration of this species-rich grassland has been very successful, with the creation of a community of considerable conservation value.

58 & 59 Lincolnshire

1 One of two small fields on a north-facing slope. Both are managed by hay-cutting with aftermath grazing.

The grassland is dominated by *Agrostis capillaris, Anthoxanthum odoratum, Holcus lanatus* and *Cynosurus cristatus*. The NVC community is MG5c (*Centaurea nigra-Cynosurus cristatus* grassland, *Danthonia decumbens* sub-community). Two indicator species for the BAP Lowland Meadow habitat, *Sanguisorba officinalis* and *Conopodium majus* are frequent, and *Lotus pedunculatus* is occasional. A further two indicator species for semi-improved grassland, *Ranunculus acris* and *Rumex acetosa* are abundant. Several other lowland meadow indicator species are scattered through the sward at low frequencies, these include *Stachys officinalis, Rhinanthus minor, Potentilla erecta* and *Lathyrus pratensis*. Cover of *Lolium perenne* and *Trifolium repens* is low. The mean cover of broad-leaved species is 32.5% and the mean number of species per m^2 is 12.3. The undesirable species *Deschampsia cespitosa* is frequent, but cover is low and it does not form large tussocks.

This grassland fulfils the standards for the Lowland Meadow BAP habitat, although the frequencies of indicator species are low and number of species per m^2 is less than 15. Grassland condition is therefore in category C. There is high potential for improvement given continued favourable management, as several additional species characteristic of lowland meadows are present. Ideal management would be cutting for hay after mid-July with grazing of the aftermath. Slightly heavier grazing would be desirable in order to break up the accumulation of litter. The field could be grazed before shutting up for hay in early April.

2 One of two small fields on a north-facing slope. Both are managed by hay-cutting with aftermath grazing.

Dominant species in this grassland are *Agrostis capillaris, Anthoxanthum odoratum* and *Holcus lanatus*. This grassland is similar in structure and appearance to that in Field 1, and is MG5c (*Centaurea nigra-Cynosurus cristatus* grassland, *Danthonia decumbens* sub-community). While fewer species were recorded throughout the field than in Field 1, four BAP Lowland Meadow indicator species were frequent, *Sanguisorba minor, Stachys officinalis, Rhinanthus minor* and *Conopodium majus,* with a further three semi-improved grassland species abundant or frequent, *Ranunculus acris, Rumex acetosa* and *Luzula campestris*. *Lotus pedunculatus* and *Ajuga reptans* are present at low frequencies. Cover of *Lolium perenne* and *Trifolium repens* is low. The mean cover of broad-leaved species is 31% and the mean number of species per m^2 is 12.2. The undesirable species *Deschampsia cespitosa* is frequent, but cover is low and it does not form large tussocks.

Grassland in this field fulfils the criteria for Lowland Meadow. It is however relatively species-poor and in condition catgegory C, but there is potential for improvement given continued favourable management. Ideal management would be cutting for hay after mid-July with grazing of the aftermath. Slightly heavier grazing would be desirable in order to break up the accumulation of litter. The field could be grazed before shutting up for hay in early April.

60 Staffordshire

This is a National Trust owned farm in the Manifold Valley with a resident tenant farmer. The meadow lies on a more or less flat terrace with sloping ground above it to the west and steeply sloping open access limestone grassland (SSSI) below it to the east. The field is essentially located half way up the valley slopes of the Manifold Valley. The adjacent limestone grassland is species rich. The whole farm has organic status (Soil Association accreditation). The field is bounded by a limestone rock outcrop/ridge (Ossoms Crag). Bare ground was created over approximately 1 ha of a *c.* 1.5ha field. Green hay from Stanton Pastures SSSI was strewn over the area in 2007. The resulting sward shows greatest affinity with MG5a (*Cynosurus cristatus-Centaurea nigra* grassland, *Lathyrus pratensis* sub-community).

The grass component of the sward is dominated by sweet vernal-grass (*Anthoxanthum odoratum*), common bent (*Agrostis capillaris*) and red fescue (*Festuca rubra*) with lower quantities of Yorkshire

fog (*Holcus lanatus*), cock's-foot (*Dactylis glomerata*), false oat-grass (*Arrhenatherum elatius*), crested dog's-tail (*Cynosurus cristatus*), perennial rye-grass (*Lolium perenne*) and tufted hair-grass (*Deschampsia cespitosa*) – this latter denoting some dampness.

The mean cover of broad-leaved species is 61.5%, which is high and largely due to large patches of red clover. The sward is moderately species rich with a mean number of species per m^2 of 16.1. BAP Lowland Meadow wildflower indicator species yellow-rattle (*Rhinanthus minor*) is constant and abundant with frequent pignut (*Conopodium majus*), oxeye daisy (*Leucanthemum vulgare*) and common bird's-foot-trefoil (*Lotus corniculatus*) plus occasional to locally frequent black knapweed (*Centaurea nigra*) and eyebright (*Euphrasia* agg.). Additional species of species-rich semi-improved grassland are also present including ribwort plantain (*Plantago lanceolata)*, meadow buttercup (*Ranunculus acris*) and red clover (*Trifolium pratense*) – which is locally abundant adding to the herb cover. Typical limestone grassland species (see species list) are restricted to the south-easterly end, where hay strewing did not occur, and limestone is close to the surface overlain by thin calcareous soils. This area is very species rich (*c.* 30 m^2) and is a valuable source of seed to establish into the new grassland. Perennial rye-grass is present at very low cover (< 1%) but white clover (*Trifolium repens*) is frequent and abundant , with a mean cover of 7.4% and in some stands as high as 25% cover. The undesirable species creeping thistle (*Cirsium arvense*) is occasional only.

With a moderately species-rich sward comprising one abundant, two frequent and two rare BAP Lowland Meadow indicator species, and low cover of undesirable species, this grassland meets the criteria for BAP (G06) Lowland Meadow habitat, condition B. The field is shut up for hay until late July, then hay cut and aftermath grazed with native and rare breeds. In 2011 Welsh Black and Dexter cattle, plus Hebridean sheep would be used to graze. The management and condition of the meadow are good and the sward will probably meet Condition A in a few years.

