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

Windsor Forest and Great Park Special Area of Conservation (SAC)
Site code: UK0012586

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Date of Publication: 12 January 2019

About this document

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to Windsor Forest and Great Park 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'

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	Windsor Forest and Great Park Special Area of Conservation (SAC)
Location	Royal Borough of Windsor and Maidenhead Runnymede Borough Council Bracknell Forest Borough Council Surrey County Council
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	1687.26 hectares
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)	Windsor Forest and Great Park
Relationship with other European or International Site designations	n/a

Site background and geography

Windsor Forest and Great Park is situated in the Thames Valley National Character Area. The surrounding landscape is largely flat to gently undulating, with low hills, predominantly rural in character but with numerous small and larger settlements. The main land uses in the area are mixed farming, timber production and grassland management for horse grazing. Parts of Windsor Forest and Great Park are open to the public and it is a very popular facility for walkers, cyclists and horse-riders. Together with Windsor Castle to the north, and Runnymede to the east the site is a very popular tourist destination. The high amenity and landscape value of Windsor Great Park makes it a significant boost to the local economy, reflected in high property values.

Windsor Forest and Great Park is internationally important for its dry oak-dominated landscape and internationally rare invertebrates, in particular beetles and other invertebrates strongly associated with ancient tree and dead wood habitat. A wide range of habitat types of value for specialised invertebrates is present at the site including damp, shady woodland, open parkland, grazed wood pasture, ponds and wetlands, flower-rich grassland and scrub. The site has one of the largest aggregations of ancient trees in Europe with an abundance of very old oaks but there are also a large number of ancient trees of many other species. Many of the older trees have features which are of very high value to specialised invertebrates such as internal rot cavities, sap runs, large-diameter dead limbs, detached bark, naturally formed pools and fungal fruiting bodies.

The Park dates back to the 11th century when it provided important functions as a source of food and timber for Windsor Castle but in later times the park was re-modelled and laid out with formal landscape features such as broad avenues of trees, coverts and clumps, small woods and broad vistas.

Many of the trees present are exceptionally old and these are in a range of different situations ranging from open parkland to dense woodland and plantation. In addition to its importance for decaying wood and parkland invertebrates, Windsor Forest and Great Park supports an outstanding assemblage of fungi, many of which are very rare.

The site is situated on alluvial sediments derived from river terrace deposits to the south of the River Thames in Berkshire to the west of London. The underlying soils are mainly poorly-draining, with a silty or sandy composition and containing abundant flint gravel. However, some parts of the site have a more free-draining, drought-prone character. The soils are mainly neutral to moderately acidic which is demonstrated in the vegetation which includes plants associated with acid grassland and heaths.

Large parts of the site are highly modified in character, as a consequence of historical woodland management, landscape planting and agricultural activity. However, the more 'natural' parts of the site support woodland which has a composition which is highly characteristic of the oak – bracken - bramble type, described in the National Vegetation Classification as W10 *Quercus robur – Pteridium aquilinum – Rubus fruticosus* woodland. This is typical of the south east of the UK where it is widespread but highly fragmented.

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:

- **H9190 Old acidophilous oak woods with *Quercus robur* on sandy plains**

  This habitat type comprises ancient lowland oak woodland on acidic, sandy or gravelly substrates. Veteran trees are relatively abundant in UK stands compared to examples in continental Europe, and are often associated with assemblages of notable lichens, fungi and invertebrates. The ground flora is typically species-poor.

  Windsor Forest and Great Park represents old acidophilous oak woods in the south-eastern part of its UK range. It has the largest aggregation of ancient and veteran oaks in Britain (and probably in Europe), a consequence of its long history as a royal park and hunting ground and management as wood-pasture. This very long continuity of management means it is of importance for its range and diversity of saproxylic invertebrates (ie those associated with decaying wood), including many rare species, for example the oak click-beetle *Lacon querceus*, which has only ever been recorded at this site in the UK.

  The site also supports an exceptional diversity of invertebrates associated with long-established woodland and parkland. Windsor Forest and Great Park is also of importance in supporting an outstanding assemblage of fungi, including some very rare species associated with veteran trees and ancient unimproved soils.

- **H9120 Atlantic acidophilous beech forests with *Ilex* and sometimes also *Taxus* in the shrub layer (Quercion robori-petraeae or Ilici-Fagenion) Beech forests on acid soils**

  This habitat type comprises beech *Fagus sylvatica* forests with holly *Ilex aquifolium*, growing on acid soils in a humid Atlantic climate. Sites of this habitat type often are, or were, managed as wood-pasture systems, in which pollarding of beech and oak *Quercus* spp. was common. This is known to prolong the life of these trees. In the UK the native range of this Annex I type is restricted, and extensive stands on acid sites are rare outside south-east England. Windsor Forest and Great Park has examples of this habitat type but its presence is not a primary reason for SAC selection.

  At Windsor Forest and Great Park this Annex I type is mostly present as part of a complex mosaic with acidophilous oak woodland and it shares many of the associated species. Some stands are on the site of Ancient Woodland but have been modified by historic planting. This is gradually being reversed through long-term habitat restoration. The key feature of the habitat type at Windsor Forest and Great Park is the large number of veteran trees, including trees with very large girth, which contributes significantly to the site's overall importance for saproxylic invertebrates and fungi.

  The primary reason that the site is of exceptional nature conservation interest derives from the outstanding assemblage of ancient and veteran trees, within a diversity of habitat and landscape situations forming a landscape-scale habitat mosaic. The long continuity of such a large number of old trees spread over a large area makes it of special importance to outstanding assemblages of insect and fungi, including very rare and specialist species, many of which have very limited powers of dispersal.

Qualifying Species:

- **S1079 Violet click beetle *Limoniscus violaceus***

  Violet click beetle *Limoniscus violaceus* was first recorded at Windsor Forest in 1937. The site is thought to support the largest of the three known populations of this species in the UK. The beetle is highly elusive and has highly specific habitat requirements, being strongly associated with large-diameter veteran trees with internal cavities containing large quantities of slowly-decaying wood in the form of moist humus-rich 'compost'.

