Definition of Favourable Conservation Status for Lowland Dry Acid Grassland

Defining Favourable Conservation Status Project

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About the DFCS project

Natural England's Defining Favourable Conservation Status (DFCS) project is defining the minimum threshold at which habitats and species in England can be considered to be thriving. Our FCS definitions are based on ecological evidence and the expertise of specialists.

We are doing this so we can say what good looks like and to set our aspiration for species and habitats in England, which will inform decision making and actions to achieve and sustain thriving wildlife.

We are publishing FCS definitions so that you, our partners and decision-makers can do your bit for nature, better.

As we publish more of our work, the format of our definitions may evolve, however the content will remain largely the same.

This definition has been prepared using current data and evidence. It represents Natural England's view of FCS based on the best available information at the time of production.

Introduction

This document sets out Natural England's view on Favourable Conservation Status (FCS) for **lowland dry acid grassland** in England. FCS is defined in terms of three parameters: natural range and distribution, area, and structure and function attributes.

Section 2 provides the summary definition of FCS in England. Section 3 covers contextual information, section 4 the metrics used and section 5 describes the evidence considered when defining FCS for each of the three parameters. Section 6 sets out the conclusions on favourable values for each of the three parameters. Annex 1 lists the references.

This document does not include any action planning, or describe actions, to achieve or maintain FCS. These will be presented separately, for example within strategy documents.

The guidance document *Defining Favourable Conservation Status in England* describes the Natural England approach to defining FCS.

2. FCS in England

Lowland dry acid grassland is a widespread but localised habitat of high biodiversity value occurring throughout the English lowlands and along the upland fringe wherever there are suitable acidic soils. It is normally maintained through grazing by livestock. The extent of this type of grassland has declined significantly over the last 100 years although its overall range has remained stable. Its vulnerability to climate change has been assessed as low and, like other semi-natural grasslands, it provides important ecosystem services.

The habitat will achieve FCS when the structural and functional attributes set out in section 6.3 are met over 95% of the favourable area. This includes attributes relating to floristic composition, sward structure, soil nutrient and pH status, grazing management and parcel size and connectivity. In particular, to achieve FCS the vegetation should be broadly typical of the relevant plant communities and their species composition. There should be some bare ground and variation in sward height including scattered scrub of various age classes. The soils should have properties typical of the habitat notably low soil P and a pH in the range 4 - 5.5. The habitat should be grazed by livestock usually at a density of 0.3–0.75 LU/ha /ha/year depending on site productivity and conservation objectives. There should be at least some contiguous or connected areas of suitable semi-natural habitat.

Favourable status will require an increase in the current extent of the habitat by approximately 49, 000 ha (c. 245 % above baseline of c. 20, 000 ha) throughout its range and maintenance of its current range and distribution

FCS parameter	**Favourable status**	**Confidence in the parameter**
Range and distribution	Maintenance of the current range – a maximum of 357 10 km grid squares. It is widely but discontinuously distributed in England with concentrations in East Anglia, southern and south west England, the West Midlands and northern England. Potentially, the whole of England is able to support the habitat where suitable acidic geology or drift deposits and edaphic conditions exist.	High

Area	69,000 ha	Moderate	
Structure and function	At least 95% of the favourable area of the habitat should meet the structure and function requirements.	Low	

Habitat definition and ecosystem context

3.1 Habitat definition

The definition of this habitat embraces the enclosed and unenclosed acid grasslands found throughout England's lowlands and normally below c300 m. The habitat often occurs as an integral part of lowland heathland landscapes, in parklands and locally on coastal cliffs and shingle. It is usually managed by extensive sheep or cattle grazing or is more rarely maintained by rabbit grazing. Unenclosed swards in the uplands above the moor wall and managed as free-range rough grazing in association with unenclosed tracts of other upland habitats, such as dwarf-shrub heath, are not covered by this definition and fall within the upland acid grassland habitat.

Lowland dry acid grassland typically occurs on nutrient-poor, generally free-draining soils, with pH ranging from 4 to 5.5, overlying acid rocks (e.g. sandstones and igneous rocks) or superficial deposits such as sands and gravels. It may also occur over more base-rich substrates in regions with higher rainfall which promotes the leaching of base cations and reduces the pH. The habitat includes the *Festuca ovina-Agrostis capillaris-Rumex acetosella* (U1), *Deschampsia flexuosa* (U2),*Agrostis curtisii* (U3), and *Festuca ovina-Agrostis capillaris-Galium saxatile* (U4) National Vegetation Classification (NVC) grassland plant communities. It also includes inland sand dune vegetation, but not coastal sand dunes, characterised by *Carex arenaria* (*Carex arenaria* dune *Festuca ovina* sub-community (SD10b) and *Carex arenaria-Cornicularia aculeata* dune, *Festuca ovina* sub-community (SD11b)), but these are highly localised.

The plant species-richness ranges considerably between types and localities but can range from rather species-poor (5 species/4m^2) to species-rich (25 species/4m^2 or more) when under favourable management. Plant species with a close association to lowland dry acid grassland in totality include *Festuca ovina*, *Agrostis capillaris*, *Galium saxatile*, *Potentilla erecta* and *Calluna vulgaris* (the latter not at high cover).

In practice, U2 *Deschampsia flexuosa* grassland is now not considered to be a high value type (see Robertson & Jefferson 2000, Jefferson and others 2014), the accepted view being that it is degraded heathland or in some cases degraded acid grassland of another type such as U1. The focus should generally be the restoration of whichever habitat it has replaced.
Only one small element of lowland dry acid grassland as defined in the UK BAP (UK Biodiversity Group 1998) is included by the UK within Natura 2000 and that falls within just a single Annex I habitat, *Inland dunes with open Corynephorus and Agrostis grasslands*. This comprises two NVC dune communities, namely SD11 *Carex arenaria-Cornicularia aculeata* dune community and the SD12 *Carex arenaria-Festuca ovina-Agrostis capillaris* grassland, where the vegetation includes stands *of Corynephorus canescens* occurring inland.

The component types of Lowland Dry Acid Grassland conform to three EUNIS habitats as follows**:**

- **E1.7** Lowland to submontane dry to mesic *Nardus* grassland (U3, U4)
- **E1.9a** Oceanic to subcontinental inland sand grassland on dry acid and neutral soils (U1)
- **E1.9b** Inland sand drift and dune with siliceous grassland (SD10, SD11)

Table 1 describes the relationship between the Priority habitat and the Annex 1 type.

Table 1: Relationship between the Priority habitat, the Annex 1 type and National Vegetation Classification (NVC) types

National Vegetation Classification type	**Lowland dry acid grassland S41 priority habitat**	**Annex 1 habitat *Corynephorus* & *Agrostis* grasslands (EU code H2330)**	**Comments**
U1 *Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland	√		
U2 *Deschampsia flexuosa* grassland	√		A degraded type of low conservation value but a focus for restoration (see text).
U3 *Agrostis curtisii* grassland	√		
U4 *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland	√		
SD10b *Carex arenaria* dune *Festuca ovina* sub-community	√		
SD11 *Carex arenaria-Cornicularia aculeata* dune, *Festuca ovina* sub-community	√	√	Only stands with *Corynephorus canescens* fall within H2330.
SD12 *Carex arenaria-Festuca ovina-Agrostis capillaris* grassland	√+	√	Only stands with *Corynephorus canescens* fall within H2330.