61, 62, 63 Devon

1 This is one of six small fields on a south-facing slope on heavy clay soils derived from Keuper marl. All had been improved by fertiliser application until 2001, with relics of species-rich grassland persisting in the field margins. The eastern part of the farm has areas of species-rich grassland and mire. No fertiliser other than a triennial application of farmyard manure has been applied since 2001. The fields are cut for hay after mid-July each year, and are grazed by Devon cattle after cutting and in early spring before shutting-up for hay. *Rumex* species and *Senecio jacobaea* are controlled by hand-pulling, and *Cirsium arvense* by occasional pony-grazing.

Approximately 60% of the grassland in this field is now species-rich MG5c (*Centaurea nigra-Cynosurus cristatus* grassland, *Danthonia decumbens* sub-community), with a mean of 20.4 species per m^2 and a cover of broad-leaved species (excluding *Trifolium repens)* of 40%. It is dominated by a mixture of grasses including *Cynosurus cristatus, Anthoxanthum odoratum, Agrostis capillaris, Holcus lanatus, Dactylis glomerata* and *Lolium perenne* with broad-leaved species including *Trifolium pratense, Trifolium repens, Hypochoeris radicata, Rumex acetosa, Ranunculus acris,Cerastium fontanum* and *Lotus corniculatus***.** The UKBAP Lowland Meadow indicator species *Lotus corniculatus* and *Oenanthe pimpinelloides* are frequent, *Centaurea nigra, Leontodon hispidus* and *Potentilla Xmixta* are occasional and *CArex flacca, Lathyrus pratensis* and *Agrimonia eupatorium* are rare. Grassland on the lower slopes is less species-rich with occasional *Rumex crispus* and *Rumex conglomeratus*.

This grassland fulfils the criteria for UKBAP Lowland Meadows. Condition is in category A. Management appears ideal for maintenance and enhancement of ecological interest.

2 This is one of six small fields on a south-facing slope on heavy clay soils. All had been improved by fertiliser application until 2001, with relics of species-rich grassland persisting in field margins. No

fertiliser other than a triennial application of farmyard manure has been applied since 2001. The fields are cut for hay after mid-July each year, and are grazed by Devon cattle after cutting and in early spring before shutting-up for hay. *Rumex* species and *Senecio jacobaea* are controlled by hand-pulling, and *Cirsium arvense* by occasional pony-grazing.

Approximately 40% of the field now has moderately species-rich MG5a (*Centaurea nigra-Cynosurus cristatus* grassland, *Lathyrus pratensis* sub-community). There is a mean of 19.2 species per m^2 and a cover of 45% of broad-leaved species (excluding *Trifolium repens*). The grasses *Cynosurus cristatus, Holcus lanatus, Agrostis capillaris, Lolium perenne, Anthoxanthum odoratum, Alopecurus pratensis* and *Poa trivialis* are dominant with the broad-leaved species *Trifolium pratense, Trifolium repens, Oenanthe pimpinelloides, Ranunculus acris, Plantago lanceolata , Cerastium fontanum, Hypochoeris radicata* and *Rumex acetosa.* The UKBAP Lowland Meadow indicator species *Oenanthe pimpinelloides* and *Centaurea nigra* are frequent, with rare *Leontodon autumnalis* and *Lotus corniculatus*.

This grassland fulfils the criteria for UKBAP Lowland Meadows. The frequency of indicator species is low however, and the cover of *Trifolium repens* is high (9.8%). Condition is therefore in category C. Management appears ideal for maintenance and enhancement of ecological interest.

3 This is one of six small fields on a south-facing slope on heavy clay. All had been improved by fertiliser application until 2001, with relics of species-rich grassland persisting in field margins. No fertiliser other than a triennial application of farmyard manure has been applied since 2001. The fields are cut for hay after mid-July each year, and are grazed by Devon cattle after cutting and in early spring before shutting-up for hay. *Rumex* species and *Senecio jacobaea* are controlled by hand-pulling, and *Cirsium arvense* by occasional pony-grazing.

The lower, southern part of the field now has moderately species-rich MG5a (*Centaurea nigra-Cynosurus cristatus* grassland, *Lathyrus pratensis* sub-community). There is a mean of 16.1 species per m^2 and a cover of 44.5% of broad-leaved species (excluding *Trifolium repens*). The grasses *Agrostis capillaris, Anthoxanthum odoratum, Holcus lanatus, Cynosurus cristatus, Dactylis glomerata* and *Lolium perenne* are dominant with the broad-leaved species *Trifolium pratense, Trifolium repens, Ranunculus acris, Plantago lanceolata , Hypochoeris radicata, Centaurea nigra* and *Rumex acetosa.* The UKBAP Lowland Meadow indicator species *Centaurea nigra* and *Lotus corniculatus* are frequent, with occasional *Leontodon saxatilis* and rare *Oenanthe pimpinelloides, Leucanthemum* vulgare and *Lotus pedunculatus*. The upper part of the field was damaged by Network Rail contractors in 2009 and has less species-rich MG6b (*Lolium perenne-Cynosurus cristatus* grassland, *Anthoxanthum odoratum* sub-community) with frequent *Rumex crispus, R. conglomeratus* and *Urtica dioica*.

This grassland fulfils the criteria for UKBAP Lowland Meadows. The frequency of indicator species is low however, and condition is therefore in category C. Management appears ideal for maintenance and enhancement of ecological interest.

64 & 48 Yorkshire

1 This is a large clearing within the woodland, possibly where formerly quarried. Scrub has been cleared over the past 20 years, and the grassland allowed to regenerate naturally.

The past quarrying has given rise to a mosaic of shorter and more species-rich grassland on the tops of spoil mounds, with taller and less rich grassland in lower-lying areas. The grassland NVC community is MG5a (*Centaurea nigra-Cynosurus cristatus* grassland, *Lathyrus pratensis* sub-community). Overall it is moderately species-rich with a mean of 13.8 species per m^2, although this is very variable, and mean cover of broad-leaved species is 40.8%. The major species are the grasses *Festuca rubra, Dactylis glomerata, Cynosurus cristatus* and *Bromus hordaceus* with the broad-leaved

species *Trifolium repens, Ranunculus acris, Plantago lanceolata, Centaurea nigra* and *Trifolium pratense*. Mean cover of *Trifolium repens* is high, at 14%. UKBAP Lowland Meadow indicator species include frequent *Centaurea nigra* and occasional *Rhinanthus minor*. Other indicator species include *Lotus corniculatus, Conopodium majus* and *Dactylorhiza fuchsii* all of which are rare here.