  At Windsor Forest and Great Park violet click beetle is strongly associated with veteran beech trees but the species is known to utilise a wide range of other tree species, including oak, and it appears to be the habitat structure which is important rather than tree species (Gouix N, Mertlik J, Jarzabeck-Müller A, Nemeth T & Brustel H 2012)**.**

  The larvae are thought to live for several years and are dependent upon the maintenance of stable environmental conditions of high humidity. The adults emerge in spring and are thought to live for only a short time, finding a mate and laying eggs in a suitable tree. Although the adults can fly the species is thought to have poor powers of dispersal and individual beetles may travel only a few metres from their host tree. The difficulties in surveying for this species and requirement for specialist identification mean that there are very few records of violet click-beetle.

Violet click beetle (Roger Key/Peoples Trust for Endangered Species)

References

Gouix N, Mertlik J, Jarzabeck-Müller A, Nemeth T & Brustel H 2012 Known status of the endangered western Palaearctic violet click beetle (*Limoniscus violaceus*) (Coleoptera). *Journal of Natural History* v46 p769-802.

Rodwell JS (ed) 1991 B*ritish Plant Communities. Volume 1. Woodlands and scrub***.** Cambridge University Press.

Table 1: Supplementary Advice for Qualifying Features: H9120. Atlantic acidophilous beech forests with *Ilex* and sometimes also *Taxus* in the shrub layer (Quercion robori-petraeae or Ilici-Fagenion); 'Beech forests on acid soils'

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**	Maintain the total extent of the H9120 feature at or above 272.69 hectares.	There should be no measurable reduction (excluding any trivial loss) in the extent and area of this feature, although it is acknowledged that it can be difficult to separate this habitat from the H9190 feature. The baseline value of extent was generated from field surveys at the time of SAC classification and will include a degree of error. The objective is to seek to maintain overall native woodland cover except where clearance will benefit the long-term condition of the feature, such as by reducing shading of veteran trees or the restoration of wood pasture. 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. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis.	
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Maintain the distribution and configuration of the H9120 feature, including where applicable its component vegetation types, across the site	A contraction in the range, or geographic spread, of the 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 resilience to adapt to future environmental changes. Fragmentation and loss of woodland and veteran trees in the past has meant there is a pressing need to maintain and increase the number of veteran trees and area of the habitat to support woodland dependent species and habitats. The best places to develop new woodland for biodiversity is adjacent to, buffering and linking existing sites from which colonisation of the relevant plants, animals (including decaying wood insects) and fungi can happen. This will increase the robustness of these populations making them more resilient to current and future pressures and stresses. In the case of Windsor Forest and Great Park a key issue of concern is the age-gap between the current cohort of veteran trees and the next generation of trees which have the potential to take their place. This is a common feature of many parkland and wood pasture sites with veteran trees. It will therefore	LEWIS J 1999 Windsor Forest and Great Park. Nature Conservation Priority Areas – A Focus for Future Management. English Nature. Provides a summary of survey data available up to that date and provides maps showing the distribution of veteran trees.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			be important, in planning woodland management, to ensure that measures are in place to retain and protect trees which may be the next generation of veterans and to ensure that trees of all ages are distributed across the site. Long-term parkland and woodland management planning should also consider the species of trees which may represent future generations of veteran trees. Many of the particularly rare wood-decay invertebrates and fungi are associated with a single species or microhabitat (such as a specific type of decay or veteran tree feature) and therefore will require a continuity of that tree species, and the full diversity of associated features in order to survive in the long-term.	
Structure and function (including its typical species)	**Vegetation community composition**	Ensure the component vegetation communities of the H9120 feature are referable to and characterised by the following National Vegetation Classification types: NVC W14 NVC W15	This habitat feature is comprised of a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. At Windsor Forest and Great Park many stands of trees and individual trees of high nature conservation value are set in a historic parkland landscape rather than semi-natural woodland and so have an atypical composition. The objective relates to those areas of long-established woodland and plantation on the site of ancient woodland.	
Structure and function (including its typical species)	**Canopy cover**	Maintain or restore where necessary a canopy of open grown native trees with free crowns over between 20-80% of each stand.	Parts of the woodland at Windsor Forest and Great Park have a modified structure as a result of past planting and silvicultural treatment. The objective is to seek to restore a structure in which trees with crowns which have developed in open situations rather than in shady woodland are a prominent and widespread component. This will help to ensure continuity of the species associated with the veteran tree assemblage as open-grown trees will generally have greater value for specialised organisms than trees in a closed canopy.	
Structure and function (including its typical species)	**Open space**	Maintain or restore where necessary areas of permanent/ temporary open space within the woodland feature, typically to cover between 10-30% of woodland area	Woodland structure includes variations in age, tree form, layering, the distribution and abundance of open space and dead wood. It plays a critical role in woodland ecosystem functioning. The target is intended for guidance only as it is acknowledged that the woodland at Windsor Forest and Great Park is set in a much wider habitat mosaic with large areas of open habitat and transitions between woodland and grassland. To be of greatest value in a parkland and wood pasture context open space should be in the form of warm, sheltered glades which provide opportunities	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			for invertebrates to feed, find nectar and pollen, rest, regulate their temperature and over-winter. Glades should be flower-rich and be in close proximity to veteran trees and standing or fallen dead wood. Other component habitats associated with open space such as stands of bramble, thickets and areas of scrub are also of high value.	
Structure and function (including its typical species)	**Old growth**	Maintain the extent and the continuity of the assemblages of veteran and ancient trees.	The objective of maintenance of the assemblage of veteran and ancient trees should be interpreted as meaning seeking to ensure long-term continuity of the assemblage, which includes the presence of replacement cohorts of trees with the potential to provide future veteran trees.	
Structure and function (including its typical species)	**Dead and decaying wood**	Maintain the continuity and abundance of standing and fallen dead and decaying wood, typically between 30 - 50 m^3 per hectare of standing or fallen decaying wood or 3-5 fallen trees >30cm diameter per hectare, and >10 standing dead trees per hectare	The availability of dead and decaying wood is of critical importance at this site. It plays a critical role in supporting the specialised saproxylic invertebrate assemblage and the assemblage of fungi. Dead and actively decaying wood will generally be of greatest value when it is of large-diameter and situated in a variety of situations, including humid, shady or partly shaded, and open sunny places. Slowly decaying standing 'hulks', large decaying tree stumps and large windthrown trees with root plates attached are of particular value as part of a varied woodland ecosystem. Large living trees with large diameter dead wood in the canopy, internal decay, cavities and rot holes are also very important features. Fallen deadwood is generally of greatest value where it is left to decay naturally in situ rather than moved, and retained as large, uncut pieces.	
Structure and function (including its typical species)	**Ancient/ veteran trees**	Restore the open space around at least 75% of ancient/veteran trees so that they are growing in open locations or with open halo around them,	Good woodland structure includes variations in age, tree form, layering, the distribution and abundance of open space and dead wood. It plays a critical role in woodland ecosystem functioning. For this Annex I habitat type, individual trees of great age and/or size (veteran or ancient trees) are particularly characteristic and important features, and their continuity should be a priority. Excessive shading by surrounding tall trees can be a significant cause of decline in the health of ancient trees in cases where the trees would have initially grown in a more open situation. Reducing this shading through sensitive clearance of surrounding trees can improve their vitality and prolong their life but this must be carried out with care as rapid changes in the immediate environment of ancient trees may cause such a shock that they die, and/or make the tree more vulnerable to high winds. Protecting their root systems and the forest soils around them will also be important. A significant amount of work has been carried out at this site to improve	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			habitat conditions for veteran trees. In particular, sensitive 'haloing' to reduce the level of shading has been beneficial. However, further work of this nature to increase the proportion of veteran trees which are not affected by excessive shading or competition from surrounding trees would help to secure improved prospects for veteran tree longevity and their associated species assemblages.	
Structure and function (including its typical species)	**Tree age class distribution**	Maintain at least 4 age classes (well-established saplings with space to develop an open crown/ middle age/ mature/over-mature) spread across the average life expectancy of the commonest trees.	In common with many parkland and wood pasture sites Windsor Forest and Great Park has significant gaps in the representation of different age classes of trees, including beech and oak. The presence of a range of tree age classes over the long-term is critical in ensuring that new generations of future veteran trees continue to be present into the long-term i.e. the next 500 years. This objective should seek to maintain the overall distribution of the veteran tree assemblage across the site, and restore presence where significant gaps in distribution have appeared. Many species associated with veteran trees have poor powers of dispersal and populations of particular species can become isolated and at risk of extinction if they are unable to locate suitable habitat if 'host' trees are lost or become unsuitable.	
Structure and function (including its typical species)	**Shrub layer**	Maintain or restore where necessary an understorey of shrubs and trees covering 15 - 30% of the semi-natural woodland areas of the site.	A varied shrub layer consisting of characteristic associated native shrubs and young trees is a characteristic feature of semi-natural woodland. It provides structure and cover for a wide diversity of organisms. The presence of flowering trees and shrubs is of critical importance in supporting woodland invertebrates.	
Structure and function (including its typical species)	**Woodland edge**	Maintain or restore where practically achievable a graduated woodland edge into adjacent semi-natural open habitats, other woodland/ wood-pasture types or scrub.	Woodland edge is defined as being the transitional zone between the forest feature and adjacent but different habitat types. These transitions, where present as a highly structured interface are often of very high value for nesting birds, and in providing shelter, resting and feeding habitat for invertebrates.	
Structure and function (including its typical species)	**Adaptation and resilience**	Maintain the resilience of the feature to climate change.	The overall vulnerability of this SAC to climate change has been assessed by Natural England (2015) as being low, taking into account the sensitivity, fragmentation, topography and management of its habitats. This means that this site is considered to be vulnerable overall but are a lower priority for further assessment and action. Individual species may be more or less vulnerable than their supporting habitat itself. In many cases, change will be inevitable so appropriate monitoring would be advisable. This recognises the increasing likelihood of natural habitat features needing 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	NATURAL ENGLAND (2015). Climate Change Theme Plan and supporting National Biodiversity Climate Change Vulnerability assessments ('NBCCVAs') for SACs and SPAs in