+ As SD12 forms part of the Annex 1 habitat, for the purposes of this definition, it is included as part of the lowland dry acid grassland habitat although it is not currently part of the Priority Habitat definition.

Sources: *Jackson & McLeod 2002; Jefferson and others 2014; Robertson & Jefferson 2000; Rodwell (1992, 2000); Rodwell and others 2007; UK Biodiversity Action Plan; Priority Habitat Descriptions. BRIG (ed. Ant Maddock) 2008.*

3.2 Habitat status

Lowland dry acid grassland is a S41 Priority Habitat in England reflecting its high conservation value.

In the European Red List of Habitats (Janssen and others 2016) habitats classified as the equivalent to the lowland dry acid grassland (EUNIS types E1.7, E1.9a & E1.9b) were assessed as either **Vulnerable** (E1.7) or **Endangered** (E1.9a and E1.9b) primarily due to declines suffered over the last 50 years. Specifically, **Vulnerable** = ≥ 30% but < 50% decline over the last 50 years; a likely future decline ≥ 30% but < 50% and historic losses since c. 1750 of ≥ 50% but < 70% and **Endangered** = ≥ 50% but < 80% decline over the last 50 years; a likely future decline ≥ 50% but < 80% and historic losses since c. 1750 of ≥ 70% but < 90%.

3.3 Ecosystem context

The distribution of the various types of lowland acid grassland relates closely to the distribution of suitable acid rocks or superficial deposits such as sands and gravels and soils that are typically infertile with pH less than 5.5 and they may range from being summer-parched to moist in character. The distribution of individual species and community composition is also greatly influenced by climate and microclimatic factors. Lowland acid grassland may also develop in places which would not have originally supported the habitat, such as in old quarries and pits and on substrates such as acid mine waste spoil heaps.

Acid grasslands typically form mosaics with scrub and woodland communities (such as NVC types W10 *Quercus rober-Pteridium aquilinum-Rubus fruticosus* woodland, W15 *Fagus sylvatica-Deschampsia flexuosa* woodland, W16 *Quercus spp.-Betula spp.-Deschampsia flexuosa* woodland, W23 *Ulex europaeus-Rubus fruticosus* scrub and W25 *Pteridium aquilinum-Rubus fruticosus* underscrub) and stands of bracken (U20 *Pteridium aquilinum-Galium saxatile* community). These mosaics relate to factors such as topography, exposure, soil depth and past management, with current grazing management maintaining them. In addition, mosaics and transitions to lowland heathland (e.g. NVC types H1 *Calluna vulgaris-Festuca ovina* heath, H2 *Calluna vulgaris-Ulex minor* heath, H3 *Calluna vulgaris-Agrostis curtisii* heath and H9 *Calluna vulgaris-Deschampsia flexuosa* heath) probably relate to edaphic and management factors.

Where acid sands patchily overlie calcareous rocks (as in Breckland), then complex mosaics of acid and calcareous grassland may occur, and sometimes both occur together with mosaics of *Calluna*-dominated heathland. Mosaics and transitions may also be formed with neutral grasslands, mediated by soil type but also by the input of agro-chemicals. In general terms, mosaics involving other habitats are more highly valued in conservation assessments (e.g. Jefferson and others 2014) and provide an important resource for species (especially invertebrates) that may require a range of habitats or habitat patches to complete their life cycle (Webb and others 2009).

At a smaller scale, acid grasslands may support microhabitats such as short or long turf, grass tussocks, patches of friable sandy bare ground, rock outcrops, and scrub of different age classes. Ephemeral ponds in acid grasslands and mosaics of acid grassland and heathland can also harbour threatened or scarce species, including bryophytes and invertebrates.

As with other types of semi-natural grassland (Bullock and others 2011), lowland dry acid grassland can provide ecosystem services including nutrient capture, carbon storage, pollination, pest control, cultural benefits to society and genetic resources.

There may sometimes be a co-occurrence of grassland biodiversity and geological and geomorphological interest. Important examples are the periglacial features of Breckland These include patterned ground – the often symmetrical natural pattern of geometric shapes (stripes, circles, polygons) formed by surface material and pingos which are small ponds often with a rampart of upheaved soil around the perimeter, caused by ice lens formation.

Sources: *Bullock and others 2011; Dolman and others 2010; Rodwell 1991a & b, 1992, 2000; Sanderson 1998; Webb and others 2017; Webb & Drewitt 2009.*

Metrics and attributes

4.1 Natural range and distribution

10 km grid square

This is the appropriate metric given the relatively wide distribution of the habitat across England.

4.2 Area

Hectare

4.3 Structural and functional attributes

Lack of or reduced livestock grazing and conversely over grazing are a threat to the structure of this habitat type. The presence of a moderate number of sheep, cattle or hardy ponies promotes the development of and maintains the habitat and it component biodiversity by reducing the number of competitive, robust species and allowing other small pioneer plants to thrive. Many sites supporting the more parched open types of acid grassland benefit from rabbit grazing (e.g. Breckland) combined with other forms of physical disturbance for maintaining the necessary open conditions, bare ground and short swards.

Structural attributes

- Vegetation communities and species composition
- Pattern of vegetation zonation/transitions
- Cover of undesirable species
- The presence of some bare ground for regeneration niches and supporting habitat for specialist invertebrates and vascular plants, especially in relation to types of parched acid grassland
- Vegetation heterogeneity and suitable ‘floweriness’ (nectar/pollen resources) to benefit fauna especially invertebrates (See Webb and others 2009)

