



European Site Conservation Objectives: Supplementary advice on conserving and restoring site features

**Hatfield Moor Special Area of Conservation (SAC)
Site Code: UK0030166**



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Date of Publication: 8 February 2019

About this document

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to Hatfield Moor SAC. This advice should therefore be read together with the SAC Conservation Objectives available [here](#).

Where this site overlaps with other European Site(s), you should also refer to the separate European Site Conservation Objectives and Supplementary Advice (where available) provided for those sites.

You should use the Conservation Objectives, this Supplementary Advice and any case-specific advice given by Natural England, when developing, proposing or assessing an activity, plan or project that may affect this site.

This Supplementary Advice to the Conservation Objectives presents attributes which are ecological characteristics of the designated species and habitats within a site. The listed attributes are considered to be those that best describe the site's ecological integrity and which, if safeguarded, will enable achievement of the Conservation Objectives. Each attribute has a target which is either quantified or qualitative depending on the available evidence. The target identifies as far as possible the desired state to be achieved for the attribute.

The tables provided below bring together the findings of the best available scientific evidence relating to the site's qualifying features, which may be updated or supplemented in further publications from Natural England and other sources. The local evidence used in preparing this supplementary advice has been cited. The references to the national evidence used are available on request. Where evidence and references have not been indicated, Natural England has applied ecological knowledge and expert judgement. You may decide to use other additional sources of information.

In many cases, the attribute targets shown in the tables indicate whether the current objective is to 'maintain' or 'restore' the attribute. This is based on the best available information, including that gathered during monitoring of the feature's current condition. As new information on feature condition becomes available, this will be added so that the advice remains up to date.

The targets given for each attribute do not represent thresholds to assess the significance of any given impact in Habitats Regulations Assessments. You will need to assess this on a case-by-case basis using the most current information available.

Some, but not all, of these attributes can also be used for regular monitoring of the actual condition of the designated features. The attributes selected for monitoring the features, and the standards used to assess their condition, are listed in separate monitoring documents, which will be available from Natural England.

These tables do not give advice about SSSI features or other legally protected species which may also be present within the European Site.

If you have any comments or queries about this Supplementary Advice document please contact your local Natural England adviser or email HDIRConservationObjectivesNE@naturalengland.org.uk

About this site

European Site information

Name of European Site	Hatfield Moor Special Area of Conservation (SAC)
Location	South Yorkshire
Site Map	The designated boundary of this site can be viewed here on the MAGIC website
Designation Date	1 April 2005
Qualifying Features	See section below
Designation Area	1363.55ha
Designation Changes	None
Feature Condition Status	Details of the feature condition assessments made at this site can be found using Natural England's Designated Sites System
Names of component Sites of Special Scientific Interest (SSSIs)	Hatfield Moors SSSI
Relationship with other European or International Site designations	The SAC overlaps part of the Thorne and Hatfield Moors SPA. Further information about this site can be found here .

Site background and geography

Hatfield Moors SAC lies within the [Humberhead Levels National Character Area](#). With Thorne Moors lying a few kilometres to the North, Hatfield Moors form England's largest area of raised bog, both within the former floodplain of the rivers feeding the Humber estuary (Humberhead Levels). The Moors lie on a flat plain formed from the bed of the glacial Lake Humber, which drained out through the Humber Gap after the last ice age. The site formed about 4-5000 years before present after a period of sea level rise caused the rivers flowing through the area to back up, and originally formed part of a vast marsh and fen covering around 500 square miles around the upper Humber, and in the Axholme and Hull valleys.

Drainage, land reclamation for agriculture, and peat extraction over the last 500 years has resulted in the loss of this wetland area, leaving Thorne and Hatfield Moors as the only remaining large scale inland wetlands. Although the Moors retain a significant wildlife interest and wetland character, they have been extensively damaged by peat extraction and the drainage of surrounding land. The site now sits as an island within an intensively managed, highly productive, arable landscape.

About the qualifying features of the SAC

The following section gives you additional, site-specific information about this SAC's qualifying features. These are the natural habitats and/or species for which this SAC has been designated.