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			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. The vulnerability and response of features to such changes will vary. 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. In the case of Windsor Forest and Great Park the expected influences related to climate change with greatest potential to affect the features of conservation interest are the arrival of 'new' pests and diseases, increased variation in rainfall (resulting in waterlogging or drying out of tree roots), increased frequency of storm events and increased fire risk. Resilience will require a range of responses, including the ability to respond quickly to threats from pests and diseases, good woodland management, sensitive management of veteran trees, control of fire risk and protection of the root zones of mature and over-mature trees. The maintenance of habitat continuity across the site and with the wider landscape will also be important.	England Available at http://publications.naturalengland.org.uk/publication/4954594591375360]. NERC 2016 Climate Change Impact Report Cards. Natural England (2014) Windsor Forest and Great Park Site Improvement Plan. Available from: http://publications.naturalengland.org.uk/publication/6221375450644480
Supporting processes (on which the feature relies)	**Functional connectivity with wider landscape**	Maintain 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, open grown trees, 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. In the case of Windsor Forest and Great Park important features of the surrounding landscape in helping to support the species assemblages and their ability to move across the landscape will include mature and over-mature trees, which may be situated in fields, hedgerows, road verges, built-up areas,	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			woods and riverbanks. Also of importance will be areas of semi-natural woodland, patches of scrub, flower-rich grassland and field margins, and river corridors, as all of these features provide important linking habitat for bats, invertebrates and birds.	
Structure and function (including its typical species)	**Tree and shrub species composition**	Maintain or restore where necessary a canopy and under-storey of which 95% is composed of site native trees and shrubs in the areas of semi-natural woodland and plantation on ancient woodland.	Native trees and shrubs in general support a greater diversity of associated species than non-native species, especially amongst groups of invertebrates which depend directly on trees for food and shelter. There are many plants and animals which use or co-exist with non-native trees, but many rare and threatened woodland species are specialists adapted to one or a few native trees or shrub species. In those parts of the site where the composition of the woodland has been modified by historical planting of non-native trees or establishment of non-native shrubs the long-term objective should be to restore a more natural composition typical of the woodland type.	
Structure and function (including its typical species)	**Browsing and grazing by herbivores**	Maintain browsing/grazing to sufficient levels to allow tree seedlings and saplings the opportunity to exceed browse height, and which maintain the characteristic structure of the woodland feature in the areas of semi-natural woodland.	Herbivores, especially deer, are an integral part of woodland ecosystems. They are important in influencing woodland regeneration, composition and structure and therefore in shaping woodland wildlife communities. In general, both light grazing and browsing is desirable to promote both a diverse woodland structure and continuous seedling establishment. Short periods with no grazing at all can allow fresh natural regeneration of trees, but a long-term absence of herbivores can result in excessively dense thickets of young trees which shade out ground flora and lower plant species. However, heavy browsing by deer or livestock can prevent woodland regeneration, and can cause excessive trampling and/or poaching damage, canopy fragmentation, bark stripping and impacts on the ground layer.	
Structure and function (including its typical species)	**Regeneration potential**	Maintain the potential for sufficient natural regeneration of desirable trees and shrubs.	The regeneration potential of the woodland feature must be maintained if the woodland is to be sustained and survive into the long-term, both in terms of quantity of regeneration and in terms of appropriate species. This will Include regeneration of the trees and shrubs from saplings or suckers, regrowth from coppice stools or pollards, and where appropriate planting. Browsing and grazing levels must permit regeneration at least in sufficient quantity to maintain canopy cover. Typically, good regeneration potential will be indicated by the presence of tree seedlings and saplings of desirable species (above grazing and browsing height) in sufficient numbers in gaps, at the wood edge and/or as regrowth as appropriate, to maintain long-term canopy cover in the areas of semi-natural woodland.	
Structure and function	**Key structural,**	Maintain the abundance of the species listed to enable each of	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure, function and/or	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
(including its typical species)	**influential and/or distinctive species**	them to be a viable component of the Annex I habitat feature (referring to the areas of semi-natural woodland): *Trees and shrubs* Beech *Fagus sylvatica* Pedunculate oak *Quercus robur* Silver birch *Betula pendula* Hornbeam *Carpinus betulus* Rowan *Sorbus aucuparia* Cherry *Prunus avium* Holly *Ilex aquifolium* Hawthorn *Crataegus monogyna* Bramble *Rubus fruticosus* *Other plants* Honeysuckle *Lonicera periclymenum* Male fern *Dryopteris filix-mas* Broad buckler-fern *Dryopteris dilatata* Pignut *Conopodium majus* Wood sorrel *Oxalis acetosella* Wood anemone *Anemone nemoralis* Bluebell *Endymion non-scriptus* Wood speedwell *Veronica montana* Primrose *Primula vulgaris* Hairy wood-rush *Luzula pilosa* Black bryony *Tamus communis* Broad-leaved helleborine *Epipactis helleborine* Assemblages of specialised fungi Assemblages of saproxylic invertebrates	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.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		Assemblages of epiphytic lichens Assemblage of bats		
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 feature	Invasive or introduced non-native species are a serious potential threat to the biodiversity of native and ancient woods, because they are able to exclude, damage or suppress the growth of native tree, shrub and ground species (and their associated typical species), reduce structural diversity 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 (eg use of broad spectrum pesticides). Such species can include *Rhododendrons*, snowberry, Japanese knotweed, giant hogweed and Himalayan balsam, for example. Similarly, this would include pheasants, rabbits and non-native invertebrate 'pest' species. Of particular concern at Windsor Forest and Great Park is the abundance and wide distribution of *Rhododendron* species, including the highly invasive *Rhododendron ponticum*. *Rhododendron* produces dense thickets which exclude other species through shading and the production of toxins, and it is a host of the pathogen which causes the syndrome referred to as Sudden Oak Death. Also of concern is the spread of oak processionary moth *Thaumetopoea processionea*. This invasive non-native species can have significant impacts on the health of ancient oaks as its caterpillars may de-foliate trees at a critical time of the year. Current control methods are limited and have damaging impacts on the invertebrate assemblage associated with trees and their supporting habitat. The non-native muntjac deer *Muntiacus reevesi* may pose a risk to ground flora (and hence the abundance of flowers and nectar sources) and tree/shrub regeneration. Pheasants are known to have impacts on invertebrate populations but the scale of those impacts will vary in relation to numbers, management practices and population density. Consideration of the scale of potential impacts may be necessary where changes in game management are proposed.	Natural England (2014) Windsor Forest and Great Park Site Improvement Plan. Available from: http://publications.naturalengland.org.uk/publication/6221375450644480
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Maintain the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal:bacterial ratio, to	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		within typical values for the habitat in the areas of semi-natural woodland.	properties may therefore affect the ecological structure, function and processes associated with this Annex I feature.	
Structure and function (including its typical species)	**Root zones of ancient trees**	Maintain the soil structure within and around the root zones of the mature and ancient tree cohort in an un-compacted condition	The management of land within and around forest habitats which are characterised by ancient trees can be crucial to their individual welfare and long-term continuity, and the landscape they are part of can be just as or even more important. The condition of the soil surrounding such trees will affect their roots, associated mycorrhizal fungi and growth. Plants have difficulty in compacted soil because the mineral grains are pressed together, leaving little space for air and water which are essential for root growth. Unless carefully managed, activities such as construction, forestry management and trampling by grazing livestock and human feet during recreational activity may all contribute to excessive soil compaction around ancient trees.	
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level as necessary, maintain natural hydrological processes to provide the conditions necessary to sustain the semi-natural woodland 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. Disruption/damage to hydrological processes could be caused by activities at some distance from the site boundary, eg through extraction of ground or surface waters; diverting or damming river channels; pollution of water source; channel alignment that disrupts natural geomorphological processes; tunnelling etc.	The assumed hydrological catchment of the site is identified in the site characterisation undertaken as part of the review of Environment Agency consents.
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 (particularly epiphytic lichens). 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	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)
			and measures to tackle diffuse air pollution, within realistic timescales.	
Supporting processes (on which the feature relies)	**Illumination**	Ensure artificial light is maintained to a level which is unlikely to affect natural phenological cycles and processes to the detriment of the feature and its typical species at this site.	Woodland biodiversity has naturally evolved with natural patterns of light and darkness, so disturbance or modification of those patterns can influence numerous aspects of plant and animal behaviour. For example, light pollution (from direct glare, chronically increased illumination and/or temporary, unexpected fluctuations in lighting) can affect animal navigation, competitive interactions, predator-prey relations, and animal physiology. Flowering and development of trees and plants can also be modified by un-natural illumination which can disrupt natural seasonal responses.	
Version Control Advice last updated: n/a				
Variations from national feature-framework of integrity-guidance: [adviser to give details of what has varied and why] Have amended the standard text to try to fit the character of the site ie a historic parkland with areas of modified woodland. Have amended the text to improve consistency with the targets for the H9109 feature to reduce the potential for confusion.				