Functional attributes

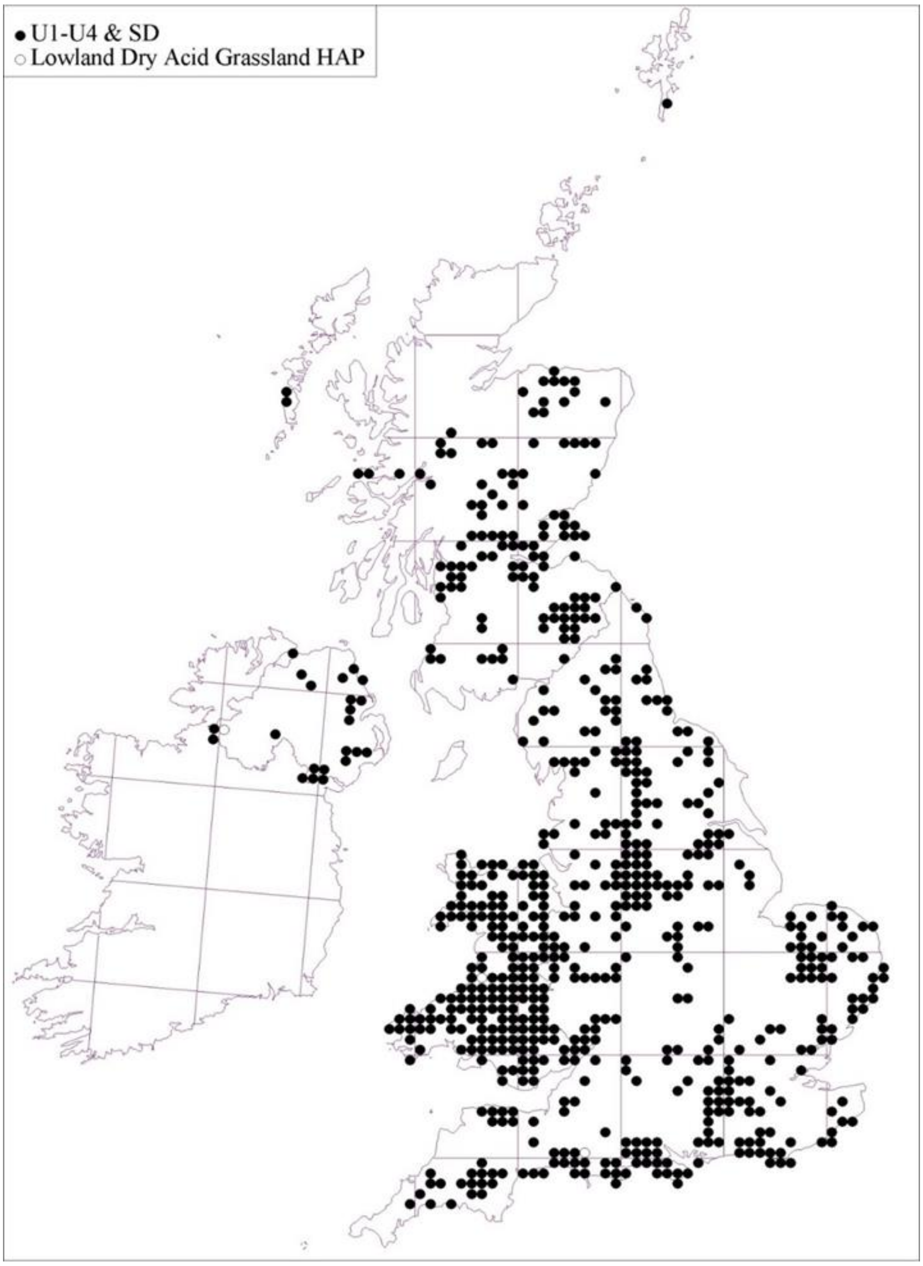
- Properties of the underlying geology (solid and drift) – acid rocks, sands & gravels or equivalent artificial substrate
- Properties of the underlying soil types, including structure, bulk density, total carbon, pH, exchangeable soil Calcium (Ca), exchangeable soil acidity, soil nutrient status and fungal: bacterial ratio.
- Supporting off-site habitat e.g. contiguous or connected areas of suitable habitats
- Functional connectivity with the wider landscape.
- Concentrations and deposition of air pollutants.
- Grazing management by livestock.
- Processes which create and maintain bare ground and early successional communities

Sources: *Dolman and others 2010; Robertson & Jefferson 2000; Rodwell 1992; Sanderson 1998;*

Evidence

5.1 Current situation

Natural range and distribution



The most up to date information on range/distribution is provided by Rodwell and others 2007 (reproduced above). Note, however, that some areas mapped may refer to areas of U4 above the upper limit of enclosure (sometimes referred to as the 'moor wall') thus not forming part of the priority habitat. The number of occupied 10 km squares in the UK is 657 of which 357 are in England, although as mentioned, some of these may be upland U4 acid grassland.

There remains the possibility that new sites may be discovered which could extend the current known distribution. However, the range is ultimately dependent on the availability of suitable substrates although the grassland can sometimes occur beyond the range of suitable natural substrates where artificial acidic wastes have been colonised by the suite of species typical of the habitat. For example, in Cambridgeshire, significant areas of acid grassland have developed over acidic material in the Whitemoor marshalling yards, March, Cambridgeshire.

Source: *Rodwell and others 2007*

Confidence: Moderate

Area

The current estimated area of the habitat in England is c.20,142 ha (Robertson & Jefferson 2000). The area of the habitat has probably remained broadly stable or has slightly diminished over the last 20 years with some small losses since but possibly at least partly compensated by restoration of sites or parts of sites that had succeeded to scrub. This assessment is based on expert opinion and not on quantitative data. This probable 'stability' has been largely due to the impact of conservation measures and programmes (both incentive schemes and statutory designations) and changes in land use policy.

Source: *Bullock and others 2011; Robertson & Jefferson 2000*

Confidence: Poor – Moderate

Patch size

Fragmentation is a major issue such that most sites are small. Data from 2011 showed that 71% of lowland dry acid grassland sites were less than 5 ha with only 6% being over 10 ha (Bullock and others 2011). Currently, the minimum size for SSSI selection is 0.5 ha (Jefferson and others 2014).

Quality of habitat patches

There is very little known about functional attributes, apart from geology, soils and the levels of atmospheric nitrogen deposition, as data are not routinely collected. Monitoring is based on structural attributes that partly act as a proxy for at least some of the functional attributes.

The majority of the information on the structure attributes comes from the monitoring of protected sites. Recent data shows that around 33% of the designated resource in SSSIs was in favourable condition. As a note of caution, this metric is based on the CSM protocol for the acid grassland habitat (Robertson & Jefferson 2000) and may not fully take account of the desired structural habitat conditions for the characteristic invertebrate fauna (e.g. level of flowering). For non-designated sites, data are available from a sample survey of Priority grasslands in 2002/03 which showed that 28% of lowland dry acid grassland stands were in favourable or good condition. A repeat sample survey in 2017/18 found that the percentage of stands in good condition had fallen to 25%.

Sources: *Hewins and others 2005; Robertson & Jefferson 2000; NE CMSi*

Confidence: Moderate

Threatened species

Lowland dry acid grassland is a very important habitat for vascular plants, lower plants, lichens and fungi. A significant number of S41 Priority species are closely associated with the habitat. Threatened vascular plants included on the England Red list of vascular plants (Stroh and others 2014)) include *Dianthus deltoides* (VU), *Hypochaeris glabra* (VU), *Lotus angustissimus* (NT), *Scleranthus perennis* subsp. *prostratus* (EN) *Teesdalia nudicaulis* (NT) *Viola lactea* (EN) and *Veronica verna* (EN).

Although the habitat supports a range of widespread bryophytes, it supports few which are rare or threatened. One notable exception is the moss *Leptodontium gemmascens* which is a priority species and classed as IUCN Vulnerable. Parched acid grassland (U1) can be particularly rich in lichens, although few are threatened or S41 priority species. Lowland dry acid grassland, particularly U4 and semi-improved acid grassland (U4b) and richer forms of semi-improved MG6 grassland derived from acid grassland, can support a rich diversity of fungi, especially waxcaps of the genus *Hygrocybe*, including some threatened/priority species such as the date waxcap (*Hygrocybe spadicea*) (Near Threatened and S41).

A range of vertebrates, reptiles and birds in particular utilise lowland dry acid grassland and associated habitats for breeding, feeding or roosting. These include several birds of conservation concern/S41 Priority species, namely skylark, lapwing (red-listed), woodlark, nightjar and stone curlew (amber-listed). S41 Priority reptile species include sand lizard, smooth snake and adder. The Pool frog, a S41 priority species, became extinct in England in the 20th century, was reintroduced at two sites in Norfolk where pingos provide breeding sites and acid grassland and other semi-natural vegetation provide supporting habitat for the species.