Qualifying habitats:

- **H7120 Degraded raised bogs still capable of natural regeneration**

Like Thorne Moors, Hatfield Moors is a remnant of the once-extensive bog and fen peatlands within the Humberhead Levels, and is still the second-largest area of extant lowland raised bog peat in England. Moraines of sand occur beneath the peat, the largest of which forms Lindholme Island, in the centre of the bog. Little, if any, original bog surface has survived the massive extraction of peat over the last few decades. Peat-cutting has now ceased, and the bog is being restored over its remaining minimum average depth of 0.5 m of peat.

Refugia of vegetation have survived as rather dry heathland and as birch *Betula* woodland. Plants include the dwarf shrubs heather *Calluna vulgaris*, cross-leaved heath *Erica tetralix*, common cottongrass *Eriophorum angustifolium*, hare's tail cottongrass *E. vaginatum*, cranberry *Vaccinium oxycoccus*, bog-rosemary *Andromeda polifolia*, bog-myrtle *Myrica gale*, and the bog-mosses *Sphagnum cuspidatum*, *S. recurvum*, *S. papillosum*, *S. subnitens* and *S. tenellum*. The bog is also notable for its invertebrate fauna, which includes the mire pill beetle *Curimopsis nigrita*.

Qualifying Species:

None

Table 1: Supplementary Advice for Qualifying Features: H7120. Degraded raised bogs still capable of natural regeneration

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	Extent of the feature within the site	Restrict the further degradation of the extent of the H7120 feature, whilst restoring 1201 ha hectares of the H7120 feature to H7110 Active Raised Bogs	There should be no measurable increase in the extent and area of this feature, and the full extent of the feature should be restored to H7110 Active Raised Bogs. The baseline-value of extent given has been generated using data taken from the site Management Plan and Definitions of Favourable Condition for the underpinning SSSI. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely - associated habitat features. For this feature, 'Bog' is taken here to be the peat deposit together with typical bog vegetation, irrespective of the precise nature and condition of that vegetation. The figure of 1201 ha includes all the peat based soils within the site, but excludes areas where no peat remains due to extraction. 'Lagg fen' comprises both peat deposit and vegetation, irrespective of nature and condition.	Natural England. 2013. Definition of Favourable Condition – Hatfield Moors SSSI Natural England. 2018. Humberhead Peatlands Site Management Plan Natural England. 2014. Site Improvement Plan – Thorne and Hatfield Moors
Extent and distribution of the feature	Spatial distribution of the feature within the site	Restrict the further degradation of the distribution of the H7120 feature, whilst expanding the distribution of the H7110 Active Raised Bog feature within the site	A contraction in the range, or geographic spread, of the current H7120 feature (and its component vegetation and typical species, plus transitional communities) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its capacity to be restored to the H7110 active raised bog feature. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and more isolated populations which are more vulnerable to extinction. These fragments also	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for some of the typical and more specialist species associated with the Annex I habitat feature. On this site the spatial extent of the feature is taken to encompass all the peat soil.	
Structure and function (including its typical species)	Soils, substrate and nutrient cycling	Restrict further degradation of the peat substrate of the H7120 feature and restore the properties of the underlying peat type, including its structure, bulk density, total carbon, pH, soil nutrient status and fungal/bacterial ratio, to within typical values for H7110 Active Raised Bog habitat.	Changes to natural properties of the bog's peat body may affect the ecological structure, function and processes associated with this Annex I feature. The typical substrate for this feature is acidic and nutrient-poor peat. Peat is distinguished from other soil types by its high content of organic matter, which results from plant growth and waterlogging combining to reduce decomposition rates and allow a build-up, over time, of semi-decomposed plant material to form peat. Peat is naturally lacking in nutrients with typically low values of calcium, phosphate, nitrate and pH. While on a typical active raised bog the surface should be made up of two distinct layers; an acrotelm and a catotelm. The thin upper layer, or 'acrotelm', is typically up to 30cms deep and consists of living plant material and is a zone of fluctuating water table, where relatively rapid plant decomposition occurs. Below this is the 'catotelm', a much thicker layer of peat which comprises broken down plant material and is always below the water table. On this site, the surface acrotelm layer has been affected by past drainage and peat cutting and has been replaced with a single layer of damaged catotelm ('haplotelm') between 0-3 metres thick, which in some places is not entirely below the water table.	
Structure and function (including its typical species)	Vegetation community composition	Restore the component vegetation communities of the H7210 feature to those resembling and characterised by the following National Vegetation Classification types typical of H7110 Active Raised Bog	This habitat feature when restored will comprise a number of associated semi-natural and natural vegetation types associated with H7110 Active Raised Bog and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and hydrology) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC).	This attribute will be periodically monitored as part of Natural England's site condition assessments McDonald, I. 2009. Flora by Foot, a botanical survey of Hatfield

