European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features

Duddon Mosses Special Area of Conservation (SAC)
Site code: UK0019833

Duddon Mosses SAC © Lawrence Hill

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About this document

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to Duddon Mosses SAC. This advice should therefore be read together with the SAC Conservation Objectives available here.

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. Any proposals or operations which may affect the site or its qualifying features should be designed so they do not adversely affect any of the attributes listed in the objectives and supplementary advice.

This supplementary advice to the Conservation Objectives describes in more detail the range of ecological attributes on which the qualifying features will depend and which are most likely to contribute to a site's overall integrity. It sets out minimum targets for each qualifying feature to achieve in order to meet the site's objectives.

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	Duddon Mosses Special Area of Conservation (SAC)
Location	Cumbria
Site maps	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	313.07 ha Black Moss, Herd House Moss south of the railway, the western part of Shaw Moss and Arnaby Moss east of the railway are not included within the SAC.
Designation Changes	n/a
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)	Duddon Mosses SSSI
Relationship with other European or International Site designations	n/a

Site background and geography

The Duddon Mosses SAC comprises a series of lowland raised bogs (locally called 'mosses') located in south Cumbria, near Broughton-in-Furness and close to the Duddon Estuary. Around a third of the SAC is managed as a National Nature Reserve by Natural England, with the rest in private ownership. The northern part of the site lies within the Lake District National Park.

The local climate is oceanic. The moderating influence of the sea results in low summer (average maximum 18.4-19^{o} C) and high winter temperatures (2.0-2.8^{o} C). The oceanic influence is also evident in the low occurrence of air frosts, recorded on only 42 days per annum at Sellafield, on the west coast of Cumbria. Annual precipitation is around 1400 mm.

The bogs lie in five separate areas between the Duddon Estuary and the head of the valley of the Kirkby Pool watercourse and are derived from an original 6-8 km of continuous wetland. The historic extent of this wetland has been almost entirely removed and the present-day Mosses represent only the centres of the surviving bogs, nonetheless supporting some of the highest quality raised bog communities in Britain. They have peat depths of up to around 6 metres and overlie some 7m depth of estuarine sediments. Peat cutting has resulted in a split-level topography on all the Mosses although the north-west of Bank End Moss, parts of both White Mosses, most of Wreaks Moss and part of Shaw Moss are thought to retain original bog surface.

By the 1980s, drying of the peat and fire damage had enabled the establishment on all the Mosses, to varying degrees, of scrub, purple moor-grass (*Molinia caerulea*) and rhododendron. Restoration works commenced in the 1990s with the aim of conserving the existing peat resource and maintaining or restoring the bog vegetation to a state where peat is actively being formed through slowing the rate of rainwater loss from the bogs to stabilise the water table and maintain it at a generally higher level. Depending on the state of the peat and vegetation, signs of recovery following works (as indicated by increased cover of bog-mosses (*Sphagnum spp*) and cotton-grasses (*Eriophorum spp*) can be seen within months to several years.

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:

- **H7110 Active raised bogs * (Priority feature)**

Active raised bogs are peat-forming ecosystems that have developed during thousands of years of peat accumulation, to such an extent that the depth of peat isolates them from the influence of groundwater. Typically, lowland raised bogs form a raised dome of peat irrigated solely by precipitation (rainfall, snow, fog).

The vegetation considered to be actively peat-forming is a mixture of heather *Calluna vulgaris*, cross-leaved heath *Erica tetralix*, deer-grass *Trichophorum germanicum*, common cotton-grass *Eriophorum angustifolium* and hare's-tail cotton-grass *E. vaginatum* with a high cover of a variety of bog-mosses, mainly *Sphagnum papillosum, S. capillifolium, S. palustre, S. cuspidatum* and *S. fallax*. Active bog is currently mainly found in the centre of the Mosses.

Within this SAC, 'active' vegetation mainly corresponds with National Vegetation Classification type **M18 *Erica tetralix-Sphagnum papillosum* raised and blanket mire** with aspects of **M15 *Scirpus cespitosus-Erica tetralix* wet heath** and **M2 *Sphagnum cuspidatum/recurvum* bog pool community.**

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

Degraded raised bogs occur where there has been widespread disruption to the structure and function of the peat body. This can involve changes to the hydrology, vegetation, and physical structure of the bog, leading to peat desiccation and oxidation and loss of species or changes in the balance of the species composition. In contrast to H7110 Active raised bogs, peat is not currently forming in degraded bog. These examples are however considered capable of natural regeneration through repair and management.