Table 2: Supplementary Advice for Qualifying Features: H9190. Old acidophilous oak woods with *Quercus robur* on sandy plains; Dry oak-dominated woodland

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**	Maintain the total extent of the H9190 feature at 621.67 hectares.	There should be no measurable reduction (excluding any trivial loss) in the extent and area of this feature, although it is acknowledged that it can be difficult to separate this habitat from the H9120 feature. The baseline value of extent was generated from field surveys at the time of SAC classification and will include a degree of error. The objective is to seek to maintain overall woodland cover except where clearance will benefit the long-term condition of the feature, such as by reducing shading of veteran trees or the restoration of wood pasture. 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. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis.	
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Maintain the distribution and configuration of the H9190 eature, including where applicable its component vegetation types, across the site	A contraction in the range, or geographic spread, of the 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 resilience to adapt to future environmental changes. 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 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.	LEWIS J 1999 Windsor Forest and Great Park. Nature Conservation Priority Areas – A Focus for Future Management. English Nature. Provides a summary of survey data available up to that date and provides maps showing the distribution of veteran trees.
Structure and function (including its	**Vegetation community composition**	Ensure the component vegetation communities of the H9190 feature are referable to	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions	Rodwell JS (ed) 1991 British Plant Communities. Volume 1. Woodlands and