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		M18 <i>Erica tetralix</i>-<i>Sphagnum papillosum</i> raised and blanket mire M2 <i>Sphagnum cuspidatum</i>/<i>Sphagnum recurvum</i> bog pool community (mire expanse and rand) M4 <i>Carex rostrata</i>-<i>Sphagnum recurvum</i> mire M6 <i>Carex echinata</i>-<i>Sphagnum recurvum/auriculatum</i> mire	Restoring degraded bog vegetation to characteristic and distinctive H7110 active bog vegetation types will be important to restoring the overall habitat feature. This will also help to conserve their typical plant species (including the constant and preferential species of a vegetation community), and therefore those of the SAC feature, at appropriate levels (recognising natural fluctuations). The component wetland types of active raised bog will comprise the bog expanse, the sloping margins of the bog (or 'rand') (although this may not always be mappable) and lagg fen. The bog expanse will typically be characterised by ombrotrophic vegetation (such as M18 <i>Erica tetralix</i>-<i>Sphagnum papillosum</i> raised and blanket mire and M2 <i>Sphagnum cuspidatum/recurvum</i> bog pool community). It should comprise an intimate mix of typical bryophytes (predominantly <i>Sphagnum</i> spp), grasses/sedges and dwarf shrubs, with no one group dominating at the expense of others on 'active' sites. <i>Sphagnum</i> should predominate on hyper-oceanic sites, while its cover may be slightly lower on eastern sites with lower rainfall. The bog rand will typically consist of communities of drier peat and the lagg fen by vegetation associated with swamp and fen habitats. The existing habitats currently fit very badly into NVC categories due to the extensive damage from drainage and peat cutting, and comprise only a small suite of the typical species. While the aim will be to restore to recognisable NVC communities, these are likely to be limited in their diversity for the foreseeable future.	Moor Yorkshire (2005-2006), Thorne and Hatfield Moors Conservation Forum That's LIFE – The Restoration of the Humberhead Peatlands – Final Report (LIFE 13NAT/UK/000451), 2019, Natural England
Structure and function (including its typical species)	Structural diversity	Restore the full range of structural features (e.g. vegetation cover, surface patterning and hydrological transitions) typically associated with H7110 Active Raised Bog to the H7120 feature at this site.	Active raised bogs in particular show varying degrees of structural variation and surface patterning reflecting hydrological gradations (which may be natural or the result of previous damage). These can occur at both macro and micro scales across the habitat and include alternative aquatic and terrestrial surface features, such as bog pools and hummocks, ridges and hollows. These features will support distinctive	Natural England. 2013. Definition of Favourable Condition – Hatfield Moors SSSI Natural England. 2018. Humberhead Peatlands Site Management Plan