This habitat is mainly located around the margins of the Mosses, where the bog hydrology has been disrupted by peat removal, drainage and the interception of rainfall, transpiration and root growth of dense trees, scrub and rhododendron. Degraded bog is largely dominated by purple moor-grass *Molinia caerulea* and birch *Betula spp* and there are some areas of dense rhododendron, where other vegetation is generally absent. The feedback effect of lowering of the water table followed by increasing dominance of trees, shrubs and purple moor-grass means that, without intervention, the peat and vegetation will continue to degrade.

At this SAC, degraded bog mainly corresponds with National Vegetation Classification type **W4c *Betula pubescens-Molinia caerulea* woodland, *Sphagnum spp.* sub-community woodland** (with varying cover of trees). The objective of restoration is to recover these communities towards **M18 *Erica tetralix-Sphagnum papillosum* raised and blanket mire**.

Qualifying Species:

There are no qualifying species features on this site.

References

RODWELL, J.S. (ed.) 1991. *British Plant Communities. Volume 1. Woodlands and scrub*. Cambridge University Press.
RODWELL, J.S. (ed.) 1991. *British Plant Communities. Volume 2. Mires and heath*. Cambridge University Press.
NATURAL ENGLAND 2014. Duddon Mosses National Nature Reserve Management Plan 2014 - 2019

Table 1: Supplementary Advice for Qualifying Features: H7110 Active raised bogs *