Lowland dry acid grassland is very important for the diversity of its associated invertebrates. Many are specialist species only associated with parched, open habitats with friable soils. The open parched acid grasslands (U1) on sandy soils in particular can support a considerable number of ground-dwelling and burrowing invertebrates such as solitary bees and wasps. Many species also require other associated features such as plenty of flowers, bare ground and sand and some scrub (Webb and others 2009).

The number of associated species is exceptional: the Pantheon database provides access to relevant listings, with species listed according to habitat traits, though these are rarely if ever exclusive to a particular habitat. For example, a search of the Pantheon database (Webb and others 2017) using ‘sand resource in open habitats’ key terms (conditions typical of open parched acid grasslands) coupled with a search for eight specific acid grassland plant species produced a list of 625 invertebrate species. This list will also include species associated with other habitats such as dunes and heathlands but illustrates what might be associated with lowland acid grassland.

A number of rare, scarce and threatened S41 priority invertebrate species, including the field cricket (*Gryllus campestris*), the spider *Walckenaeria stylifrons*, silver-studded blue (*Plebejus argus*) and grayling (*Hipparchia semele*) are associated with the habitat.

Sources: *Buglife [https://www.buglife.org.uk/advice-and-publications/advice-on-managing-bap-habitats/lowland-dry-acid-grassland]; JNCC website (S41 priority species list); Stroh and others 2014; Webb and others 2009; Jon Webb pers. comm*

Confidence: High

5.2 Historical variation in the above parameters

There has been a significant loss of this habitat, notably during the second half of the 20th century as acid grasslands were ploughed and reseeded to produce improved grassland or arable farmland. In addition, large areas such as in the Lincolnshire coversands and Breckland were subject to afforestation with coniferous species such as Scots and Corsican pine. Additionally losses also occurred in the first half of the 20th century. Dolman and others (2010), for example, report that between 1900 and 1934, 7,872 ha of grass-heath (including dry acid grassland) was lost to arable and afforestation. Afforestation continued post-war and eventually one quarter of the Breckland region was planted.

As with other types of semi-natural grassland, the extent and rate of loss is largely unknown. This is partly due to the fact that recognition of the nature conservation importance of lowland dry acid grassland in its own right has really only occurred in the last 20 years. For example, there are no lowland acid grassland sites listed in the 1977 Nature Conservation Review (Ratcliffe 1977). Any mention of lowland acid grassland in Ratcliffe (1977) is in the context of the various heathland key sites listed in the NCR such as the New Forest and the Breckland sites. However, Countryside Survey reported a 12.7% decrease in acid grassland (Broad habitat) between 1990 and 2007 (see Natural England 2008).

The decrease between 1990 and 1998 was greater at 17.5%. Plant species richness also decreased in acid grassland in Great Britain over this period.

In addition to direct loss, significant areas have ceased to be used for grazing and/or have experienced a loss of their rabbit populations, resulting in a loss of habitat quality, with sites trending towards species-poor vegetation, fewer open areas for specialist species and/or becoming dominated by scrub species. Also, the loss of processes which create or maintain bare ground and early successional stages of acid grassland development, such as formation of track ways, turf cutting, small-scale sand/gravel quarrying and, in Breckland, wind blow, has contributed to a decline in nature conservation interest.

Habitat fragmentation and isolation of sites is also an ongoing threat which commenced in earnest post-WW2. The latter can make it more difficult to ensure sites are managed by grazing, especially in arable areas, and theoretically may lead to losses of component species as a result of extinction debt.

Island biogeography theory predicts that the decreasing extent and fragmentation of semi-natural grasslands over the last 50-100 years will ultimately result in losses of species from remaining areas of grassland habitat. Long transient times in response to decreasing habitat area and increasing isolation due to fragmentation may cause the present plant (and animal) species distribution to reflect the historical rather than the present landscape configuration. Hence, current species populations are possibly not yet in equilibrium with the current landscape configuration but are rather reflecting historical fragment layout. Therefore, this time lag in species response may have created a so-called extinction debt resulting in species still occupying habitat fragments in which they eventually will disappear (see for example Tilman et al 1994).

Although the reality of extinction debt has not been demonstrated for grasslands in England/UK, the principles outlined in Lawton et al (2010) of 'better, bigger and more joined' up should be applied. Also, practically, at an individual site level, species populations on small or isolated patches are undoubtedly at a greater risk of extinction for a number of reasons: increased ratio of edge to area increases their susceptibility to external factors such as fertiliser drift; increased probability that stochastic events such as drought and fire will cause extinction across the entire site; tendency to be at greater risk of deterioration in habitat quality over time; and their dependence on migrants from larger habitat patches to maintain viable populations.

In some cases, nutrient enrichment from local sources can result in unfavourable conditions which can take several decades to reverse depending on the level of intervention. Acid grasslands have been shown to be susceptible to atmospheric nitrogen deposition which has caused negative changes in species composition through nutrient enrichment and soil acidification (Stevens and others 2010).

Natural range and distribution

Despite the losses in extent, the overall range envelope over the last 50-100 years has probably been relatively stable although there has been a total loss of sites and also fragmentation and a reduction in size of sites. There is no evidence that this habitat has actually been lost from any 10 km squares over this period but this habitat probably has the least amount of information on trends of any of the grassland priority habitats.

Area

Significant areas of lowland dry acid grassland have been lost during the last 60 years, though it is rarely possible to provide accurate figures. In addition, losses of acid grassland to arable cultivation and forestry also predate the post-war agricultural revolution and Dolman and others (2010) provide some figures of losses for Breckland between 1900 and 1934 (see above).

Patch size

While there is no historical information on patch size, given the decline in overall extent, it is a reasonable assumption that there has been a concomitant reduction in patch size.

Quality of habitat patches

Very little is known concerning historic trends in the quality of the habitat of which decline is probably more of a 20th century phenomenon largely due to a lack of grazing and aerial deposition of nitrogen (see Bobbink and others 1998, Stevens and others 2010).

There is ecological evidence of the negative effects of fragmentation and isolation on the populations of some of the characteristic vascular plants of this and other semi-natural grassland habitats through, for example, genetic erosion.

Sources: Bobbink and others 1998; Blackstock and others 1999; Bullock and others 2011; Dolman and others 2010; Fuller 1987; Lawton and others 2010; Preston and others 2002; Rodwell and others 2007; Sanderson 1998; Stevens and others 2010; Stroh and others 2014; Tilman and others 1994

Confidence: Poor

Threatened species

As detailed in section 5.1, Lowland dry acid grassland is a very important habitat for vascular plants, lower plants, lichens and fungi. A significant number of S41 Priority species are closely associated with the habitat. Also several birds of conservation concern/S41 Priority species and S41 Priority reptile species are closely associated with the habitat. Apart from vascular plants, birds and reptiles there is very little data on historical trends for other taxa. Overall specialist vascular plants of lowland dry acid grassland have undergone declines over the last 50 or so years

(Sanderson 1998, Stroh and others 2019). Although certain specialist species of birds such as nightjar, woodlark & stone curlew underwent considerable declines in the second half of the 20th century, there has been a recovery of populations of these species over the last 20 years or so due to targeted conservation measures (Woodward and others 2019). However, species of reptiles such as adder are in steep decline (Gardner and others 2019) due to human disturbance, habitat loss and fragmentation and too intensive scrub management.