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			patterns of bog vegetation, and so will be sensitive to changes in topography and hydrology. All previous natural features have been destroyed on this site, due to the removal of the original peat surface by peat cutting. However an extensive network of flooded cuttings and drains mimics some of the expected features. Typical Lagg Fen habitats have been mostly been lost, but small areas remain in places	
Structure and function (including its typical species)	Key structural, influential and/or distinctive species	Restore the abundance of the typical species listed below to enable each of them to be a viable component of H7110 Active Raised Bog habitat <i>Sphagnum</i> mosses including <i>Sphagnum capillifolium</i>; <i>S. magellanicum</i>; <i>S. papillosum</i>; <i>S. tenellum</i>; <i>Sphagnum cuspidatum</i>; <i>S. pulchrum</i>	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; • Structural species which form a key part of the Annex I habitat's structure or help to define that habitat on a particular SAC (see also the attribute for 'vegetation community composition'). • Influential species which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat) • Site-distinctive species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular SAC. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available.	Natural England. 2013. Definition of Favourable Condition – Hatfield Moors SSSI This attribute will be periodically monitored as part of Natural England's site condition assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			For this feature, the vegetation of the mire expanse should comprise an inter-mix of typical bryophytes (predominantly <i>Sphagnum</i> spp), graminoids and dwarf shrubs, with no one group dominating at the expense of others on 'active' sites. Although <i>Sphagnum</i> may predominate on hyper-oceanic sites, purple moor-grass <i>Molinia</i> may be typical and abundant on the bog margin ('rand') of active sites and more widely on degraded sites.	
Structure and function (including its typical species)	Invasive, non-native and/or introduced species	Ensure invasive and introduced non-native species are either rare or absent, and if present are not undermining the restoration of the H7120 feature	Invasive or introduced non-native species can be a serious potential threat to the structure and function of these habitats, because they are able to exclude, damage or suppress the growth of their associated typical species, reduce structural diversity of the habitat and prevent the natural regeneration of characteristic site-native species. Once established, the measures to control such species may also impact negatively on the features of interest (e.g. use of broad spectrum herbicides). The main damaging invasive non-native species on the site are Rhododendron, <i>rhododendron ponticum</i> and Himalayan Balsam <i>Impatiens glandulifera</i> is also widespread in more nutrient rich areas. Water fern, <i>Azolla filiculoides</i> has also been found.	McDonald. I. 2009. Flora by Foot, a botanical survey of Hatfield Moor Yorkshire (2005-2006), Thorne and Hatfield Moors Conservation Forum
Structure and function (including its typical species)	Supporting off-site habitat	Restore the extent, quality and spatial configuration of land or habitat surrounding or adjacent to the site which is known to support the restoration of the H7120 raised bog feature	The structure and function of the qualifying habitat, including its typical species, may rely upon the continued presence of areas which surround and are outside of the designated site boundary. Changes in surrounding land-use may adversely (directly/indirectly) affect the functioning of the feature and its component species. For example, this supporting off-site habitat may be critical to the typical species of the feature to support their population dynamics ('metapopulations') or to prevent/reduce/absorb damaging impacts from adjacent land uses The protection and management of peripheral peat and the land immediately around the peat body will be of critical functional importance to the restoration of the H7120 feature to active bog and lag. The hydrology and ongoing management of this land must also be compatible with the long-term recovery	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			and maintenance of the bog. The nature of the wider landscape within which the bog sits will determine the extent of the functionally important off-site habitat, and will need site-by-site assessment. There are a few areas of supporting habitat (birch woodland on peat), or supporting bog vegetation. There are also some adjacent areas which would support lagg fen if not in agricultural use, and would formerly have been part of the bog ecosystem	
Structure and function (including its typical species)	Hydrology	At a site, unit and/or catchment level (as necessary), restore natural hydrological processes to provide the water levels and conditions necessary to prevent further degradation of the H7120 feature within the site and to enable its restoration to H7110 active raised bog	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site. The restoration of this structural attribute of the H7120 degraded bog feature will be a key element of its recovery to H7110 active raised bog. The hydrology of degraded raised bog fails to support the processes and vegetation of active raised bog, which is the desired feature on this part of the site. Low and/or fluctuating water levels in the peat leads to oxidation and loss (wastage) of the peat along with loss of ability of the peat body to retain rainwater and accumulate peat. Bog species adapted to waterlogged, acidic and nutrient-poor conditions will be lost. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. The surface of an active raised bog has low nutrient, waterlogged or high water table conditions. An abundance of the bog-mosses <i>Sphagnum papillosum</i>, <i>S. capillifolium</i>, <i>S. tenellum</i> and <i>S. magellanicum</i> will often indicate good surface conditions. Typically, the hydrology of the H7120 habitat feature has already been degraded but is considered capable of recovery. Further detrimental changes to the hydrology of a degraded raised bog can lead to further desiccation, oxidation and a further loss of species and will undermine the aim to restore this feature to active raised bog. This target is currently generic	Natural England. 2014. Detailed Notification Review, Hatfield Moor