Although the cover of *Trifolium repens* is high and the frequencies of indicator species are low, this grassland meets the definition of UKBAP Lowland Meadow, although it is in condition category C. Current management appears suitable, and if this is continued then condition and quality should improve.

2 This large clearing is oriented at 90^0 to area 1 (above). A pylon line runs along its length, and this is probably responsible for its long-term survival as open grassland. It has probably been quarried for limestone in the past, and relics of this are present as hollows and spoil heaps. There has been a considerable amount of scrub clearance recently. This has resulted in a mosaic of vegetation types including well-established grassland, successional grassland and regenerating scrub.

The grassland is species-rich with a mean of 20.3 per m^2, and a cover of broad-leaved species of 50.5%. There is however a mean of 8.1% cover of scrub (chiefly *Rubus caesius)* within the grassland. The NVC community is CG5a (*Bromus erectus-Brachypodium pinnatum* grassland, *Hieracium spp* sub-community), dominated by the grasses *Bromus erectus, Festuca rubra* and *Brachypodium pinnatum* with abundant associated species including *Carex flacca, Lotus corniculatus, Trifolium repens, Medicago lupulina, Primula* veris and *Dactylis glomerata*. UKBAP Lowland Calcareous Grassland indicator species include frequent *Carex flacca, Lotus corniculatus, Primula veris,* and occasional *Centaurea nigra, Rhinanthus minor* and *Linum catharticum*. *Pilosella officinarum, Leontodon hispidus, Clinopodium vulgare, Galium verum, Polygala vulgaris* and *Dactylorhiza fuchsii* are rare. The uncommon species *Hypericum montanum* was present.

The regenerating scrub consists largely of *Rubus caesius* with occasional *Crataegus monogyna* and *Fraxinus excelsior*. *Mercurialis perennis* is frequent. There is a stand of dense *Heracleum sphondylium, Cirsium arvense* and *Urtica dioica* at the northern end of the clearing.

The grassland fulfils the criteria for UKBAP Lowland Calcareous Grassland. There is however a considerable amount of regenerating scrub within the grassland, and it is therefore in condition category B. Management appears to be suitable, but continued control of scrub will probably be essential for some years.

66 Shropshire

This field is part of the former historic area of Tibberton Moor, which was drained centuries ago. The underlying soils are apparently quite deep and peaty. Permanent grassland was created (under the previous stewardship agreement) and is now classified as 'restoration' under the current HLS agreement. The grassland was created by strewing green hay harvested from Mottey Meadows National Nature Reserve – a series of species rich floodplain meadows in Staffordshire. The grassland that has been created here is damp but lacks most of the herb species typical of damp grassland; it currently shows greatest affinity with NVC MG1e *Arrhenatherum elatius* grassland, *Centaurea* nigra sub-community, although a poor fit here.

The sward is dominated by a mixture of grass species comprising abundant sweet vernal-grass (*Anthoxanthum odoratum*), red fescue (*Festuca rubra*), Yorkshire fog (*Holcus lanatus*) and cock's-foot (*Dactylis glomerata*). False oat-grass (*Arrhenatherum* elatius), Timothy (*Phleum pratense*) and soft-brome (*Bromus hordeaceus* are frequent whilst other species are rarer, including crested dog's-tail (*Cynosurus cristatus*) and meadow foxtail (*Alopecurus pratensis*) – a frequent species of floodplain grassland. There are some problematic annual grasses, such as areas of sterile brome (*Anisantha sterilis*).

The mean cover of broad-leaved species is high at over 60%, which is higher than the condition assessment criterion of >20% cover for lowland meadow. The sward is moderately species rich with a mean number of species per m^2 of 14.2. UKBAP Lowland Meadow indicator species black knapweed (*Centaurea nigra*)and yellow rattle (*Rhinanthus minor*) are constant and abundant, whilst BAP indicators oxeye daisy (*Leucanthemum vulgare*), autumn hawkbit (*Leontodon autumnalis*) and greater burnet (*Sanguisorba officinalis*) – a typical species of wet meadows – are occasional. Additional species of species-rich semi-improved grassland are also present including ribwort plantain (*Plantago lanceolata)*, meadow buttercup (*Ranunculus acris*), bulbous buttercup (*R. bulbosus*) and red clover (*Trifolium pratense*) – which is locally abundant adding to the herb cover. Other species typical of floodplain grassland, such as meadowsweet (*Filipendula ulmaria*) were e not noted during the survey. Perennial rye-grass is rare within the site, whilst white clover (*Trifolium repens*) was absent from the surveyed area. There is a large area of weedy undesirable species on the east side of the site. Here the annual grass sterile brome plus creeping and spear thistle (*Cirsium arvense, C. vulgare*) plus nettle (*Urtica dioica*) were abundant. Docks (*Rumex* spp.) were noted elsewhere.

With a moderately species-rich sward of, on average, greater than 14 species m^2 including two abundant, one frequent and two occasional indicator species, and low cover of undesirable species, this grassland meets the criteria for BAP (G06) Lowland Meadow habitat, condition A. However, it does not meet the criteria for the flood plain meadows habitat as it lacks the community associates. The whole site is hay cut after mid-July and then aftermath grazed. Eradicating the area of noxious weeds on the eastern side would benefit this grassland, and to improve species diversity it may be worth a trying an additional hay-strew with hay from a more species-rich field within the site (Wall Farm has many restoration fields).

67 & 11 Suffolk

1 This field was set-aside in the 1990s, then entered into the Countryside Stewardship Scheme. It was drilled with a grass-seed mixture, although little of this appears to have survived. The soils are largely freely-draining sand, although the valley that bisects the field has deeper and more water-retentive soil. The valley bottom was not surveyed, and has mesotrophic grassland dominated by *Holcus lanatus* with *Cirsium palustre, Lotus pedunculatus* and *Equisetum palustre*. The whole field is sheep-grazed.