Sources: Gardner and others 2019, Sanderson 1998, Stroh & others 2019, Woodward and others 2019.

Confidence: Poor

5.3 Future maintenance of biological diversity and variation in the habitat

Lack of or reduced livestock grazing and conversely over grazing are a threat to this habitat type. In the current socio-economic context, the latter seems much less likely to be much of a threat due to the habitat's increasing irrelevance to modern intensive farming systems. Grazing of semi-natural grasslands with low agricultural productivity and/or difficult terrain has become less economically viable due to low forage yields, higher labour costs and limitations imposed by difficult terrain or isolation, especially in areas dominated by arable farming. Changes in social factors, including demographic changes, have also exacerbated the trend towards abandonment (Jefferson and others 2014).

In contrast, in a limited number of instances, high and excessive pressure of livestock disturbs the soil structure and vegetation and can have destructive effects. For some lower plants species, especially lichens, cattle grazing may be inappropriate and such sites would benefit from sheep grazing in combination with a revival of rabbit populations.

Natural England/RSPB (2014) assessed the vulnerability of this habitat to climate change as Low. It is expected to be relatively robust to the direct threats posed by climate change, although the climate space of some of its component species is projected to change and therefore their distribution may change, including range expansions.

Climate change interactions with nutrient enrichment from atmospheric deposition and changes in temperature and rainfall patterns that affect agricultural management of grasslands may accelerate negative change. Efforts to reduce nutrient enrichment and acidification from nitrogen deposition will continue to be necessary to maintain or restore favourable status.

Natural range and distribution

The current range and distribution is likely to be favourable for future maintenance of the habitat.

Area

There is little information on which to make an assessment of the habitat area and site size required for the future maintenance of biodiversity. Some expansion would be very desirable to make up for historic losses and ensure sustainability of threatened species populations such as field cricket.

There are two possible approaches to deriving a figure for the habitat area required for the future maintenance of biological diversity or Favourable Conservation Status.

1. Use the guidance provided by *Defining Favourable Conservation Status in England* (Natural England 2017 v 0.6). This method uses a "rule-of-thumb" to derive a figure for restoring a proportion of the *historical* loss of the habitat. When applied to the restoration of lowland dry acid grassland, this indicates an ambition to restore 90-100% of the historical loss (based on the current status of the habitat as Vulnerable, a high number of associated threatened species/highly degraded structure and function attributes and good potential for restoration). Assuming a loss of 80% of the habitat (and therefore the current extent is 20% of the historical extent) this would require a minimum increase in area of c 72,500 ha.

2. Use data produced by the NE habitat network mapping project. This would indicate an increase of 48,700 ha. This is based on the figure required to create a connected network of habitat incorporating existing habitat patches.

It is proposed to use the figure generated by Method 2). This method is based on the most robust data from an ecological perspective and is justifiable given our knowledge of historical losses and the likely negative impacts of decreased patch size and connectivity.

The Annex 1 habitat H2330: Inland dunes with open *Corynephorus* and *Agrostis* grasslands is a component of the priority habitat but is known only from 2 sites in eastern England, both SSSI & SAC. Its extent has been estimated as 120 ha. Given the very specialised conditions under which the habitat occurs (on fixed inland dunes) and the very limited scope for habitat creation, it is not proposed to set an expansion ambition for this Annex 1 type.

Patch size

Little is known on what constitutes a viable patch size for this habitat but seemingly provided management is appropriate, patches as small as 0.5 ha may be viable for the maintenance of the habitat. This is the minimum size for qualification for SSSI selection under the lowland grassland guidelines (Jefferson and others 2014). Certain fauna species though will require larger patch sizes, although such detail is often lacking.

Patch quality & diversity

The attributes listed in section 6.3 will be required to be met for maintenance of the quality of the habitat.
Although the evidence base is limited, there is a likelihood that patch quality and species diversity of lowland dry acid grassland sites has probably declined over the last 90 years, at least in some geographical areas, due to a range of impacts including nutrient enrichment and management changes (see 5.2). The lack of available data on these changes makes it challenging to decide on what constitutes an appropriate baseline. However, there is definitely scope for analysis of historic acid grassland datasets to examine this issue in more detail, although in contrast to other grassland types such as calcareous grassland, these are likely to be very limited.
A particular example of a shifting baseline, although not lowland dry acid grassland, are data form the long-running Rothamsted Park Grass neutral grassland plots showed a shifting baseline of species richness in plots with the baseline dropping by 15 species m^2 over a 130 year period (Dodd and others 1994).
Should the CSM favourable condition baseline plus species richness and species composition variables from the National Vegetation Classification and other unpublished vegetation data (Rodwell 1992) be used as measures of quality and diversity then, assuming the pressures of nutrient enrichment and lack of management are reduced over time, then quality and diversity of patches can be maintained or even enhanced.

Quality of habitat patches

The role and importance of functional connectivity and supporting off-site habitat are poorly understood. However, for certain component species, such factors may be critical to maintaining or expanding populations and to prevent genetic erosion. The attributes listed in section 6.3 will be required to be met for maintenance of the quality of the habitat**.**

Threatened species

All species partially or wholly dependent on this habitat should be Least Concern, when assessed using IUCN criteria (or considered to be Least Concern if not formally assessed). To achieve this, most of the attributes listed in 6.3 will need to be met, although there will be some variation depending on the autecology of the species in question**.**

Sources: *Crick and others 2020, Dodd and others 1994**,** Natural England & RSPB 2014; Stevens and others 2010*

Confidence: Poor - Moderate

5.4 Potential for restoration

The most common cause of poor quality of existing acid grassland sites is a lack of or inappropriate grazing. This can be readily addressed, although practical factors relating to the availability of grazing animals or the need for associated infrastructure (fencing, water supply, access etc) can hinder progress. The potential for restoration is generally good, although in areas where atmospheric deposition of nitrogen is above critical levels, restoration will be more challenging.

There is scope for expansion/restoration of lowland dry acid grassland in two contrasting ways. Firstly, by natural colonisation of suitable substrates (including artificial) and secondly by restoration from arable or semi-improved grassland.

The methodology of grassland habitat restoration is now well understood due to a considerable body of research effort (see Pywell and others 2013). Restoration or creation of acid grassland from arable, semi-improved grassland or forestry is readily achievable provided that restoration is targeted to land that is situated on appropriate geology and soils, has low soil Phosphorus, is amenable to being managed by grazing and ideally links or extends existing acid grassland sites.

There are some examples of successful restoration (Hewins 2012, Wilson and others 2013) although the timescales for such grasslands to resemble 'ancient' examples may usually be measured in decades. The best examples of restoration are where very infertile, exposed acid substrates border or are surrounded by existing acid grassland. These appear to fairly readily re-colonise naturally over time. This may also be the case in situations where acid grassland has been restored from forestry plantation where there has been less modification of soil conditions compared to agricultural pastureland such as by the addition of nutrients.