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	Restore the H7110 feature over the whole site	There should be no measurable net reduction (excluding any trivial loss) in the extent and area of this feature, and in some cases, the full extent of the feature may need to be restored. The baseline-value of extent given has been generated using data gathered from the listed site-based surveys. 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. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. For this feature, the term 'Bog' is taken here to be the peat deposit together with typical bog vegetation, irrespective of the precise nature and condition of that vegetation. 'Lagg fen' comprises both peat deposit and vegetation, irrespective of nature and condition. This feature requires hydrological restoration as the effects of peat cutting and historic drainage of the remaining bog area and agricultural land combined with more recent fires and scrub invasion have resulted in the water table being lower than is optimum for 'active' (= peat-forming) vegetation. The active bog vegetation has been gradually declining in species-richness and extent.	NATURAL ENGLAND, 2014. Duddon Mosses Site Improvement Plan (SIP066).Available: http://publications.naturalengland.org.uk/publication/5667921359536128
Structure and function (including its typical species)	Vegetation community composition	Ensure the component vegetation communities of the H7110 feature are referable to and characterised by the following National Vegetation Classification types: M18 *Erica tetralix-Sphagnum papillosum* raised and blanket mire M2 *Sphagnum cuspidatum/ recurvum* bog pool community	Maintaining or restoring these distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. Following restoration, the vegetation is expected to recover to the M18 and M2 communities, with transitions between them. The lagg (or marginal fen) is currently mainly absent but could include the following vegetation communities; M4 *Carex rostrata-Sphagnum recurvum* mire; M6 *Carex echinata-Sphagnum recurvum/auriculatum* mire; M23 *Juncus effusus/acutiflorus-Galium palustre* rush-pasture; M25 *Molinia caerulea-Potentilla erecta* mire; M27 *Filipendula ulmaria-Angelica sylvestris* mire; S4 *Phragmites australis* swamp & reedbeds S27 *Carex rostrata-Potentilla palustris* fen; W5 *Alnus glutinosa – Carex paniculata* woodland; W6 *Alnus glutinosa – Urtica dioica* woodland. *Sphagnum recurvum* includes what are now called *S. fallax, S angustifolium and S. flexuosum.*	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	Structural diversity	Restore the full range of typical structural features associated with the H7110 feature at this site, e.g. vegetation cover, surface patterning and hydrological zonations	A raised bog with appropriate hydrology will possess a domed structure comprising the mire expanse (the centre), the rand (sloping edge) and the lagg (marginal fen with groundwater influence). 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 macro and micro scales across the habitat and include alternative aquatic and terrestrial surface features, such as pools and hummocks, and terrestrial features such as ridges and hollows. These features will support distinctive patterns of bog vegetation, and so will be sensitive to changes in topography and hydrology. These can be modified or disrupted by activities such as drainage, burning, grazing, vehicular access and peat digging.	
	Key structural, influential and distinctive species	Restore the abundance of the species listed below to enable each of them to be a viable component of H7110 Active Raised Bog habitat; 1. Mixed assemblage of typical bryophytes (predominantly *Sphagnum* spp), Cyperaceae and dwarf shrubs (mainly Ericaceae) 2.Nightjar *Caprimulgus europaeus* (not expected to be present in every year as this site is at the edge of its range) 3.Adder *Vipera berus* 4. Large heath butterfly *Coenonympha tullia* 5. Veilwort *Pallavicinia lyellii* 6. Assemblage of wet mire invertebrates (including bog bush cricket *Metrioptera brachyptera* and raft spider *Dolomedes fimbriatus*	Some plant or animal species (or related groups of such species) make a particularly important contribution to the 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 habitat's structure or help to define an Annex I habitat on a site (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 site. 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. For this feature, the vegetation of the mire expanse should comprise an inter-mix of typical bryophytes (predominantly *Sphagnum* spp), grasses and dwarf shrubs, with no one group dominating at the expense of others on 'active' sites.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
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, but if present are causing minimal damage to the H7110 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 pesticides). *Rhododendron ponticum* is widespread on this site and is considered to be a threat due to its adverse impact on bog vegetation and hydrology.	
	Supporting off-site habitat	Restore the extent, quality and spatial configuration of land or habitat surrounding or adjacent to the site which supports the H7110 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. This supporting habitat may be critical to key typical species of the feature to support their feeding, breeding, roosting, population dynamics ('metapopulations'), pollination or to prevent, reduce or absorb impacts on the feature from adjacent land uses e.g. pesticide drift, nutrient enrichment. For this feature the protection and management of peripheral peat and the land immediately outside the designated site may be of critical functional importance to the restoration or maintenance of the hydrology of active bog and its management must also be compatible with long-term maintenance of the bog.	EATON M.,FOWERAKER, M. J., GOODALL R. & HARRIS, K. E. (2006) Definition of Hydrological Protection Zones at Lowland Bog Sites in Cumbria: Duddon Mosses. Report for the Environment Agency. Capita Symonds Ltd
Structure and function (including its typical species)	Hydrology	At a site level, restore natural hydrological processes to provide the conditions necessary to sustain the H7110 feature within the site	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. 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. Raised bogs require a high and stable water table within the peat body. Artificial drainage and peat removal or disturbance may increase the rate of water loss from the bog. Historic damage should be repaired and new activities that lower the water table or expose peat to aerobic conditions should be avoided. Groundwater should not be allowed onto the bog. In active bogs, the rate of accumulation of dead plant remains exceeds the rate of decay. This is only possible when the water table (derived from precipitation only) is at the surface for most of the year.	LABADZ, J. & BUTCHER, D. (2004) Investigation of the Effects of Environment Agency Drainage Maintenance Regimes on Raised Mire SACs and adjacent Agricultural Land in Cumbria: Duddon Mosses. The Nottingham Trent University for Environment Agency and English Nature