The grassland is a well-established U1c (*Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland, *Erodium cicutarium-Teesdalia nudicaulis* sub-community). It is a short, open, species-rich community with a mean of 18 species per m^2, dominated by *Holcus lanatus, Vulpia bromoides, Agrostis capillaris, Crepis capillaris, Geranium pusillum, Rumex acetosella* and *Brachythecium albicans*. Annuals including *Vulpia bromoides, Crepis capillaris, Geranium pusillum, Filago vulgaris, Filago minima, Ornithopus perpusillus* and *Hypochoeris glabra* are abundant, and bryophytes and lichens are also a prominent part of the community. Lowland Dry Acid Grassland habitat indicator species include frequent or abundant *Rumex acetosella, Erodium cicutarium*, occasional lichens (*Peltigera rufescens*, *Cladonia rangiformis* and *Cladonia pocillum*) and rare *Aphanes inexspectata, Leontodon saxatilis* and *Pilosella officinarum*. Additional indicator species considered here are *Filago vulgaris, Filago minima, Hypochoeris glabra* (all frequent) and *Ornithopus perpusillus* (occasional), all of which are characteristic of the highest quality dry acid grasslands. The undesirable species *Senecio jacobaea, Cirsium arvense* and *Cirsium vulgare* are all locally frequent, but their combined cover is only 1.3%. There are large rabbit warrens on the east-facing slope.

This grassland fulfils the criteria for the UKBAP Dry Acid Grassland habitat. Current management appears ideal for maintenance of the ecological interest.

2 This is a narrow strip in the floodplain of a small river, immediately to the west of the river itself. To the north of this is a further area of floodplain meadow listed as a county wildlife site. The small area of *Glyceria maxima* swamp at the southern end of the field was not surveyed. The whole valley is grazed by cattle.

The vegetation is largely M23a (*Juncus acutiflorus* rush-pasture). Much of this is dominated by *Juncus effuses* and *Juncus acutiflorus*, although there are some patches of shorter vegetation where *Juncus* spp are absent. Other abundant species include *Holcus lanatus, Poa trivialis, Agrostis stolonifera, Ranunculus repens, Lotus pedunculatus, Cirsium palustre, Myosotis scorpioides, mentha aquatica, Filipendula ulmaria* and *Pulicaria dysenterica*. Frequent Purple Moor-Grass and Rush-Pasture indicator species include *mentha aquatica, Filipendula ulmaria, Galium palustre* and *Lotus pedunculatus*, while *Angelica sylvestris* and *Lychnis flos-cuculi* are rare. Other relatively uncommon species include *Carex distans* and *Scirpus sylvaticus*. Small *Alnus glutinosa* trees are present along a ditch in one area, but their area is limited. Some small areas are heavily stock-poached, but the extent of these is limited.

This site fulfils the criteria for UKBAP Purple Moor-grass and Rush-Pasture. It is in condition category A. Current management appears ideal for maintaining ecological interest.

68 & 37 Lancashire

1 This is a complex flush system on a north-facing slope and at the base of the slope. To the north of this is the narrow flood-plain of the River Yarrow, and the slope to the east has drier grassland. The western end of the flush has coppiced *Alnus glutinosa* woodland. There has been a considerable amount of *Salix cinerea* scrub clearance from the eastern and central part of the flush system. The site is grazed by cattle and sheep.

The floodplain has a mosaic of seasonally wet MG10a (*Juncus effusus-Holcus lanatus* rush-pasture, *Juncus effusus* sub-community) with MG5 (*Centaurea nigra-Cynosurus cristatus* grassland). The drier parts of the slope have a relatively species-poor MG6b (*Lolium perenne-Cynosurus cristatus* grassland, *Anthoxanthum odoratum* sub-community). The central part of the flush system has been recently cleared of scrub and has very wet swamp vegetation with *Juncus effusus, Typha latifolia, Oenanthe crocata* and *Iris pseudacorus*. The eastern and western parts of the flush system only were surveyed here.

The western part of the flush system on the slope is relatively dry M23a (*Juncus acutiflorus-Galium palustre* rush pasture). *Holcus lanatus, Agrostis capillaris, Anthoxanthum odoratum, Juncus acutiflorus* and *Juncus conglomeratus* are dominant here in rather species-poor vegetation. The eastern part of the flush system has recently been cleared of scrub, and is much richer. There is more bare soil and water, and no species is dominant. *Rumex acetosa, Poa trivialis, Holcus lanatus, Juncus acutiflorus, Lotus pedunculatus, Equisetum palustre, Stellaria uliginosa, Angelica sylvestris, Cirsium palustre, Galium palustre* and *Mentha aquatica* are abundant. Overall, there is a mean of 16.8 species per m^2, and a cover of 44% broad-leaved species. There is a cover of 6% of non-jointed *Juncus spp*. Two UKBAP Purple-Moor Grass and Rush Pasture indicator species *Lotus pedunculatus* and *Galium palustre* are frequent; three, *Angelica sylvestris, Mentha aquatic* and *Lychnis flos-cuculi* are occasional and three, *Caltha palustris, Dactylorhiza fuchsia* and *Carex flacca* are rare.

This vegetation fulfils the criteria for UKBAP Purple-Moor Grass and Rush Pasture. It is in condition category A. Current management is suitable for maintenance and enhancement of the ecological interest of the site. Recent scrub clearance has been successful in restoration of the flush system vegetation.

2 This former arable field was seeded in 2006. The southern and western part of the field is fenced from grazing animals and shut-up for haylage. The rest of the field is grazed by cattle and sheep. The ungrazed part only was surveyed.

The grassland is uniform and moderately species-rich with a mean of 13.9 species per m^2 but with a cover of broad-leaved species (excluding *Trifolium repens)* of 11.4%. *Trifolium repens* is dominant throughout with a cover of 71.5%. Grasses including *Lolium perenne, Cynosurus cristatus, Anthoxanthum odoratum, Poa trivialis ,Festuca rubra, Phleum bertolonii* and *Holcus lanatus* are abundant. Abundant broad-leaved species include *Centaurea nigra* and *Achillea millefolium*. UKBAP Lowland Meadow indicators include frequent *Centaurea nigra,* occasional *Rhinanthus minor* and *Leucanthemum vulgare* and rare *Lotus corniculatus*. Semi-improved grassland indicators *Trifolium pratense, Trifolium dubium* and *Ranunculus acris* are occasional. The NVC community is MG5a (*Centaurea nigra-Cynosurus cristatus* grassland, *Lathyrus pratensis* subcommunity).

This grassland fails the criteria for the UKBAP Lowland Meadow habitat. *Trifolium repens* cover is greater than 10%, frequency of indicator species is low, and cover of broad-leaved species (other than *Trifolium repens*) is below 30%. It does however pass as good-quality semi-improved grassland, and with suitable management, grassland condition may improve. Current management by hay-cutting and sheep and cattle grazing is ideal.