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts.	
Structure and function (including its typical species)	Water chemistry	Maintain the surface water and groundwater supporting the hydrology of the rain-fed bog at a low nutrient status.	Active raised bog in an undamaged state is characterised by a dome of peat which has developed through several thousand years of peat accumulation. This dome stands above the level of the surrounding land surface and effectively isolates the surface of the raised bog from the influence of groundwater. By being elevated, the raised bog is directly fed by atmospheric precipitation and so it has an acidic nature that is naturally poor in nutrients and which sustains its characteristic bog communities and associated typical species. Active raised bogs are naturally lacking in nutrients with typically low values of calcium, phosphate, nitrate and pH. The mire expanse of an active raised bog typically has low nutrient, waterlogged or high water table conditions. An abundance of the bog-mosses <i>Sphagnum papillosum</i>, <i>S. capillifolium</i>, <i>S. tenellum</i> and <i>S. magellanicum</i> will often indicate good surface condition. There are not thought to be any water inputs to the site other than rainfall.	
Structure and function (including its typical species)	Adaptation and resilience	Reduce the further degradation of the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site	This recognises the increasing likelihood of natural habitat features to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with, and adapt to environmental stress and change whilst retaining the same basic structure and ways of functioning. Such environmental changes may include changes in sea levels, precipitation and temperature for example, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. The vulnerability and response of features to such changes will vary. The overall vulnerability of this SAC to climate change has been assessed by Natural England (2015) as being high, taking into account the sensitivity, fragmentation, topography and management of its habitats. This means that this site is considered to be the most vulnerable sites overall and are likely to require the most adaptation action, most urgently. A site based assessment should be carried out as a priority.	Natural England. 2015. Climate Change Theme Plan and supporting National Biodiversity Climate Change Vulnerability assessments ('NBCCVAs') for SACs and SPAs in England [Available at http://publications.naturalengland.org.uk/publication/4954594591375360].

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			This means that action to address specific issues is likely, such as reducing habitat fragmentation, creating more habitat to buffer the site or expand the habitat into more varied landscapes and addressing particular management and condition issues. Individual species may be more or less vulnerable than their habitat itself. In many cases, change will be inevitable so appropriate monitoring would be advisable. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's recovery and long-term viability as an Active Raised Bog. Current climate change models indicate little overall change in total rainfall, but wetter winters and drier summers.	
Supporting processes (on which the feature relies)	Air quality	Restore as necessary the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	This habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH₃), oxides of nitrogen (NO_x) and sulphur dioxide (SO₂), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			measures to tackle diffuse air pollution, within realistic timescales.	
Supporting processes (on which the feature relies)	Functional connectivity with wider landscape	Restore the overall extent, quality and function of any supporting features within the local landscape which provide a critical functional connection with the site	This recognises the potential need at this site to maintain or restore the connectivity of the site to its wider landscape in order to meet the conservation objectives. These connections may take the form of landscape features, such as habitat patches, hedges, watercourses and verges, outside of the designated site boundary which are either important for the migration, dispersal and genetic exchange of those typical species closely associated with qualifying Annex I habitat features of the site. These features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity would be beneficial. Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case by case basis.	
Supporting processes (on which the feature relies)	Conservation measures	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to restore the structure, functions and supporting processes for restoration to H7110 Active Raised Bog	Active and ongoing conservation management is needed to prevent further degradation of the H7120 Degraded Raised Bog feature at this site, and, more importantly, to restore it to H7110 Active Raised Bog habitat. This information will typically be found within, where applicable, supporting documents such as the Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Usually, raised bog restoration measures will aim to elevate and stabilise the underlying water table and re-establish waterlogged conditions, so the bog can re-grow and regain its characteristic structural features (e.g. bog pools) and its typical plant assemblages. Further details about the necessary conservation measures for this site can be provided by contacting Natural England.	Natural England. 2018. Humberhead Peatlands Site Management Plan
Version Control Advice last updated: N/A				

Attributes	Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Variations from national feature-framework of integrity-guidance: N/A			