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
typical species)		and characterised by the following National Vegetation Classification type: NVC type W10 *Quercus robur-Pteridium aquilinum – Rubus fruticosus* woodland.	(especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. At Windsor Forest and Great Park many stands of trees and individual trees of high nature conservation value are set in a historic parkland landscape rather than semi-natural woodland and so have an atypical composition. The objective relates to those areas of long-established woodland and plantation on the site of ancient woodland.	scrub**.** Cambridge University Press.
Structure and function (including its typical species)	**Old growth**	Maintain the extent and continuity of undisturbed, mature/old growth stands (typically comprising at least 20% of the feature at any one time). Maintain the extent and continuity of the assemblage of veteran and ancient trees	Good woodland structure includes variations in age, tree form, layering, the distribution and abundance of open space and dead wood. It plays a critical role in woodland ecosystem functioning. For this habitat type, old or over-mature elements of the woodland are particularly characteristic and important features, and their continuity should be a priority. The objective of maintenance of the assemblage of veteran and ancient trees should be interpreted as meaning seeking to ensure long-term continuity of the assemblage, which includes the presence of replacement cohorts of trees with the potential to provide future veteran trees.	
Structure and function (including its typical species)	**Open space**	Maintain or restore where necessary areas of permanent/ temporary open space within the H9190 woodland feature, typically to cover between 10-30% of area.	Woodland structure includes variations in age, tree form, layering, the distribution and abundance of open space and dead wood. It plays a critical role in woodland ecosystem functioning. The target is intended for guidance only as it is acknowledged that the woodland at Windsor Forest and Great Park is set in a much wider habitat mosaic with large areas of open habitat and transitions between woodland and grassland. To be of greatest value in a parkland and wood pasture context open space should be in the form of warm, sheltered glades which provide opportunities for invertebrates to feed, find nectar and pollen, rest, regulate their temperature and over-winter. Glades should be flower-rich and be in close proximity to veteran trees and standing or fallen dead wood. Other component habitats associated with open space such as stands of bramble, thickets and areas of scrub are also of high value.	
Structure and function	**Vegetation structure -**	Maintain the continuity and abundance of standing or fallen	The availability of dead and decaying wood is of prime importance at this site. It plays a critical role in supporting the specialised saproxylic	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
(including its typical species)	**dead wood**	dead and decaying wood, typically between 30 - 50 m^3 per hectare of standing or fallen timber or 3-5 fallen trees >30cm per hectare, and >10 standing dead trees per hectare	invertebrate assemblage and the assemblage of fungi. Dead and actively decaying wood will generally be of greatest value when it is of large-diameter and situated in humid, shady or partly shaded places. Slowly decaying standing 'hulks', large decaying tree stumps and large windthrown trees with root plates attached are of particular value as part of a varied woodland ecosystem. Large living trees with large diameter dead wood in the canopy, internal decay, cavities and rot holes are also very important features.	
Structure and function (including its typical species)	**Open space for ancient/ veteran tree trees**	Maintain or restore where necessary a canopy of open grown native trees with free crowns over between 20-80% of each stand.	Parts of the woodland at Windsor Forest and Great Park have a modified structure as a result of past planting and silvicultural treatment. The objective is to seek to restore a structure in which trees with crowns which have developed in open situations rather than in shady woodland are a prominent and widespread component. This will help to ensure continuity of the species associated with the veteran tree assemblage as open-grown trees will generally have greater value for specialised organisms than trees in a closed canopy.	
Structure and function (including its typical species)	**Tree age class distribution**	Maintain at least 4 age classes (well-established saplings with space to develop an open crown/ middle age/ mature/over-mature) spread across the average life expectancy of the commonest trees.	In common with many parkland and wood pasture sites Windsor Forest and Great Park has significant gaps in the representation of different age classes of trees, including beech and oak. The presence of a range of tree age classes over the long-term is critical in ensuring that new generations of future veteran trees continue to be present into the future. This objective should seek to maintain the overall distribution of the veteran tree assemblage across the site, and restore presence where significant gaps in distribution have appeared. Many species associated with veteran trees have poor powers of dispersal and populations of particular species can become isolated and at risk of extinction if they are unable to locate suitable habitat if 'host' trees are lost or become unsuitable.	
Structure and function (including its typical species)	**Shrub layer**	Maintain or restore where necessary an understorey of scrub or young growth covering 15 - 30% of the semi-natural woodland areas of the site.	A varied shrub layer consisting of characteristic associated native shrubs and young trees is a characteristic feature of semi-natural woodland. It provides structure and cover for a wide diversity of organisms. The presence of flowering trees and shrubs is of critical importance in supporting woodland invertebrates.	
Structure and function (including its typical	**Woodland edge**	Maintain a graduated woodland edge into adjacent semi-natural open habitats, other woodland/ wood-pasture types or scrub.	Woodland edge is defined as being the transitional zone between the forest feature and adjacent but different habitat types. These transitions, where present as a highly structured interface are often of very high value for nesting birds, and in providing shelter, resting and	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
species)			feeding habitat for invertebrates.	
Structure and function (including its typical species)	**Adaptation and resilience**	Maintain the resilience of the feature to climate change.	The overall vulnerability of this SAC to climate change has been assessed by Natural England (2015) as being low, taking into account the sensitivity, fragmentation, topography and management of its habitats. This means that this site is considered to be vulnerable overall but are a lower priority for further assessment and action. Individual species may be more or less vulnerable than their supporting habitat itself. In many cases, change will be inevitable so appropriate monitoring would be advisable. This recognises the increasing likelihood of natural habitat features needing 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. The vulnerability and response of features to such changes will vary. 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. In the case of Windsor Forest and Great Park the expected influences related to climate change with greatest potential to affect the features of conservation interest are the arrival of 'new' pests and diseases, increased variation in rainfall (resulting in waterlogging or drying out of tree roots), increased frequency of storm events and increased fire risk. Resilience will require a range of responses, including the ability to respond quickly to threats from pests and diseases, good woodland management, sensitive management of veteran trees, control of fire risk and protection of the root zones of mature and over-mature trees. The maintenance of habitat continuity across the site and with the wider landscape will also be important.	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]. NERC 2016 Climate Change Impact Report Cards. NATURAL ENGLAND (2014) Windsor Forest and Great Park Site Improvement Plan. Available from: http://publications.naturalengland.org.uk/publication/6221375450644480
Structure and function (including its typical	**Browsing and grazing by herbivores**	Maintain browsing/grazing to sufficient levels to allow tree seedlings and saplings the opportunity to exceed browse	Herbivores, especially deer, are an integral part of woodland ecosystems. They are important in influencing woodland regeneration, composition and structure and therefore in shaping woodland wildlife communities. In general, both light grazing and browsing is desirable to	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
species)		height, and which maintain the characteristic structure of the woodland feature in the areas of semi-natural woodland.	promote both a diverse woodland structure and continuous seedling establishment. Short periods with no grazing at all can allow fresh natural regeneration of trees, but a long-term absence of herbivores can result in excessively dense thickets of young trees which shade out ground flora and lower plant species. However, heavy browsing by deer or livestock can prevent woodland regeneration, and can cause excessive trampling and/or poaching damage, canopy fragmentation, bark stripping and impacts on the ground layer.	