70 & 73 Cumbria

1 This south-facing field is immediately below the moorland wall at an altitude of approximately 300m. It includes a steep slope in the north with species-rich CG9 (*Sesleria albicans-Galium sterneri* grassland) which could act as a seed source. The adjacent field to the south is part of Orton Meadows SSSI, and has a range of species-rich grasslands and mires.

The NVC community is MG6b (*LOlium perenne-Cynosurus cristatus* grassland, *Anthoxanthum odoratum* sub-community). It is species-rich with 16.2 species per m^2 and a mean cover of broad-leaved species (excluding *Trifolium repens*) of 32.5% Grasses including *Cynosurus cristatus, Anthoxanthum odoratum, Agrostis capillaris, Holcus lanatus* and *Lolium perenne* and *Trifolium repens* are dominant. *Trifolium repens* has a cover of 26%. Other abundant broad-leaved species include *Ranunculus acris, Plantago lanceolata, Rhinanthus minor, Euphrasia arctica, Cerastium fontanum, Bellis perennis* and *Rumex acetosa*. UKBAP Upland Meadow indicator species include frequent *Rhinanthus* minor and *Euphrasia arctica*, *Centaurea nigra* and *Leucanthemum vulgare* are rare. Semi-improved grassland indicator species include *Plantago lanceolata, Rumex acetosa, Trifolium pratense, Achillea millefolium, Hypochoeris radicata* and *Luzula campestris*.

This site fails the criteria for UKBAP Upland Meadows. The cover of *Trifolium repens* is over 10% and the frequency of indicator species is low. It however passes as good-quality semi-improved grassland. The adjacent species-rich calcareous grassland may act as a seed source for further colonisation, and it is likely that given continued suitable management, condition will improve.

2 This field is on level ground below Orton Scar and immediately to the south of part of an SSSI. A stream runs along the east of the field, and beside this there are relics of species-rich MG3 (*Anthoxanthum odoratum-Geranium sylvaticum* grassland) and M26 (*Molinia caerulea-Crepis paludosa* mire) including *Caltha palustris, Geum rivale, Sanguisorba officinale, Dactylorhiza purpurella, Geranium sanguineum, CArex disticha, Crepis paludosa, Gymnadenia conopsea* and *Trifolium medium*. This may act as a seed source for further colonisation.

The grassland has been seeded relatively recently. It is species-rich with a mean of 16.5 species per m^2 and mean cover of broad-leaved species is 51.5%. The NVC community is MG6b (*LOlium perenne-Cynosurus cristatus* grassland, *Anthoxanthum odoratum* sub-community), although there are affininties with MG3 (*Anthoxanthum odoratum-Geranium sylvaticum* grassland). Dominant

species include the grasses *Anthoxanthum odoratum, Lolium perenne, Agrostis capillaris, Alopecurus pratensis, Holcus lanatus* and *Poa trivialis*, and the broad-leaved species *Rumex acetosa, Ranunculus acris, Rhinanthus minor, Cerastium fontanum* and *Plantago lanceolata*. UKBAP Upland Meadow indicator species include frequent *Rhinanthus minor* and *Euphrasia arctica,* and occasional *Alchemilla sp* and *Conopodium majus*. *Sanguisorba officinalis, Leucanthemum vulgare, Leontodon autumnalis* and *Leontodon hispidus* are rare.

This site fulfils the criteria for UKBAP Upland Meadows. It is in condition category A although the frequency of indicator species is low and it is in the early stages of restoration. It is likely that condition will improve under continued suitable management by hay-cutting with aftermath grazing.

71 Shropshire

The field surveyed forms part of the larger area of Pen-yr-Estyn Moss, a 43-ha site, formerly under grazing and arable cultivation. This field was previously drained via a network of drains and pumps installed in the 1970s. A project has been underway, with assistance of Shropshire Wildlife Trust, to restore the area to wetland through grants under the Countryside Stewardship Scheme, and now Higher Level Stewardship. The field surveyed was formerly arable. The pumps draining this field were turned off approximately 10 years ago, and natural regeneration allowed to occur. A few years ago a series of pools and scrapes were created. The field is generally cut after mid-July, then aftermath grazed with sheep, although this winter all the rushes were cut whilst the ground was frozen solid. The current plant community is intermediate between the more species poor, unproductive agricultural grassland type NVC MG10a *Holcus lanatus–Juncus effusus* rush pasture, typical sub-community and the more diverse M23b *Juncus effusus–Galium palustre* rush-pasture. The ponds are establishing well with many aquatic, emergent and marginal species associated with them.

The community dominants are soft rush (*Juncus effusus*), the grasses creeping bent (*Agrostis stolonifera*) and Yorkshire fog (*Holcus lanatus*) with the herb creeping buttercup (*Ranunculus repens*).Other frequent species include bulbous rush (*Juncus bulbosus*), marsh foxtail (*Alopecurus geniculatus*), white clover (*Trifolium repens*) and common mouse-ear (*Cerastium fontanum*). The mean cover of broad-leaved species is 11.5%, with a mean number of species per m^2 of 10.6. UKBAP priority habitat (G07) Purple moor-grass and rush pastures indicator species greater bird's-foot-trefoil (*Lotus pedunculatus*) is occasional whilst marsh bedstraw (*Galium palustre*) and lesser spearwort (*Ranunculus flammula*) are rare components of the sward. Additional species typical of wet grassland are also present including bog stitchwort (*Stellaria uliginosa*), oval and hairy sedges (*Carex* ovalis, *C. hirta*) and trifid bur-marigold. There is also a large stand of blunt-flowered rush (*Juncus* s*ubnodulosus)*, rare in Shropshire, in this field. Cover of non-jointed rushes such as soft rush, the community dominant here, is less than 20% on average (under the 50% level required for BAP quality habitat).Bare ground is occasional and is mostly associated with the scrapes and ponds. Scrub is generally absent. Weedy species such as marsh thistles (*Cirsium palustre*) are rare within the stand.

The land owner counted 28 lapwings (14 pairs) and 4 curlews (2 pairs) within the site during a count in 2011 – whether they are nesting in this field or the adjacent wetland fields is not clear but breeding waders are certainly using the site.