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	Water chemistry	Maintain the surface water and groundwater supporting the hydrology of the H7110 feature at a low nutrient status	This habitat type is predominantly rain-fed and should be naturally low in nutrients to sustain its characteristic bog communities and associated typical species. Any sources of water which contributes to supporting the bog habitat, including the margins of the bog and the lagg (the peripheral zone around the bog), should similarly be lacking in nutrients.	
	Soils, substrate and nutrient cycling	Restore the properties of the underlying peat, including structure, bulk density, total carbon, pH, soil nutrient status and fungal:bacterial ratio, to within typical values for H7110 Active Raised Bogs habitat	Changes to natural peat properties may affect the ecological structure, function and processes associated with this Annex I feature. The typical substrate for this feature is acidic and nutrient/mineral-poor peat with a water content of over 85%. 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. The peat-forming vegetation and zone of peat deposition ('acrotelm') overlies up to 8 metres of consolidated peat ('catotelm'). To maintain the catotelm/peat body, the peat should be saturated, anaerobic, acidic and nutrient-poor and water movement should be minimal. Any activities that lower the water table will expose the peat to oxygen, increase nutrient levels or change the acidity. Any of these impacts will be detrimental.	
Structure and function (including its typical species)	Adaptation and resilience	Restore the H7110 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 precipitation and temperature for example, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. 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 long-term viability. The H7110 feature will be most resilient when the hydrology and topography approach that found on undamaged sites, vegetation is actively peat-forming and the bog is unconstrained to spread or contract vertically or laterally. The overall vulnerability of this particular SAC to climate change has been assessed by	NATURAL ENGLAND, 2015. Climate Change Theme Plan and National Biodiversity Climate Change Vulnerability Assessments (NBCCVAs). Available at http://publications.naturalengland.org.uk/publication/4954594591375360

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Natural England as being *moderate*, taking into account the sensitivity, fragmentation, topography and management of its habitats. This means that some adaptation action for specific issues may be required, 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 required.	
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. The critical loads for Nitrogen and Acidity are currently being exceeded at this site (APIS accessed 21/12/2015) 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 (NOx) 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 measures to tackle diffuse air pollution, within realistic timescales.	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.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
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 associated with the H7110 feature	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements.	NATURAL ENGLAND, 2014. Duddon Mosses Site Improvement Plan (SIP066).Available: http://publications.naturalengland.org.uk/publication/5667921359536128 NATURAL ENGLAND, 2014. Duddon Mosses NNR Management Plan 2014 – 2019 NATURAL ENGLAND, 2005. Views About Management A statement of English Nature's views about the management of Duddon Mosses Site of Special Scientific Interest (SSSI). http://www.sssi.naturalengland.org.uk/Special/sssi/vam/VAM%201000199.pdf
Version Control n/a				
Variations from national feature-framework of integrity-guidance: An attribute for *''Spatial distribution of the feature within the site'* is not applicable to this site as the bog is confined to the part of the site on deep peat and outside the influence of groundwater, apart from the lagg, and is not mobile. An attribute for *'Functional connectivity with wider landscape* is not applicable as the site does not rely on ecological connectivity to other wetland sites.				