Structure and function (including its typical species)	**Regeneration potential**	Maintain the potential for sufficient natural regeneration of desirable trees and shrubs	The regeneration potential of the woodland feature must be maintained if the woodland is to be sustained and survive into the long-term, both in terms of quantity of regeneration and in terms of appropriate species. This will Include regeneration of the trees and shrubs from saplings or suckers, regrowth from coppice stools or pollards, and where appropriate planting. Browsing and grazing levels must permit regeneration at least in sufficient quantity to maintain canopy cover. Typically, there should be tree seedlings of desirable species (measured by seedlings and <1.3m saplings above grazing and browsing height) visible in sufficient numbers in gaps, at the wood edge and/or as regrowth as appropriate, to maintain long-term canopy cover in the areas of semi-natural woodland. Typically, oak will only establish in gaps and clearings or on the edges of woods and does not grow well in the shade of other trees. Successful establishment should be at a sufficient rate to provide future cohorts of veteran oaks into the future.	
Structure and function (including its typical species)	**Tree and shrub species composition**	Maintain or restore where necessary a canopy and under-storey of which 95% is composed of site-native trees and shrubs in the areas of semi-natural and plantation woodland.	Native trees and shrubs in general support a greater diversity of associated species than non-native species, especially amongst groups of invertebrates which depend directly on trees for food and shelter. There are many plants and animals which use or co-exist with non-native trees, but many rare and threatened woodland species are specialists adapted to one or a few native trees or shrub species (birches, willows and oaks, are examples of trees that host many specialist insect species).	
Structure and function (including its typical species)	**Key structural, influential and/or distinctive**	Maintain the abundance of the species listed to enable each of them to be a viable component of the Annex I habitat feature (referring to the areas of semi-	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;	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
	species	natural woodland): *Trees and shrubs* Beech *Fagus sylvatica* Pedunculate oak *Quercus robur* Hornbeam *Carpinus betulus* Silver birch *Betula pendula* Rowan *Sorbus aucuparia* Cherry *Prunus avium* Holly *Ilex aquifolium* Hawthorn *Crataegus monogyna* Bramble *Rubus fruticosus* *Other plants* Honeysuckle *Lonicera periclymenum* Male fern *Dryopteris filix-mas* Broad buckler-fern *Dryopteris dilatata* Pignut *Conopodium majus* Wood sorrel *Oxalis acetosella* Wood anemone *Anemone nemoralis* Bluebell *Endymion non-scriptus* Wood speedwell *Veronica montana* Primrose *Primula vulgaris* Hairy wood-rush *Luzula pilosa* Black bryony *Tamus communis* Broad-leaved helleborine *Epipactis helleborine* Assemblages of specialised fungi Assemblages of saproxylic invertebrates Assemblages of epiphytic lichens	• 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.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		Assemblage of bats		
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 H9190 feature	Invasive or introduced non-native species are a serious potential threat to the biodiversity of native and ancient woods, because they are able to exclude, damage or suppress the growth of native tree, shrub and ground species (and their associated typical species), reduce structural diversity 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 (eg use of broad spectrum pesticides). Such species can include *Rhododendrons*, snowberry, Japanese knotweed, giant hogweed and Himalayan balsam, for example. Similarly, this would include pheasants, rabbits and non-native invertebrate 'pest' species. Of particular concern at Windsor Forest and Great Park is the abundance and wide distribution of *Rhododendron* species, including the highly invasive *Rhododendron ponticum*. *Rhododendron* produces dense thickets which exclude other species through shading and the production of toxins, and it is a host of the pathogen which causes the syndrome referred to as Sudden Oak Death. Also of concern is the spread of oak processionary moth *Thaumetopoea processionea*. This invasive non-native species can have significant impacts on the health of ancient oaks as its caterpillars may de-foliate trees at a critical time of the year. Current control methods are limited and have damaging impacts on the invertebrate assemblage associated with trees and their supporting habitat. The non-native muntjac deer *Muntiacus reevesi* may pose a risk to ground flora (and hence the abundance of flowers and nectar sources) and tree/shrub regeneration. Pheasants are known to have impacts on invertebrate populations but the scale of those impacts will vary in relation to numbers, management practices and population density. Consideration of the scale of potential impacts may be necessary where changes in game management are proposed.	Natural England (2014) Windsor Forest and Great Park Site Improvement Plan. Available from: http://publications.naturalengland.org.uk/publication/6221375450644480
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Maintain the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal:bacterial ratio, to	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		within typical values for the H9190 habitat.	matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature.	
Structure and function (including its typical species)	**Root zones of ancient trees**	Maintain the soil structure within and around the root zones of the mature and ancient tree cohort in an un-compacted condition	The condition of the soil surrounding such trees will affect their roots, associated mycorrhizal fungi and growth. Plants have difficulty in compacted soil because the mineral grains are pressed together, leaving little space for air and water which are essential for root growth. Unless carefully managed, activities such as construction, forestry management and trampling by grazing livestock and human feet during recreational activity may all contribute to excessive soil compaction around ancient trees.	
Supporting processes (on which the feature relies)	**Functional connectivity with wider landscape**	Maintain 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. In the case of Windsor Forest and Great Park important features of the surrounding landscape in helping to support the species assemblages and their ability to move across the landscape will include mature and over-mature trees, which may be situated in hedgerows, road verges, built-up areas, woods and riverbanks. Also of importance will be areas of semi-natural woodland, patches of scrub and bracken, flower-rich grassland and field margins, and river corridors, as all of these features provide important linking habitat for bats, invertebrates and birds.	
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	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 (particularly epiphytic	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		feature of the site on the Air Pollution Information System (www.apis.ac.uk).	lichens). 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.	on the Air Pollution Information System (www.apis.ac.uk).
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level as necessary, maintain natural hydrological processes to provide the conditions necessary to sustain the H9190 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. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. This is included as disruption/ damage to hydrological processes could be caused by activities at some distance from the site boundary, eg through extraction of ground or surface waters, diverting or damming river channels, pollution of water source, channel alignment that disrupts natural geomorphological processes, tunnelling etc.	The assumed hydrological catchment of the site is identified in the site characterisation undertaken as part of the review of Environment Agency consents.
Supporting processes (on which the feature relies)	**Illumination**	Ensure artificial light is maintained to a level which is unlikely to affect natural phenological cycles and processes to the detriment of the feature and its typical species at this site.	Woodland biodiversity has naturally evolved with natural patterns of light and darkness, so disturbance or modification of those patterns can influence numerous aspects of plant and animal behaviour. For example, light pollution (from direct glare, chronically increased illumination and/or temporary, unexpected fluctuations in lighting) can affect animal navigation, competitive interactions, predator-prey relations, and animal physiology. Flowering and development of trees and plants can also be modified by un-natural illumination which can disrupt natural seasonal responses.	
Version Control Advice last updated: n/a				
Variations from national feature-framework of integrity-guidance:				