With only one occasional and two rare indicator species for BAP habitat Purple moor-grass and rush pastures, the rush-pasture in this field does not qualify as a this habitat. However, the field does support wet (G02) semi-improved grassland with good potential for further restoration to BAP priority habitat. The ponds qualify as BAP habitat (W07) Ponds as they are set within a semi-natural habitat, are within 500m of other ponds (as there is a series of them), are unpolluted, support only desirable native aquatics and emergents, are not stocked with fish and have naturally fluctuating

water levels. Most importantly the fields are thought to either qualify as habitat for breeding waders or be well on the way – the cover of tussocky grasses is perhaps a little low but the fields are generally wet and waders are using the site.

72 Shropshire

The field surveyed was arable until the early 1990s, then was a ley until approximately 5 years ago when restoration started. Hay was strewn on top of the existing perennial ley using green hay cut from an unimproved meadow located nearby on the same farm estate. There has been some success but the owner is disappointed with the result and is to repeat the exercise next year – other fields on the farm (not ex-arable) that have had the same treatment have been a greater success. The original hay meadow from which the hay was cut supports a healthy population of meadow saffron (*Colchicum autumnale*). The plant community that has established shows greatest affinity with NVC MG6b Lolium perenne– *Cynosurus cristatus* grassland, *Anthoxanthum odoratum* sub-community. The field was last shut up for hay four years ago, since then it has been used to fodder ewes on it with species rich hay. In 2012 the plan is to strew green hay and leave it on, with no grazing.

The plant community is dominated by grasses; Yorkshire fog (*Holcus lanatus*), sweet vernal-grass (*Anthoxanthum odoratum* and common bent (*Agrostis capillaris*) are constant within the sward whilst crested dog's-tail (*Cynosurus cristatus*) and perennial rye-grass (*Lolium perenne*) are frequently encountered across the field. Other species are rare or localized only. The mean cover of broad-leaved species is quite low, in the range of 2–40% cover across the field, with a mean of 14.5%; this is lower than the condition assessment criterion of >20% cover for UKBAP Lowland Meadow habitat. The sward is supports a mean number of species per m^2 of 11.2. Only one UKBAP Lowland Meadow indicator species, common bird's-foot-trefoil (*Lotus corniculatus*), was recorded in the field, but this species was frequent in the sward. Several species indicative of species-rich semi-improved grassland are also present however, including red clover (*Trifolium pratense*) (which is abundant), meadow buttercup (*Ranunculus acris*) and common sorrel (*Rumex acetosa*) (which are frequent), plus occasional common cat's-ear (*Hypochaeris radicata*) and field wood-rush (*Luzula campestris*).

Perennial rye-grass is present but not constant; it ranges from 2–30% cover where it does occur. White clover (*Trifolium repens*) is also only present in some areas and again can achieve cover from 1–30%. Overall these species, which are indicative of more improved conditions, when considered together attain an average cover of much less than 30% across the field. Undesirable species were largely absent from the random stops but were present in localized, disturbed areas and on the perimeters of the field – particularly along the upper (northern) boundary (thistles, *Cirsium* spp. and nettle, *Urtica dioica*) and along the southern boundary bordering the stream (bracken, *Pteridium aquilinum*).

The sward meets the criteria for semi-improved grassland, which points to potential for further restoration to Lowland Meadow. This may be achieved by further inoculation with green hay from unimproved areas on the farm (as is the current plan), and by altering the management of the field from a pasture to a traditional hay-meadow. This may enable establishment and proliferation of a greater diversity and cover of desirable herb species.

Heathlands

74 Berkshire

This is a large hill-fort to the south of Bracknell. The site had been planted with conifers which were cleared in 1998, although coniferous plantation remains in the area surrounding the hill-fort. The whole area inside the hill-fort is now lowland heath.

Calluna vulgaris is dominant in a species-poor heathland community. The only frequent associates include *Deschampsia flexuosa, Hypnum cupressiforme, Dicranum scoparium* and locally *Pteridium aquilinum*. Other dwarf shrubs including *Erica* cinerea and *Vaccinium myrtillus* are occasional and Ulex *minor* is rare. The NVC community is H2a. The site has breeding nightjar, woodlark and Dartford warbler.

The heathland is divided into three areas for management purposes. The south-western third (approximately 50% of the area) is scrub-free, the north-western third has a 15% cover of 2-3m tall *Betula pendula* and *Pinus sylvestris* scrub, while the south-eastern third has aprroximately 10% cover of 1-2m tall scrub. There are patches of *Pteridium aquilinum*. Swathes have been cut through the heath in the south-west, and these areas are dominated by short, pioneer heather. The rides that cross the site were not recorded, but have much more species-rich vegetation.

This heathland is in condition category A. The current programme of scrub management appears effective at minimising scrub cover, and the cutting of swathes ensures a varied age structure.

75 & 76 Surrey

This common is situated to the west of Epsom on London Clay. It was formerly common grazing land, but since grazing ceased in the 1940s, it has become largely covered by *Betula pubescens* and *Quercus robur* scrub. Some small clearings remained within the scrub, and these are being enlarged by scrub clearance and subsequent grazing by Galloway cattle. Deer are abundant also.

1 This clearing was enlarged from 2000 onwards around a small patch of *Calluna vulgaris* that was discovered in 1990. The vegetation now consists of patchily dominant *Calluna* in a matrix of moderately species-rich grassland dominated by *Agrostis capillaris, Agrostis vinealis, Potentilla erecta* and *Anthoxanthum odoratum*. *Molinia caerulea* is locally frequent, and this vegetation is probably related to the wet heath community M25b (*Molinia caerulea-Potentilla erecta* mire, *Anthoxanthum odoratum* sub-community). Woody species are regenerating in places, chiefly *Betula pubescens* but also *Populus tremula* and *Ulex europaeus*.

The mean cover of *Calluna vulgaris* is 21.5%, below the threshold level for favourable condition of Lowland Heath, and most of this heather is mature, with only small patches of pioneer shrubs. Cover of scrub is 19.1%, greater than the acceptable upper limit. This stand of Lowland Heath is in condition category C.

2 This clearing has been gradually enlarged since the early 1990s. Scrub has been removed by volunteers, and topsoil has been removed in three small areas. Grazing by cattle was introduced in 2009. *Calluna vulgaris* is patchily dominant throughout the clearing in a matrix of grassland dominated by *Agrostis capillaris* and *Agrostis vinealis*. *Molinia caerulea* and *Juncus effusus* are frequent and there is limited regeneration of scrub. The vegetation is related to the wet heath community M25b (*Molinia caerulea-Potentilla erecta* mire, *Anthoxanthum odoratum* sub-community).