Restoration would also have significant benefits for associated fauna species provided management is able to produce a heterogeneous sward structure and natural colonisation is maximised by targeting restoration to enhance the size of sites and connect existing ones. The impact of acid grassland restoration and expansion is likely to be beneficial for typical grassland species assemblages and for certain species requiring larger areas of habitat such as stone curlew or field cricket (*Gryllus campestris*).The latter species is rare and all of the extant meta-populations (there are currently only five) are on acid grasslands in West Sussex/ adjacent Hampshire and Surrey. This species requires extensive areas of short turf interspersed with small, regular patches of bare ground and longer grass tussocks. Such a micro-habitat is best maintained by grazing and is likely to benefit from a landscape-scale approach with substantial expansion and increased connectivity of sites.

Sources: *Dolman and others 2010; Hewins 2012; Jon Curson pers. comm.; Pywell and others 2013; Stevens and others 2010; Wilson and others 2013.*

Confidence: Moderate

Conclusions

6.1 Favourable range and distribution

The favourable range and distribution is the current range for the habitat.

At present the habitat is recorded from 35710 km squares in England and as a minimum this should be maintained.

The range could be monitored using a combination of climate, topographical and soil/substrate parameters.

6.2 Favourable area

The favourable area is set at 69,000 ha (i.e. 20,000 + 49,000) - the current area of the habitat increased to create a habitat network. The rationale for this ambition is set out in section 5.3. Temporal changes in the area could be monitored by a combination of field-based sample-based monitoring and earth observation methods. The latter are likely to become increasingly sophisticated and may, in combination with traditional field monitoring, offer a good prospect of monitoring favourable area.

6.3 Favourable structural and functional attributes

Structural attributes

- Typical vegetation community and species composition[1]
- Natural pattern of vegetation zonation/transitions
- Low cover of undesirable species – includes low frequency and cover of a range of negative indicators including shrubs/trees, bracken, coarse grasses and selected herbaceous species such as thistles (*Cirsium* spp). Specific thresholds depend on specific NVC types/sub-types
- The presence of some bare ground for regeneration niches and supporting habitat for specialist Invertebrates and vascular plants, especially in relation to types of parched acid grassland. Targets are specific to particular NVC types but in most cases up to 10% bare ground is acceptable to achieve favourable condition
- Vegetation heterogeneity and suitable ‘floweriness’ to benefit fauna especially invertebrates. The latter, in general terms, means the presence of flowers throughout the spring and summer providing a source of nectar and pollen (Webb and others 2009)

Functional attributes

- Unmodified or natural properties of the underlying geology (solid and drift) – acid rocks, sands & gravels or equivalent artificial substrate
- Properties of the underlying soil types, including structure, bulk density, total carbon, pH, exchangeable soil Calcium (Ca), exchangeable soil acidity, soil nutrient status and fungal: bacterial ratio, to within typical values for the habitat. For this feature, soil P index should

typically be index 0 (< 9 mg l -1). However, P indices of 1 or 2 have been measured on sites which may have had a past history of ploughing.

- Supporting off-site habitat e.g. contiguous or connected areas of suitable habitats
- Functional connectivity with the wider landscape [2]
- Concentrations and deposition of air pollutants at or below the site-relevant Critical Load or Level values.
- Suitable grazing management by livestock appropriate to deliver conservation objectives, usually within the range 0.3–0.75 LU/ha /ha/year, depending on site productivity and conservation objectives and ensuring sward heterogeneity commensurate with guidance in Webb and others 2009.
- Processes which create and maintain bare ground and early successional communities

Patch size

Little is known on what constitutes a viable patch size for this habitat but seemingly, provided management is appropriate, patches as small as 0.5 ha may be viable in the long-term. This is the minimum size for qualification as an SSSI (Jefferson and others 2014). Certain animals require larger patch sizes, although precise details are often lacking. Thus, 95% of lowland dry acid grassland by area should be in patches of 0.5ha or above. However, there are benefits to having larger and more connected patches (see Footnote [2]) but it would seem impractical to be overly prescriptive in specifying a percentage and area thresholds.

Quality of habitat patches

At least 95% of the favourable area of the habitat meets the structural and functional requirements as described above.

Threatened species

All species partially or wholly dependent on this habitat should be Least Concern, when assessed using IUCN criteria (or considered to be Least Concern if not formally assessed), as regards to this habitat.
Most of the attributes are amenable to measurement. An agreed method for measuring or setting targets for off-site habitat or functional connectivity is required.

[1] Annex 2 lists typical and positive indicator plant species for the habitat.
[2] These two attributes are included as there is some evidence for the benefits of larger habitat patches and general connectivity of sites both between grasslands but also other habitat types. The evidence is summarised in Lawton and others (2011) and further elucidated in the forthcoming Natural England Nature Networks Handbook.

Annex 1: References

Blackstock, T.H., Rimes, C.A., Stevens, D.P., Jefferson, R.G., Robertson, H.J., MacKintosh, J. and Hopkins, J.J. 1999. The extent of semi-natural grassland communities in lowland England and Wales: a review of conservation surveys 1978-96. *Grass and Forage Science* 54, 1-18.

Bullock, J.M., Jefferson, R.G., Blackstock, T.H., Pakeman, R. J., Emmett, B. A., Pywell, R. J., Grime, J. P. and Silvertown, J. W. 2011. *Chapter 6: Semi-natural grasslands*. In: The UK National Ecosystem Assessment Technical Report. UK National Ecosystem Assessment, UNEP-WCMC, Cambridge.

Crick, H 2020 Crosher, I., Mainstone, C., Taylor, S., Wharton, A., Langford, P., Larwood, J., Lusardi, J., Appleton, D., Brotherton, P., Duffield, S. & Macgregor, N. 2020 Nature Networks Evidence Handbook Natural England Research Report NERR 08.

Crofts, A. & Jefferson, R.G. 1999 *The Lowland Grassland Management Handbook*. English Nature & The Wildlife Trusts, Peterborough.

Dodd, M.E., Silvertown, J., McConway, K., Potts, J. & Crawley, M. 1994 Stability in the plant communities of the Park Grass Experiment: the relationships between species richness, soil pH and biomass variability. *Philosophical Transactions of the Royal Society Series B*, 346, 185-193.

Dolman, P.M., Panter, C.J., Mossman, H.L. 2010 *Securing Biodiversity in Breckland: Guidance for Conservation and Research. First Report of the Breckland Biodiversity Audit.* University of East Anglia, Norwich.

Gardner, E., Julian, A., Monk, C. & Baker, J. 2019 Make the Adder Count: population trends from a citizen science survey of UK adders. *Herpetological Journal*, 29, 57-70.

Hewins, E. 2012 A survey of selected agri-environment grassland and heathland creation and restoration sites: Part 1. *Natural England Commissioned Report*, NECR107. Natural England, Sheffield.

Hewins, E.J., Pinches, C., Arnold, J., Lush, M., Robertson, H. & Escott, S. 2005 The condition of lowland BAP priority grasslands: results from a sample survey of non-statutory stands in England. *English Nature Research Reports*, No 636. English Nature, Peterborough.

Natural England 2008 *State of the Natural Environment 2008*. Natural England, Sheffield. http://publications.naturalengland.org.uk/publication/31043

Natural England and RSPB 2014 *Climate Change Adaptation Manual: Evidence to support nature conservation in a changing climate.* Natural England Commissioned Research Report no. 546.

Natural England 2018. Defining Favourable Conservation Status for habitats and species in England.

Jackson, D.L. & McLeod, C.R. 2002. Handbook on the UK status of EC Habitats Directive interest features: provisional data on the UK distribution and extent of Annex I habitats and the UK distribution and population size of Annex II species. *JNCC Report* 312. Joint Nature Conservation Committee, Peterborough.