Attributes	Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Some targets modified to clarify their intent and to fit the Windsor context			

Table 3: Supplementary Advice for Qualifying Features: S1079. *Limoniscus violaceus* Violet click beetle

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting processes (on which the feature and/or its supporting habitat relies)	**Conservation measures**	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain the structure, functions and supporting processes associated with the Violet click beetle and/or its supporting habitats.	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. The ecological requirements of the violet click beetle are still poorly understood because of the rarity of the species and because it spends most of its lifecycle out of sight deep in the centre of hollow trees. However, it is known that the species has a strong association with beech trees at this site (but may also inhabit other species) and that it is mostly associated with large-diameter trees in a wooded rather than parkland setting, where there are large quantities of decaying wood. The survival of the species is thought to be dependent upon the continued availability of suitable veteran trees within a relatively short distance of existing 'host' trees. Long-term woodland management, veteran tree management and tree planting strategies will all be important in ensuring that existing host trees are protected and their life prolonged as far as practically possible, that the management of surrounding woodland is conducted sensitively and that future generations of suitable trees become available in the longer term. It is possible that consideration of active management to specifically create suitable supporting habitat for this species may be required, especially if no suitable alternative trees are present in the vicinity of existing host trees which are approaching the end of their life. This would require careful planning to avoid unintentional damage to other features of nature conservation importance.	GOUIX N, MERTLIK J, JARZABECK-MÜLLER A, NEMETH T & BRUSTEL H 2012 Known status of the endangered western Palaearctic violet click beetle (*Limoniscus violaceus*) (Coleoptera). Journal of Natural History vol 46 p769-802. Provides a very useful summary of known aspects of violet click beetle ecology, habitat requirements and behaviour. For notes on ecology see also: WHITEHEAD PF 2003, Current knowledge of the violet click beetle (*Limoniscus violaceus*) in Britain. Proceedings of the second pan-European conference on Saproxylic Beetles. London. People's Trust for Endangered Species. pp 1-9 NATURAL ENGLAND (2014) Windsor Forest and Great Park Site Improvement Plan. Available from: http://publications.natural