The mean cover of *Calluna vulgaris* is 20%, below the threshold level for favourable condition of Lowland Heath. The age structure is more varied than that in parcel 1 however, and cover of scrub is less than 4%. Condition is in category B.

77 Surrey

Large areas of this common are covered with planted *Pinus sylvestris* woodland. A programme of clearing this woodland and restoring the heathland was started in 2006. There are now several large clearings, created each winter since 2006. The surveyed area was cleared in 2006-7, although the slope to the north has older heather and may have been clear for a longer period.

Calluna vulgaris is dominant, forming a dense, species-poor heathland cover. The only frequent associated species are *Dicranella varia* and *Dicranum scoparium*. The only other dwarf shrub is *Erica cinerea* which is rare. There is local regeneration of *Betula pendula* and *Pinus sylvestris*, and a few large *Pinus sylvestris* have been left. The NVC community is H2a (*Calluna vulgaris-Ulex minor* heath, typical sub-community).

This heathland is in condition category B. Mean cover of *Calluna vulgaris* is 64.5%, but in this young stand, the age structure is not diverse with very little mature heather. Cover of scrub is patchy, but is only 3.5% overall, and there is 4.5% cover of *Pteridium aquilinum*.

78 & 79 Surrey

This is a large area of former heathland, afforested with conifers in the mid-20th century. The whole area belongs to the RSPB and is being restored to open heathland by the gradual clearance of trees.

1 This compartment was cleared of trees in 2004-5, with brash burnt on the site and stumps removed. *BEtula pendula* and *Pinus sylvestris* scrub developed subsequently, and this was cleared in 2010. *Calluna vulgaris* was dominant , forming a dense cover. The heathland is species-poor with frequent *Deschampsia flexuosa* and bryophytes including *PSeudoscleropodium purum, Dicranum scoparium, Hypnum cupressiforme* and *Pleurozium schreberi*. *Ulex minor* and *Erica cinerea* are rare. The NVC community is H2a (*Calluna vulgaris-Ulex minor* heath, typical sub-community).

This lowland heathland is in condition category B. Cover of *Calluna* is 71%, but the age structure is not diverse, with very little pioneer or mature heather. There is less than 1% of scrub, chiefly *Betula pendula* and *Pinus sylvestris*.

2 This compartment was cleared of trees in 2005-6, and the brash was baled and removed from the site and stumps left in situ. Deep furrows run across the site. *Calluna vulgaris* was dominant, but there was also much unvegetated soil. There were few associated species, the most abundant being *Deschampsia flexuosa, Pseudoscleropodium purum, Dicranum scoparium, Dicranella varia* and *Pleurozium schreberi*. Tree saplings, chiefly *Pinus sylvestris* and *Betula pendula* were also frequent. The NVC community is H2a (*Calluna vulgaris-Ulex minor* heath, typical sub-community).

This compartment is in condition category B. While the cover of *Calluna vulgaris* is more than 40%, the age structure is not diverse with no mature shrubs. Scrub is present, but at 6.6% cover it is below the limit of 15% for this habitat.

80 Staffordshire

This is a privately owned area of conifer plantation lying between two parts of a woodland SSSI. The conifer has been clear-felled in many areas and a heathland flora has regenerated naturally. An area of open heathland that has regenerated in compartment 2545 was surveyed – part of this 4.4 ha compartment still supports mature conifer and a further area has been planted with broadleaves. A pond has been created. Only the open heathland was surveyed. The young heathland that has naturally regenerated on this site has affinities with NVC H8e *Calluna vulgaris–Ulex gallii* heath, *Vaccinium myrtillus* sub-community, although the sub-community constants vary in this rather atypical stand.

The heathland is dominated (60% cover) by heather (*Calluna vulgaris*), with much lower occurrence of the dwarf shrubs western gorse (*Ulex gallii*) and bilberry (*Vaccinium myrtillus*), which are occasional to locally frequent (a further 5% cover). These latter dwarf shrubs can be more abundant in this community type but the recent plantation history has a bearing on the rate of establishment and the typicalness of the stand. The heather is mostly in the building phase (57% cover of 6–15 yrs old) although there is a small amount of pioneer heather 3–4% of age 1-5 yrs). The grasses purple moor-grass (*Molinia caerulea*) and wavy hair-grass (*Deschampsia flexuosa*) are frequent, whilst common bent (*Agrostis capillaris*), velvet bent (*A. canina*) and Yorkshire fog (*Holcus lanatus*) occur at much lower frequency and cover – the community has quite a grassy appearance. Bryophytes are an important part of the ground layer with abundant *Hypnum jutlandicum* and frequent *Campylopus introflexus.* Herbs are rare with a little heath bedstraw (*Galium saxatile*), tormentil (*Potentilla erecta*) – both heathland species – and foxglove (*Digitalis purpurea*) and rosebay willowherb (*Chamerion angustifolium*), both typical species of woodland clearance. The slightly damp nature of the habitat is marked by occasional rushes; heath rush (*Juncus squarrosus*), soft rush (*Juncus effusus*) and bulbous rush (*Juncus bulbosus*). Scrub is quite a frequent feature of the community with frequent bramble (*Rubus fruticosus*) and tree seedlings and saplings also occasional to locally frequent such as young downy birch (*Betula pubescens*), pedunculate oak (*Quercus robur*) and willow (*Salix* spp.). Bracken (*Pteridium aquilinum*) is occasional to locally abundant, particularly in the north-western part of the site. Scrub (tree saplings and bramble) covers on average, greater than 5% of the habitat. Bare ground is also high at up to 30% (mean 7.9%).

The habitat meets the criteria for BAP priority habitat Lowland Heath, condition category B (failing to reach condition A because of the lack of a range of age classes of heather present due to the recent history of the restoration). However, as the site is adjacent to a SSSI with Lepidoptera interest (the Argent and Sable moths, both UK BAP priority species, occur in Burnt Wood SSSI) the aim of the CSS restoration was to create open, heathy woodland with pioneer birch. This is being achieved, although the tree canopy cover is not yet the requisite 20–30% outlined in the management plan supplied by Natural England.

This site is a successful example of heathland restoration.