Janssen, J.A.M and 48 others 2016 *European Red List of Habitats. Part 2. Terrestrial and freshwater habitats*. Publications Office, European Union.

Jefferson, R.G., Smith, S.L.N. and MacKintosh, E.J. 2014. *Guidelines for the Selection of Biological SSSIs. Part 2: Detailed Guidelines for Habitats and Species Groups. Chapter 3 Lowland Grasslands*. Joint Nature Conservation Committee, Peterborough.

Kirkham, F.W., Mole, A, Gardner, S.M. & Wilson, D.W. 2003. Review of Stocking Levels Recommended for Semi-natural Lowland Grasslands. Countryside Council for Wales (CCW) *Contract Science Report No. 596*. CCW, Bangor.

Lawton, J.H., Brotherton, P.N.M., Brown, V.K., Elphick, C., Fitter, A.H., Forshaw, J., Haddow, R.W., Hilborne, S., Leafe, R.N., Mace, G.M., Southgate, M.P., Sutherland, W.J., Tew, T.E., Varley, J. and Wynne, G.R. 2010. *Making Space for Nature: a Review of England's Wildlife Sites and Ecological Network.* Report submitted to the Secretary of State, the Department for Environment, Food and Rural Affairs on 16 September 2010. Defra, London

Pywell, R.F., Woodcock, B., Tallowin, J.R.B., Mortimer, S.R. & Bullock, J.M. 2012 Restoring species-rich grassland: principles and techniques. In: Peel, S., Chesterton, C., Cooke, A., Jefferson, R.G., Martin, D., Smith, B., Smith, S. & Tallowin, J.R.B. eds Restoring diverse grasslands: What can be achieved where, and what will it do for us? *Aspects of Applied Biology* 115, 11-21.

Ratcliffe, D.A. 1977 *A Nature Conservation Review*. Cambridge University Press, Cambridge.

Robertson, H.J. and Jefferson, R.G. 2000. Monitoring the condition of lowland grassland SSSIs. Volume I: English Nature's rapid assessment system. *English Nature Research Reports* 315, Volume I. English Nature, Peterborough.

Robertson, H.J., Jefferson, R.G., Wilson, P.J., Reed, M.E., McDonnell, E. & Wheeler, B. 2002 Monitoring grassland Biodiversity Action Plan targets: condition and restoration assessment methodologies for non-statutory grasslands. Interim Report, English Nature, Peterborough.

Rodwell, J.S. (ed). 1991. *British Plant Communities. Volume 2: Mires and heaths*. Cambridge University Press, Cambridge.

Rodwell, J. S. ed. 1992 *British Plant Communities Volume 3: Grasslands and Montane Communities*. Cambridge University Press, Cambridge.

Rodwell, J.S. (ed). 2000 British Plant Communities. Volume 5:*Maritime Communities and Vegetation of Open Habitats*.Cambridge University Press, Cambridge.

Rodwell, J.S., Morgan, V., Jefferson, R.G. and Moss, D. 2007. The European context of British lowland grasslands. *JNCC Report* 394. Joint Nature Conservation Committee, Peterborough.
Sanderson, N. A. 1998 A review of the extent, conservation interest and management of lowland acid grassland in England. *English Nature Research Report* No. 259. English Nature, Peterborough.

Stevens, C., Dupré, C., Dorland, E., Gaudnik, C., Gowing, D.J.G., Bleeker, A., Diekmann, M., Alard, D., Bobbink, R., Fowler, D., Corcket, E., Mountford, O., Vandvik, V., Aarrestad, P.A., Muller, S. & Dise, N.B. 2010 Nitrogen deposition threatens species richness of grasslands across Europe. *Environmental Pollution*, 158, 2940–2945

Stroh, P.A., Leach, S.J., August, T.A., Walker, K.J., Pearman, D.A., Rumsey, F.J., Harrower, C.A., Fay, M.F., Martin, J.P., Pankhurst, T., Preston, C.D. & Taylor, I. 2014 *A Vascular Plant Red List for England*. Botanical Society for Britain and Ireland, UK.

Stroh, P.A., Walker, K.J., Smith, S.L.N., Jefferson, R.G., Pinches, C. & Blackstock, T.H. 2019. *Grassland plants of the British and Irish lowlands: ecology, threats and management.* Botanical Society of Britain and Ireland, Hertfordshire.

Tilman, D., May, R.M., C.L. Lehman, C.L. & M.A. Nowak, M.A. 1994 Habitat destruction and the extinction debt. *Nature*, 371: 65–66.

UK Biodiversity Group 1998. *Tranche 2 Action Plans. Volume II – terrestrial and freshwater habitats*. English Nature, Peterborough, UK.

Van Vliet, W. 2017 Draft methodology for defining FCS for Structure and Functions Version 17 august 2017. Internal Natural England paper for FCS project.

Webb, J.R., Drewitt, A.L. & Measures, G.H. 2009 Managing for species: integrating the needs of England's priority species into habitat management. *Research Report NERR024*. Natural England, Sheffield.

Webb, J., Heaver, D., Lott, D., Dean, H.J., van Breda, J., Curson, J., Harvey, M., Gurney, M., Roy, D.B., van Breda, A., Drake, M., Alexander, K.N.A. and Foster, G. 2017. Pantheon - database version x.x.x. [online] Available at: http://www.brc.ac.uk/pantheon/ [Date Accessed: 26-09-17].

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 Report, NECR107. Natural England, Sheffield.

Woodward, I.D., Massimino, D., Hammond, M.J., Harris, S.J., Leech, D.I., Noble, D.G., Walker, R.H., Barimore, C., Dadam, D., Eglington, S.M., Marchant, J.H., Sullivan, M.J.P., Baillie, S.R. & Robinson, R.A. 2019. *Bird Trends 2019: trends in numbers, breeding success and survival for UK breeding birds*. Research Report 708. BTO, Thetford. www.bto.org/birdtrends

Annex 2: Constant and positive indicator species for lowland dry acid grassland

Constant species from component National Vegetation Classification types

Agrostis capillaris, Agrostis curtisii, Anthoxanthum odoratum, ***Calluna vulgaris****, Carex arenaria, Cetraria aculeata, Danthonia decumbens, Deschampsia flexuosa,Festuca ovina,* ***Galium saxatile****, Nardus stricta,* ***Potentilla erecta****, Rhytiadelphus squarrosus,* ***Rumex acetosella****,*

Typical species indicating favourable condition (from Robertson & Jefferson 2000 and additions from Robertson and others 2002)

Those in bold above plus: *Anemone nemorosa, Aira spp., Aphanes spp.,Astragalus danicus,Campanula rotundifolia, Centaurium erythraea, Cladonia spp., Dianthus deltoides, Erica spp., Gallium verum, Lathyrus liinifolius, Leontodon hispidus, Leontodon saxatilis, Lotus corniculatus, Myosotis ramossisima, Ornithopus perpusillus, Pedicularis sylvatica, Pilosella officinarum, Plantago coronopus, Polygala spp., Sedum acre, Serratula tinctoria, Stachys officinalis, Succisa pratensis, Teesdalia nudicaulis, Teucrium scorodonia, Thymus spp., Vaccinium myrtillus, Veronica officinalis,Viola spp*