Table 2: 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	Avoid further degradation in the extent of the H7120 feature, whilst restoring the H7120 feature to H7110 Active Raised Bog by 2035	The Annex I habitat of 'degraded raised bogs' only includes examples which are 'capable of natural regeneration', i.e. "*where the hydrology can be repaired and where, with appropriate rehabilitation management there is a reasonable expectation of re-establishing vegetation with peat-forming capability within 30 years*" (European Commission, 2013). There should be no measurable net increase in the extent and area of this feature, and in most cases, the full extent of the feature should be restored to H7110 Active Raised Bogs. No area is given for this feature as, whilst it is mainly present in former peat cuttings, it also occurs as a mosaic with Active Raised Bogs. 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. 'Lagg fen' comprises both peat deposit and vegetation, irrespective of nature and condition.	EUROPEAN COMMISSION, 2013. Interpretation Manual of European Habitats. EUR 28 p84
Structure and function (including its typical species)	Soils, substrate and nutrient cycling	Avoid any 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. The surface of an active raised bog 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 (typically up to 10 metres), which comprises broken down plant material and is always below the water table. The surface acrotelm layer of degraded raised bogs affected by past drainage or burning may be replaced with a single layer of damaged catotelm ('haplotelm').	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
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; M18 *Erica tetralix-Sphagnum papillosum* raised and blanket mire M2 *Sphagnum cuspidatum/Sphagnum recurvum* bog pool community (mire expanse and rand) M4 *Carex rostrata-Sphagnum recurvum* mire M6 Carex *echinata-Sphagnum recurvum/ auriculatum* mire M23 *Juncus effusus/acutiflorus-Galium palustre* rush-pasture M25 *Molinia caerulea-Potentilla erecta* mire M27 *Filipendula ulmaria-Angelica sylvestris* mire S4 *Phragmites australis* swamp & reedbeds S27 *Carex rostrata-Potentilla palustris* fen W5 *Alnus glutinosa – Carex paniculata* woodland W6 *Alnus glutinosa – Urtica dioica* woodland (lagg)	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). 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). Degraded raised bog on this site is currently characterised by an impoverished vegetation mainly dominated by purple moor-grass *Molinia caerulea* with dense to sparse cover of birch *Betula spp,* pine *Pinus sylvestris* and rhododendron *Rhododendron ponticum* and lacking significant cover of any bog mosses *Sphagnum* spp. These communities will have low representation when the site is restored to H7110 Active Raised Bogs. 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 *Erica tetralix-Sphagnum papillosum* raised and blanket mire and M2 *Sphagnum cuspidatum/recurvum* bog pool community). It should comprise an intimate mix of typical bryophytes (predominantly Sphagnum spp), cotton-grasses/sedges and dwarf shrubs, with no one group dominating at the expense of others on 'active' sites. Sphagnum should predominate on hyper-oceanic sites like this one. The bog rand will typically consist of communities of drier peat and the lagg fen by vegetation associated with swamp and fen habitats.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
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	Development of structural features is an indicator of hydrologically suitable conditions for restoration to the Active Raised Bogs feature. 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 patterns of bog vegetation, and so will be sensitive to changes in topography and hydrology. These can be modified or disrupted by activities such as drainage, burning, grazing, vehicular access and peat digging.	
	Key structural, influential and distinctive species	Restore the abundance of the species listed below to enable each of them to be a viable component of H7110 Active Raised Bog habitat; [see species listed for the H7110 feature in table 1 above]	See the notes for this attribute in Table 1 above.	
	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. the use of broad spectrum herbicides). *Rhododendron ponticum* is widely distributed on this site and is considered to be a threat to the bog vegetation and hydrology.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
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 degraded bog feature	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 lagg. Such land may lie outside of the designated site boundary. The hydrology and ongoing management of this 'functionally-linked' land must also be compatible with the long-term recovery 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.	EATON M.,FOWERAKER, M. J., GOODALL R., & HARRIS, K. E. (2006) Definition of Hydrological Protection Zones at Lowland Bog Sites in Cumbria: Duddon Mosses. Report for the Environment Agency. Capita Symonds Ltd
	Hydrology	At a site level, 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. Restoration of a constantly high water table in the peat will largely covert degraded bog to active bog. 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 *Sphagnum papillosum, S. capillifolium, S. tenellum* and *S. magellanicum* 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 and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts.	LABADZ, J. & BUTCHER, D. (2004) Investigation of the Effects of Environment Agency Drainage Maintenance Regimes on Raised Mire SACs and adjacent Agricultural Land in Cumbria: Duddon Mosses. The Nottingham Trent University for Environment Agency and English Nature

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	Water chemistry	Maintain the surface water and groundwater supporting the hydrology of the H7120 feature at a low nutrient status	Due to its position above the ground water table, the mire expanse and rand of this habitat type obtain their water from precipitation, which interacts with the bog's vegetation to produce naturally low nutrient levels which sustain its characteristic bog communities and associated typical species. Any sources of water which contributes to supporting the bog habitat, including the margins of the bog and the lagg (the peripheral zone around the bog), should similarly be lacking in nutrients.	
Supporting processes (on which the feature relies)	Air quality	Restore 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 (see the notes for this attribute in Table 1 above). The critical loads for Nitrogen and Acidity are currently being exceeded at this site. (APIS accessed 21/12/2015)	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.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
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. 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. 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.	NATURAL ENGLAND, 2014. Duddon Mosses Site Improvement Plan (SIP066).Available: http://publications.naturalengland.org.uk/publication/5667921359536128 NATURAL ENGLAND, 2014. Duddon Mosses NNR Management Plan 2014 – 2019 NATURAL ENGLAND, 2005. A statement of English Nature's views about the management of Duddon Mosses Site of Special Scientific Interest (SSSI). http://www.sssi.naturalengland.org.uk/Special/sssi/vam/VAM%201000199.pdf
Version Control Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: Attributes considered to be not applicable to this site: *Adaptation and resilience* (on this site, degraded bog will succeed to woodland) *Functional connectivity* (covered by hydrology)				