81 Shropshire

This is a 136 ha area of the southern end of the Long Mynd – a high heathland plateau. The survey area is an area of ex-forestry land that previously supported a conifer crop. The crop was felled by the Forestry Commission and the site entered into an ESA agreement. The agreement started in 2004. Natural regeneration of the existing relict heathland was allowed and the area has had no subsequent management. Sheep have access to the area as they graze the entire plateau but they rarely graze the heathland areas, favouring the grassier communities. The heathland that has regenerated on this site has affinities with H9b *Calluna vulgaris–Deschampsia flexuosa* heath, *Vaccinium myrtillus–Cladonia* spp. sub-community.

The heathland is overwhelmingly dominated by heather (*Calluna vulgaris*), which forms a tall, almost uninterrupted stand 0.5–0.8 m high, cover 50–100% (mean 83%). This heather is predominantly in the building phase (6–15 years) and is even aged due to the single felling event that promoted the establishment of the heather; mature/degenerate phase heather (>15 years) is therefore lacking, and the paucity of gaps in the stand has also resulted in very low occurrence of pioneer (>6 years old) heather. The only other constants in the community beneath the canopy of the heather are wavy hair-grass (*Deschampsia flexuosa*), bryophytes (mostly *Hypnum* spp. but also *Pleurozium schreberi, Hylocomium splendens, Polytrichum commune* amongst others) and lichens (*Cladonia* spp.). There are a few areas, on the margins and in breaks in the heather canopy in which bilberry (*Vaccinium myrtillus*) has established. Bilberry is abundant beyond this stand in the heathy grassland

between this heather stand and the winch and runway. There are a few further areas where there are pockets of acid grassland. The grassy areas are probably associated with thinner soils overlying rock outcrops; these support common bent (*Agrostis capillaris*), wavy hair-grass, sheep fescue (*Festuca ovina*), crested dog's-tail (*Cynosurus cristatus*), heath bedstraw (*Galium saxatile*) and sedges (*Carex pilulifera*, *C. binervis*) and some young pioneer heather.

Of most interest in the heath community was the presence of stag's-horn clubmoss (*Lycopodium clavatum*; see images below). This species is rare in Shropshire. It was most frequent to the south of the track that runs into the forestry (at approximately SO40479049), although it was noted elsewhere in openings in the heather. Its persistence here will be dependent on correct management; it is usually lost due to overgrazing, undergrazing, heather burning, conversion to scrub and agricultural improvement. Here it is threatened by competition and shade cast by the very dense heather canopy. There are no undesirable species within the heathland stand, or scrub invasion and bare ground is minimal.

The heath here meets the criteria for BAP priority habitat Upland Heath, condition B. It does not qualify as condition A, the highest condition category, because the heather is even aged and lacks sufficient (10% or more) pioneer heather (under 6 years in age) or sufficient mature/degenerate heather (over 15 years) – although this latter is missing due to the relatively young age of the heathland restoration.

The heath requires management to prevent the stand from remaining even-aged and eventually all degenerating at the same time.

82 Shropshire

Shropshire Wildlife Trust own and manage this heathland – part of the Stiperstones Ridge. Coniferization in the 1960s affected much of this site and a recent programme of clearance to restore the heathland habitat has been underway. An extensive area of conifer was cleared in 2001; this area is already well-established heath. A further area of sitka spruce was clear-felled along the south-east facing slopes by the Wildlife Trust in 2006 when they acquired the land; this is the area surveyed (unit 7368). The young heathland that has naturally regenerated on this site has affinities with NVC H12c *Calluna vulgaris*–*Vaccinium myrtillus* heath, *Galium saxatile* sub-community. This is a widely distributed sub-montane heathland type, on more free-draining soils. The community is also similar to the floristically-similar U2 *Deschampsia flexuosa* grassland, which frequently results from forest clearance. The community is probably transitional from U2 to H12c but is most likely to settle as H12 *Calluna vulgaris*–*Vaccinium myrtillus* heath.

The young heathland is atypical due to its recent history as plantation. Currently the grasses wavy hair-grass (*Deschampsia flexuosa*) and common bent (*Agrostis capillaris*) dominate with heath bedstraw (*Galium saxatile*) – an indicator of unimproved acid grassland and heath. Heather (*Calluna vulgaris*) is frequent, occurring in 7 of the 10 random stops at covers of 2–60% (mean cover 12.5%). Other dwarf shrubs are present; bilberry (*Vaccinium myrtillus*) is occasional to locally frequent and western gorse (*Ulex gallii*) is rare. Bilberry is abundant in the established heath on the plateau and slopes above this area and will no doubt increase in frequency over time. Bramble (*Rubus fruticosus*) is frequent – which is undesirable. Broom (*Cytisus scoparius*) is also present. Herb species, apart from heath bedstraw, are rare with occasional areas with tormentil (*Potentilla erecta*), sheep sorrel (*Rumex acetosella*) and foxglove (*Digitalis purpurea*). Other grasses, green-ribbed sedge (*Carex binervis*), bryophytes (e.g. *Dicranella heteromalla, Hypnum jutlandicum, Polytrichum formosum*) and occasional seedlings and saplings formed the bulk of the rest of the vegetation. Saplings were quite abundant in some areas such as along the top edge of this compartment, with rowan (*Sorbus aucuparia*), hawthorn (*Crataegus monogyna*), silver birch (*Betula pendula*), sycamore (*Acer pseudoplatanus*) and young spruce regeneration (*Picea sitchensis*). These will need to be controlled.

Bracken (*Pteridium aquilinum*) is occasional only but scrub cover is still a little high (0–50%, mean 11.6%). Bramble could become problematic.

Due to the less than 25% cover of dwarf shrubs the heathland restoration areas currently falls under the category of Fragmented Heath (M02) – a relict upland heath type found in moorland grazing units in mosaic with acid grassland. However, this is seen as a transitional phase and there is every confidence that the heath will meet the criteria for UKBAP priority habitat Upland Heath within a few years once the cover of dwarf shrubs is higher. This heathland restoration project is proceeding well. The heather and bilberry are establishing at an acceptable rate for the 5-year period following clearance. The site is to be sheep grazed using the flock of Hebridean sheep and this should help to control some of the scrub and bramble but taller, and larger areas of existing scrub should be controlled by hand. Potential overgrazing of the dwarf shrub cover should be monitored.