Annex 3: List of lowland dry acid grassland SSSIs with area of habitat

List of lowland dry acid grassland SSSIs with area (ha) of habitat	
SSSI Name	Area (ha)
STANFORD TRAINING AREA	1,580.1
RICHMOND PARK	735.9
BUSHY PARK AND HOME PARK	537.1
THE MALVERN HILLS	535.3
THE NEW FOREST	369.9
ROMAN RIVER	282.0
THETFORD HEATHS	270.6
HARE'S DOWN, KNOWSTONE & RACKENFORD MOORS	226.2
CAVENHAM - ICKLINGHAM HEATHS	211.4
LEISTON - ALDEBURGH	194.0
HOLLOW MOOR & ODHAM MOOR	183.2
RISBY WARREN	157.1
BRIDGHAM & BRETTENHAM HEATHS	144.5
MOORS RIVER SYSTEM	142.7
WIMBLEDON COMMON	129.3
RAF LAKENHEATH	111.0
CORFE COMMON	81.9

WHITELEIGH MEADOWS	81.8
EAST WRETHAM HEATH	78.5
RAMPISHAM DOWN	72.0
WINDSOR FOREST AND GREAT PARK	71.9
BARNHAM HEATH	70.3
GRENOFEN WOOD AND WEST DOWN	67.9
WANGFORD WARREN AND CARR	67.8
AVON VALLEY (BICKTON TO CHRISTCHURCH)	64.5
DITCHLING COMMON	59.9
COMMON MOOR, EAST PUTFORD	55.0
PRIDDY POOLS	52.7
MOOR FARM	47.0
HUMBER ESTUARY - 2000480	46.9
LITTLE HEATH, BARNHAM	46.2
EPPING FOREST	45.1
MAIDSCROSS HILL	44.8
LAMBERT'S CASTLE	43.1
CROXTON PARK	42.0
DUNSDON FARM	42.0
CROXLEY COMMON MOOR	39.6
EAST RUSTON COMMON	39.5
DUNGENESS, ROMNEY MARSH AND RYE BAY	38.4

CHRISTCHURCH HARBOUR	36.6
ASHFORD HILL WOODS AND MEADOWS	35.2
LUNDY	35.0
ABBOTSBURY CASTLE	34.9
BRADGATE PARK AND CROPSTON RESERVOIR	34.1
CHEQUER'S WOOD AND OLD PARK	33.9
LAUGHTON COMMON	33.1
OLD BODNEY CAMP	32.8
BEAFORD MOOR	31.4
THURSLEY, HANKLEY & FRENSHAM COMMONS	29.7
SOUTHMOOR FARM	28.4
CRESSBROOK DALE	27.7
DUNSTER PARK AND HEATHLANDS	27.5
HAMPS AND MANIFOLD VALLEYS	27.3
WHIDDON MOOR, LUCKCOFT AND ODHAM MARSHES	26.9
LEZIATE, SUGAR AND DERBY FENS	25.5
BRADWORTHY COMMON	24.7
PRIORY MEADOWS, HICKLING	24.4
ANDREW'S WOOD	23.4
STRENSALL COMMON	22.1
EELMOOR MARSH	21.9
MOOREND COMMON	21.6

RED LODGE HEATH	20.8
RUISLIP WOODS	20.4
BAMBURGH COAST AND HILLS	20.4
ULVERSCROFT VALLEY	19.5
WEST DORSET COAST	19.2
WRAWBY MOOR	18.5
BRENDON AND VEALAND FEN	18.4
FRITTON COMMON	18.2
MESSINGHAM HEATH	17.8
GRIME'S GRAVES	17.7
GOODERSTONE WARREN	17.2
SCOTTON BECK FIELDS	16.7
COMMON MOOR LANGTREE	16.2
BRENDON FARM (NORTH)	15.8
SULHAM AND TIDMARSH WOODS AND MEADOWS	15.2
RANMORE COMMON	15.2
SMALL BROOK	14.8
CLUMBER PARK	14.0
BRASENOSE WOOD AND SHOTOVER HILL	13.3
TUETOES HILLS	12.5
CRANMORE	12.4
THORESBY LAKE	12.1

HURST HILL	11.5
GILMOOR AND MOORLANDS	11.3
MOORGREEN MEADOWS	10.2
CALTHORPE BROAD	10.1
DIMMINSDALE	9.7
BENTLEY PRIORY	9.2
BATH PASTURE	9.1
RIBSONS MEADOWS	9.0
HIGH WOOD AND MEADOW	9.0
TOLLER PORCORUM	8.9
BESTHORPE WARREN	8.8
SHORTHEATH COMMON	8.8
STANTON PASTURES & CUCKOOCLIFF VALLEY	8.5
PATMORE HEATH	8.5
DANE-IN-SHAW PASTURE	7.9
MONKWOOD GREEN	7.8
COATES CASTLE	7.7
MAULDEN HEATH	7.6
KINGFORD FEN	7.5
ERISWELL LOW WARREN	7.4
SANDY WARREN	7.3
MAPPERTON AND POORTON VALES	7.2

BOURLEY AND LONG VALLEY	7.0
HOLTON AND SANDFORD HEATHS	7.0
BRASSIDE POND	6.4
CROFT PASTURE	6.2
ARGER FEN	5.0
COOMBE MEADOW	5.0
STADDON MOOR	4.8
HURCOTT PASTURE	4.7
COOMBE HILL HOLLOW	4.3
PAMBER FOREST AND SILCHESTER COMMON	4.3
GIBBIN'S BROOK	4.3
MONK'S DALE	4.2
GUNNERTON NICK	4.2
DRY SANDFORD PIT	4.2
BRIDDLESFORD COPSES	3.9
DANBURY COMMON	3.7
FRIEZELAND GRASSLAND	3.7
LUDHAM - POTTER HEIGHAM MARSHES	3.6
LONG DALE & GRATTON DALE	3.4
HIGHCLERE PARK	3.3
LORDSWELL FIELD	3.3
POPEHOUSE MOOR	3.2

PARK CORNER HEATH	2.9
LATHKILL DALE	2.6
HAINTON SHEEPWALK	2.5
KNEBWORTH WOODS	2.4
DEVIL'S SPITTLEFUL	2.2
TRING RESERVOIRS	2.1
CROFT HILL	2.0
BOGNOR REEF	2.0
BARROW HILLS SANDPIT	1.9
BLUE POOL AND NORDEN HEATHS	1.9
HATFIELD MOORS	1.6
THE LUMP, PRIESTWESTON	1.6
THRASHER'S HEATH	1.4
HIGHFIELD MOSS	1.3
ROECLIFFE MANOR LAWNS	1.3
WORMLEY-HODDESDONPARK WOODS NORTH	0.8
BAGTHORPE MEADOWS	0.7
CRAG PIT, SUTTON	0.7
BRAMSHILL	0.4
RAMSDEN CORNER PLANTATION	0.3
Grand Total	8,438.9

Further information

Natural England evidence can be downloaded from our **Access to Evidence Catalogue**. For more information about Natural England and our work see **Gov.UK**. For any queries contact the Natural England Enquiry Service on 0300 060 3900 or e-mail **enquiries@naturalengland.org.uk** .

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