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
				england.org.uk/publication/6221375450644480 ENGLISH NATURE (2005) Windsor Forest and Great Park SSSI. Views About Management. Available from: http://publications.naturalengland.org.uk/publication/6221375450644480
Supporting habitat: extent and distribution	**Extent of supporting habitat**	Maintain the total extent of the habitat(s) which support the feature, which, as a precautionary approach, is the extent of woodland present at time of SAC classification.	In order to contribute towards the objective of achieving an overall favourable conservation status of the feature at a UK level, it is important to maintain or if appropriate restore the extent of supporting habitats and their range within this SAC. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection, and may be subject to periodic review in light of improvements in data. The location of host trees supporting this species at Windsor Forest and Great Park is known from capture records. However, given the elusive nature of the species it is possible that it may be more widespread or at least present in other locations at the site. Therefore, the same principles applied for the protection of the veteran tree element of the site should be applied in relation to violet click beetle.	
Supporting habitat: extent and distribution	**Distribution of supporting habitat**	Maintain the distribution and continuity of the Violet click beetle's supporting habitat, including where applicable its component vegetation types and associated transitional vegetation types, across the site	Although violet click beetle is thought to be strongly associated with veteran beech trees in a specific part of the site at Windsor Forest and Great Park it cannot be assumed that it is not present in other locations. And for the continuity of presence at the site it will be important that there is continuous availability of veteran trees with suitable conditions to support the larval stage. So the protection of the veteran tree assemblage across the whole site and availability of new cohorts of future veterans will be important for the conservation of this species.	LEWIS J 1999 Windsor Forest and Great Park. Nature Conservation Priority Areas – A Focus for Future Management. English Nature.
Supporting processes (on which the	**Adaptation and resilience**	Maintain the feature's ability, and that of its supporting habitat, to adapt or evolve to wider	The overall vulnerability of this SAC to climate change has been assessed by Natural England (2015) as being low, taking into account the sensitivity, fragmentation, topography and management of its	NATURAL ENGLAND, 2015. Climate Change Theme Plan and

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
feature and/or its supporting habitat relies)		environmental change, either within or external to the site	habitats. This means that this site is considered to be vulnerable overall but are a lower priority for further assessment and action. Individual species may be more or less vulnerable than their supporting habitat itself. In many cases, change will be inevitable so appropriate monitoring would be advisable. This recognises the increasing likelihood of supporting 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. 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 risk of damage to, or loss of living trees due to summer droughts, or storms may increase. These risks may require additional consideration in the course of tree and woodland management planning. The response of wood decay fungi and the process of wood decay, as well as of violet click beetle to climate change is difficult to predict but as critical parts of the lifecycle of violet click beetle are likely to be dependent upon temperature, particularly metamorphosis and timing of emergence, there may be impacts associated with changing weather patterns and more frequent extremes of temperature. The maintenance of a stable environment in the vicinity of potential host trees will therefore be important, to help to protect against rapid changes in temperature and humidity. The impact of climate change may be positive or negative depending on the combination of temperature and moisture. Suitable habitat should be available in order to provide a varied range of temperature and moisture combinations to continue to provide the correct conditions for wood decay that suit the beetle	supporting National Biodiversity Climate Change Vulnerability assessments ('NBCCVAs') for SACs and SPAs in England [Available at http://publications.naturalengland.org.uk/publication/4954594591375360].
Supporting habitat: structure/	**Soils, substrate and nutrient**	Maintain the properties of the underlying soil types, including structure, bulk density, total	Soil supports basic ecosystem function and is a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation	

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function	**cycling**	carbon, pH, soil nutrient status and fungal:bacterial ratio, within typical values for the supporting habitat	types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with the supporting habitat of this Annex II feature.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Air quality**	Maintain or, where necessary, restore 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).	The supporting habitat of this feature 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 (including food-plants) and reducing supporting habitat quality and population viability of this feature. 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 (www.apis.ac.uk).
Supporting habitat: structure/ function	**Abundance of standing decaying-wood**	Maintain all large-diameter veteran and ancient trees where they do not pose a significant health and safety risk.	The continued availability of large-diameter trees will be of critical importance in ensuring the survival of this species. Beech and oak trees are thought to be favoured by violet click beetle but the species of tree appears to be less important than the structure of the tree and the state of the decaying wood. The larvae feed in deep, moist, slowly-decaying woody material deep in the cavity of hollowed-out trees. It is thought that the species shows a preference for trees in a woodland setting with a humid environment rather than trees in an open parkland setting and the adults may require sources of pollen for feeding, such as hawthorn, bramble and crab apple, within a short distance of host trees. Fallen trees, decaying stumps and standing hulks with internal cavities which are open to the elements are important for many invertebrates and fungi but are not utilised by violet click beetle.	GOUIX N, MERTLIK J, JARZABECK-MÜLLER A, NEMETH T & BRUSTEL H 2012 Known status of the endangered western Palaearctic violet click beetle (*Limoniscus violaceus*) (Coleoptera). Journal of Natural History vol **46** p769-802

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Supporting habitat: structure/ function	**Continuity of decaying-wood habitat**	Ensure the continuous presence of future ancient tree cohorts for long-term survival of the species.	Very old hollow trees provide the larval habitat for violet click beetle. It is thought that adults have poor powers of dispersal and so it will be important that potentially suitable alternative host trees become available as existing host trees rot away and no longer provide suitable conditions. Tree planting and retention policies should consider aspects such as the need to plant new generations of trees of appropriate species and where they should be located, identify potential 'future veterans' for retention, consider the need for management of trees to prolong their life, such as by pollarding or 'haloing', and whether management is required in the vicinity of potential host trees to maintain or improve habitat suitability, or to help secure the survival of the host trees. Little is known about the dispersal dynamics of the species so the required distribution of suitable trees and appropriate woodland density is currently unknown - therefore a precautionary approach should be taken, with potential future host trees in reasonably close proximity (<100m) of existing known or potential host trees. . They do appear to utilise both woodland and pasture trees, it is the wood mould resource that is most critical. Tree planting policy and woodland management planning should be set in a context which will ensure that future generations of over-mature and veteran trees will continue to be a significant component of the woodland and parkland. Given the lifespan of ancient and veteran trees tree planting and retention plans should ideally be looking at least 300 years into the future.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Continuity of natural processes**	Maintain continuity of natural processes through timber decay and nutrient recycling	Natural processes of decomposition and decay are important in providing suitable habitat conditions for beetle larvae.	
Population (of the feature)	**Occupation of wood-mould trees.**	Maintain or increase the abundance of known host trees occupied by the Violet click beetle, and trees considered to have suitable habitat conditions, whilst avoiding deterioration from	Trees which are, and can be, occupied by the beetle larvae are critical. The larvae live in the black mulch within hollow trees that forms towards the end of the cycle of decay, usually at or below ground level. At present emergence trapping as described by Gouix (2012) is now considered to be the best option for getting an understanding of occupation in likely trees.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		its current levels as indicated by the latest count or equivalent.		
Version Control Advice last updated: n/a				
Variations from national feature-framework of integrity-guidance: n/a				